

Autodesk®

MotionBuilder® 2009

User's Guide



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MotionBuilder Interface

As with most software, MotionBuilder, includes standard interface items that let you perform general tasks.

For example, you can use the MotionBuilder menu bar to open recently saved files, select keyboard configurations, create custom layouts, and access the MotionBuilder Help. You can use the Preferences window to customize the MotionBuilder settings.

This section discusses the basic interface of MotionBuilder and includes topics on the MotionBuilder menu bar, setting Preferences, and creating custom layouts.

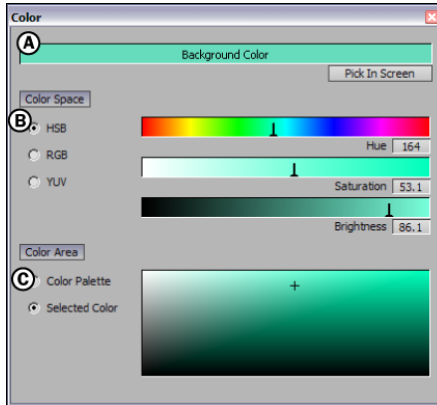
This section also discusses common interface items that consist of windows, fields, or other interface items that appear in more than one place within MotionBuilder.

The following common interface items are discussed.

- [Color window](#) on page 4
- [Asset Selection list](#) on page 7
- MotionBuilder menu bar
- Viewer window
- Asset browser
- Navigator window
- [Layouts](#) on page 13
- [Preferences](#) on page 19
- [Color window](#) on page 4
- [Asset Selection list](#) on page 7

Color window

Use the Color window to change the color of lights, models, materials, shading effects, and any other object or any other asset with a color property.



Color window A. Current Color area B. Color space C. Color area

Current color area

The Current Color area of the Color window lets you view the color that is currently active in MotionBuilder, for example, the color of a selected object in the Viewer window.

Whenever you make changes to the color selection in the Pick In Screen, Color Space, or Color areas, these areas reflect the new color.

The Current Color area also identifies the name of the setting to which you are applying the color. For example, if you select an object with a red Emissive Light setting in a scene, the Current Color area displays the color red and is labelled “Emissive”.

For example, the Current Color area indicates that it is displaying the color for the camera’s Background.

Pick In Screen

Use Pick In Screen to select colors from objects already displayed in the Viewer window.

Click Pick In Screen, then click anywhere on your screen to “capture” the color.

For example, you can click Pick In Screen then move your mouse over a colored light. The Pick In Screen field color changes as you move over the colored light’s beam. Locate the color you want and click to capture it.

Color Space area

The Color Space area lets you change the current color using one of three different color spaces. Use the Color Space area to define your color selection with more precision.

The Color Space area is divided into three Color Space settings, one for each color mode:

- HSB
- RGB
- YUV

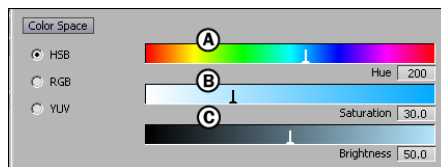
Switch to any of these three color modes by selecting the corresponding option beside the color sliders.

Drag the Color Indicator across the Color bars to select a new color. You can also create exact colors by double-clicking the Value field found under the Color bars and entering a value.

Depending on the color space selected, changes to the current color may create a color shift in each color bar.

HSB option

Select the HSB option to choose your color using a mix of hue, saturation, and brightness. The Hue color bar shows the entire spectrum of available colors.

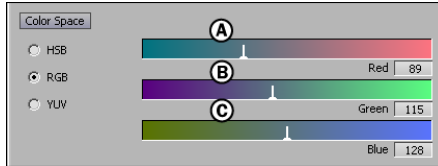


HSB Color Space A. Hue selector B. Saturation selector C. Brightness selector

Use the Hue slider first to select the color, then use the Brightness and Saturation sliders to adjust the contrast. Changing the Hue also repositions the Saturation and Brightness color bars. Changing the Saturation also changes the Brightness bar.

RGB option

Select the RGB option to choose a color using a mix of red, green, and blue. The three color bars switch to show the red, green, and blue spectrum.



RGB Color Space A. Red selector B. Green selector C. Blue selector

RGB is an additive color system and is used when working with computer monitors or other light-emitting devices.

YUV option

Select the YUV option to choose a color using a mix of Y, U, and V values. The three color bars switch to represent the Y, U, and V spectrum. YUV is a standard color mode used for television transmission.

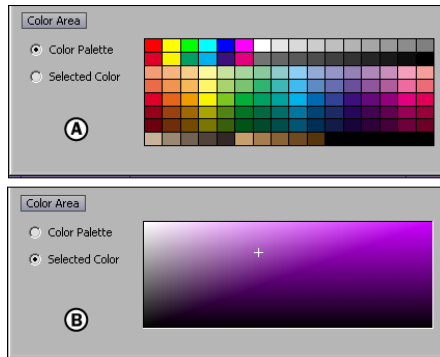


YUV Color Space A. Y selector B. U selector C. V selector

Y is the luminance component, U and V are the chrominance components or color signals.

Color area

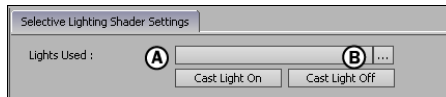
The Color area lets you change the current color using an interactive color palette that you can modify after you select a color swatch. You can also select the color from a palette of color swatches. Both options are shown in the following image.



A.Color area showing color palette **B.** Color area showing selected color

Asset Selection list

The Asset list is an interface item that lets you specify one or more assets. The Asset list is found next to the Asset field in many Navigator window panes, for example the Selective Lighting Shader settings .



Selective Light Shader settings A. Lights Used field B. Asset list button

Access the Asset list through the Asset list button that appears next to the field. When you click the Asset list button, a list of all the corresponding assets added to your scene displays.

Asset Selection list contextual menu

If you right-click the Asset list, a contextual menu appears with options for selecting and organizing the Asset list.

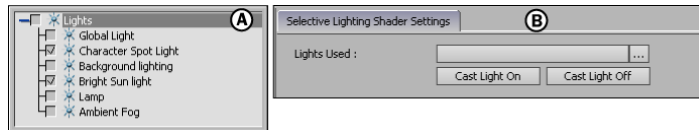


Asset List Contextual Menu.

Tree/List

The Tree/List options let you choose which way you want to view the contents of the Asset list.

- Select Tree to make the Asset list display in a tree hierarchy with check boxes that are either activated or disabled.
- Select List to make the Asset list for the selected objects display as a list. Unlike the Tree display, the List display only shows objects that have been selected.



Asset List display A. Tree B. List

| Option | Behavior |
|--------------------------|--|
| Check Whole Branches | Select Check Whole Branches to select the item and all its child items when selecting/deselecting something in the Asset list. |
| Find First Checked Child | Select Find First Checked Child if the tree hierarchy is collapsed. It expands the tree to the first selected child item. |
| Find Child by Name | Select Find Child by Name to open the Find Child by Name search window. Enter the name of a specific asset or object in |

| Option | Behavior |
|---------------|---|
| | the search window to have MotionBuilder locate it. |
| Expand Branch | Select Expand Branch to completely expand the branch of the item selected. |
| Select Branch | Use the Select Branch option to select all the items included in the item's hierarchy in the Asset list and in the Viewer window. |
| Select Object | Use the Select Object option to select the object in the Asset list and in the Viewer window. |

Using the Color window

Use the Color window to change the color of lights, models, materials, shading effects, and any other object or any other asset with a color property.

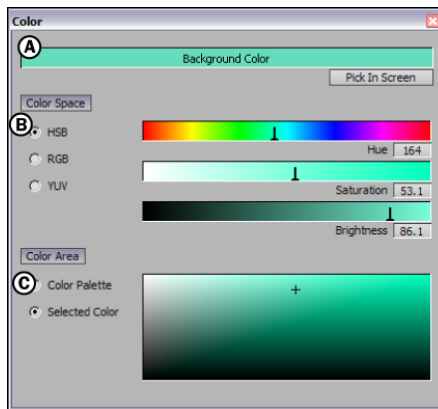
To use the color window:

- 1 Click the Color (...) button in any window next to an option that lets you change the color of an object.
For example, you can open the Color window from the Emissive, Ambient, Diffuse, or Specularity color areas of the Material settings pane by clicking the Color (...) button.



Material Settings: Color buttons

2 The Color window appears.



Color window A. Current Color area B. Color space C. Color area

- 3 Set your color using one of the three methods:
 - Choose a the Color mode (HSB, RGB, or YUV), and adjust the colors
 - Select between the Color palette and Selected Color options.
 - Click Pick In Screen if the color you want is already somewhere in the Viewer window.
- 4 Once you have selected a color, close the Color window using the X button in the upper right corner.

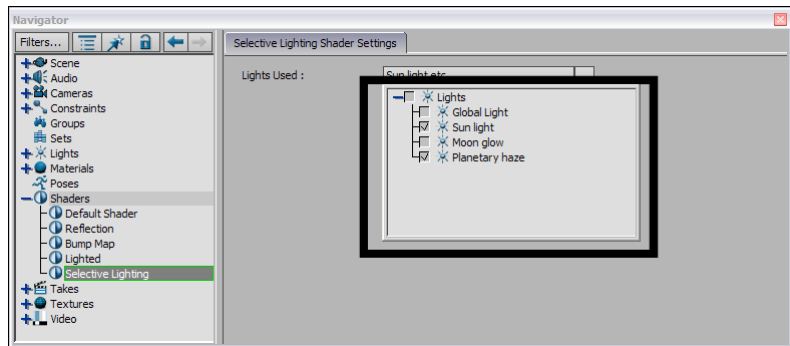
Selecting assets using the Asset Selection list

The Asset list is an interface item that lets you specify one or more assets.

To select items from the Asset Selection list:

- 1 Click the Asset List (...) button.

The Asset list appears with assets appropriate to the asset you are selecting. For example, if you are using the Lights Used Asset list, all the lights used in the scene are displayed.



The Asset list appears with assets appropriate to the selected asset.

- 2 Activate the option that corresponds to each asset you want to select.
- 3 If you want to select all items contained in the list, activate the option next to the root folder. For example, in the preceding image, the root folder is the Lights folder.

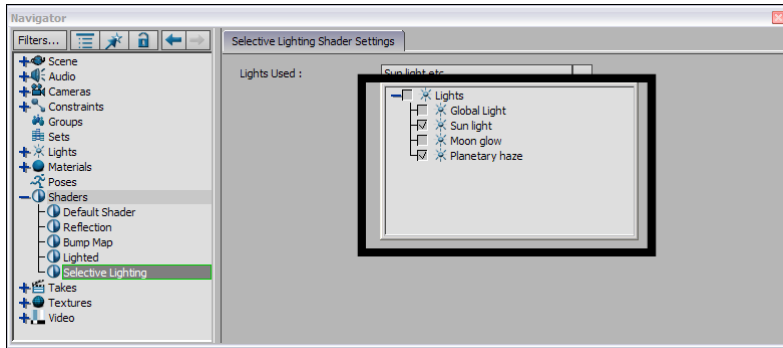
NOTE

When multiple assets are selected, only the first asset is listed, followed by "etc".

Removing assets from the Asset Selection list

To remove items in your Asset list:

- 1 Double-click the Asset field. A list appears with all the assets you have assigned.



Click the Asset field to display a list of the items you have selected from the Asset list.

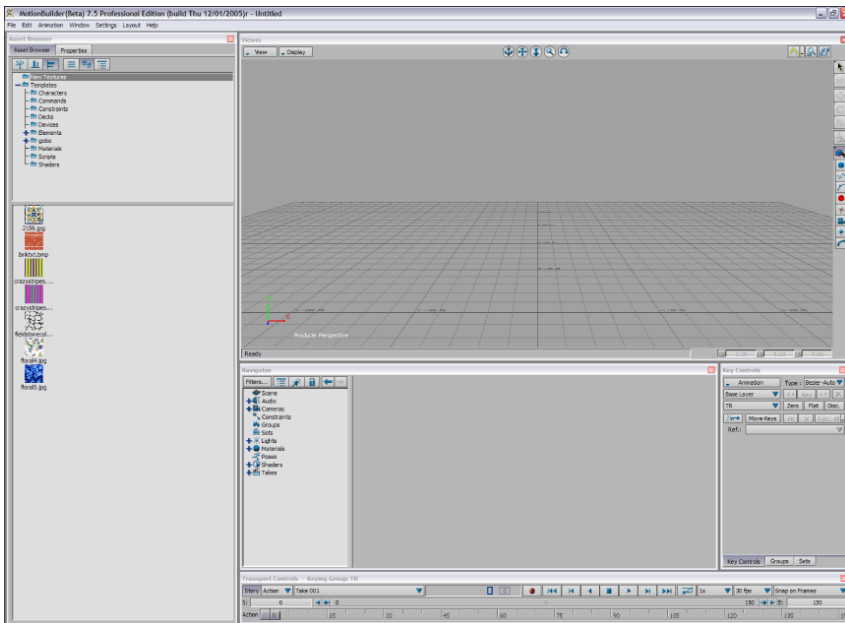
- 2** Select every item that corresponds to the items you want to remove from the list.
- 3** Click Remove.

To remove multiple items, you must repeat this procedure multiple times.

Layouts

2

MotionBuilder includes the Creation, Animation, Editing, Preview, and Story layouts that are designed for specific tasks. For example, the Creation layout, with the large Asset browser, Navigator, and Viewer window, is an ideal layout for creating MotionBuilder scenes.



Creation Layout (1280 by 1024)

Each layout saves the size and position of currently opened windows. You can create, rename, update, and delete custom layouts using the Layout menu.

You can use an external text editor to add tabs to the windows in your custom layouts so that more than one window can occupy the same screen space.

NOTE The windows in each pre-defined layout may change depending on your screen size. For example, the Creation Layout contains different windows when your display preferences are set to 1280 by 1024 compared to 1600 by 1200.

- [Creating, updating, renaming, and deleting a layout](#) on page 14
- [Adding tabs to custom layouts](#) on page 16

Creating, updating, renaming, and deleting a layout

Layout creation lets you arrange the MotionBuilder interface by hiding, showing, or resizing specific windows and tools. This section contains information on creating, renaming, updating, and deleting custom layouts.

To create a new layout:

- 1 Select Layout > Create New Layout, enter a name in the dialog box.
- 2 Click Ok.

The new layout displays in the list of custom layouts within the Layout menu.

To update the current layout:

- 1 Select the custom layout from the list of custom layouts in the Layout Menu.
- 2 Rearrange the MotionBuilder interface by hiding, showing, or resizing specific windows and tools.
- 3 Select Layout > Update Layout. A dialog box appears asking you to confirm.
- 4 Click Ok.

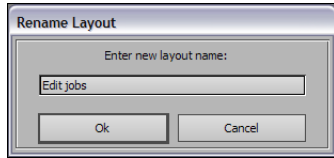
The selected layout is updated to reflect the size, selection, and arrangement of MotionBuilder windows currently displayed.

NOTE You cannot update the four default layouts: Creation, Animation, Editing, Preview, and Story. If a default layout is selected, the Update Current Layout menu item is disabled.

To rename the current layout:

- 1 Select Layout > Rename Layout.

The Rename Layout dialog box appears , letting you rename the current layout.



Rename Layout dialog box

NOTE You cannot rename the four default layouts: Creation, Animation, Editing, Preview, and Story. If one of these five default layouts is selected, the Rename Current Layout menu item is disabled.

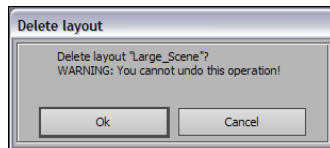
To delete a custom layout:

- 1 Select Layout > Delete Layout.

A dialog box appears prompting you to select the custom layout you want to delete.

- 2 Select a custom layout and click Ok.

A second dialog box displays asking you to confirm deletion.



Delete Layout dialog box

- 3 Click Ok to delete the selected layout.

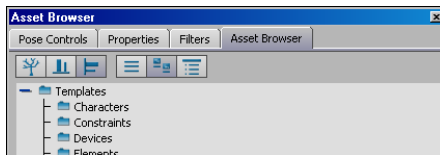
NOTE Be careful while deleting custom layouts. Deleting a layout cannot be undone.

If you delete the current layout, MotionBuilder switches to either the next custom layout or the first default layout. If there are no custom layouts, MotionBuilder switches to the first default layout.

- [Adding tabs to custom layouts](#) on page 16

Adding tabs to custom layouts

Default layouts contain windows with tabs that combine two or more windows in the same window. For example, the following figure combines the Pose Controls window, Properties window, Filters window, and Asset browser in the same location. To switch between windows, click on the appropriate tab.



Window with tabs

To add tabs to a custom layout:

- 1 Go to `/bin/config/Layouts` directory in your MotionBuilder folder after performing a Show Package Contents.
- 2 Open and edit your custom layout using a text editor.
- 3 To create a window with two tabs, change the `NbTools` line to the number of tabs you want.

NOTE There is a limit of nine tabs per window.

- 4 For each tab, you must add a separate `ToolName_n = window_name`, where `n` is the number of the tab and `window_name` is the name of a MotionBuilder window.

The following is an example of a window declaration:

```
[Wnd_2]
NbTools = 3
ToolName_1 = Asset Browser
ToolName_2 = Groups
ToolName_3 = Properties
UsePix = true
```

```
TabPos = top  
ToolX = 8  
ToolY = 7  
ToolW = 240  
ToolH = 998
```

- 5 Change the position, width, and height of the window using the `ToolX`, `ToolY`, `ToolW`, and `ToolH` lines. Change the tab position by specifying either `Top` or `Bottom` beside `TabPos`.

NOTE Be careful when you edit custom layouts. Typographical errors, bad numbering, and multiple windows with identical tabs can cause problems.

- [Creating, updating, renaming, and deleting a layout](#) on page 14

Preferences

3

The Preferences window lets you view and set MotionBuilder default and operational preferences.



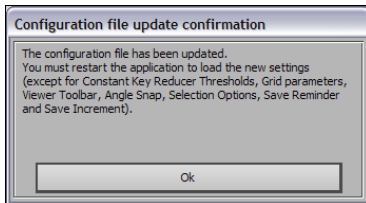
Access the Preferences window by selecting either Settings > Preferences from the menu bar.

The Preferences window contains the following preferences:

- [Character preferences](#) on page 21
- [Devices preferences](#) on page 21
- [FCurve preferences](#) on page 24
- [Fields and Values preferences](#) on page 25
- [Filters preferences](#) on page 27

- [Loading preferences](#) on page 28
- [Memory preferences](#) on page 30
- [OpenGL preferences](#) on page 31
- [Python preferences](#) on page 37
- [Saving preferences](#) on page 39
- [SDK preferences](#) on page 42
- [Selective Redraw preferences](#) on page 43
- [Shading preferences](#) on page 44
- [SteeringWheels preferences](#) on page 46
- [Undo preferences](#) on page 49
- [ViewCube preferences](#) on page 50
- [Viewer preferences](#) on page 53
- [Serial Ports window](#) on page 22
- [Viewer Info window](#) on page 35

After you have modified the options in any of the Preferences window's panes, click Ok to activate the changes. A dialog box appears informing you that MotionBuilder must be restarted before some preferences take effect.

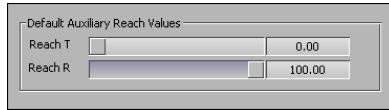


**Configuration File Update
confirmation dialog box**

NOTE Be careful when you change preferences, as the Preferences window contains configurable options that refer to the operation of MotionBuilder on your computer.

Character preferences

In the Preferences window, the Character preferences let you change default Reach values.

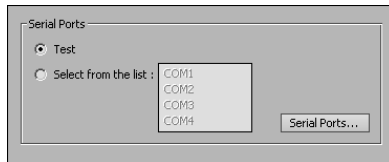


Default Auxiliary Reach values

The Default Auxiliary Reach sliders let you set default Reach Translation and Rotation preferences. See [Control rig effector properties](#) on page 1262.

Devices preferences

In the Preferences window, the Devices preferences contain the Serial Ports area, which lets you search for and assign new serial ports.



Test

The Test option lets you specify which ports are available to MotionBuilder. Activate Test to search for valid ports from the default setup of your operating system.

Select from the List

Activate Select From the List when you want to override the default ports setup and choose a new serial port from the list. *Ctrl*-click to select multiple ports.

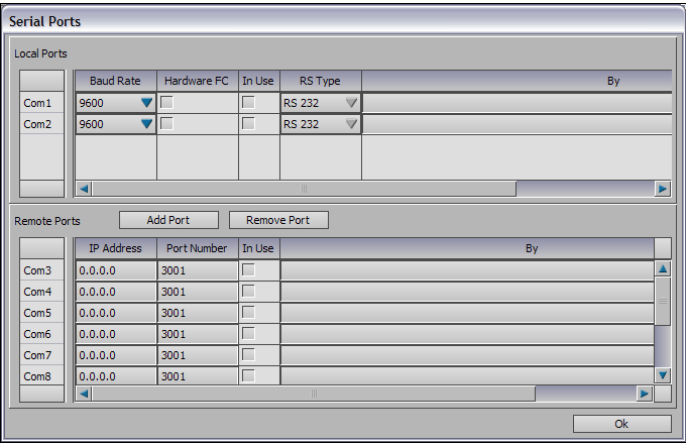
Serial Ports button

Click the Serial Ports button to open the Serial Ports window so you can view and configure the serial and remote ports that physically connect devices to MotionBuilder. See [Serial Ports window](#) on page 22.

NOTE MotionBuilder shows the current preferences of your computer system as the default. Use caution when changing them, as some preferences might not provide optimal results for your computer.

Serial Ports window

Use the Serial Ports window to view and configure the serial and remote ports that physically connect devices to MotionBuilder.



Local Ports area

Use the Local Ports area to change the preferences for ports directly connected to your computer, such as Com1, Com2, and Lpt1. The Local Ports area has four entry fields:

| Option | Description |
|----------------|--|
| Baud rate menu | Set the baud rate of the devices directly connected to your computer using the Com1 or Com2 port using the Baud Rate |

| Option | Description |
|--------------------|--|
| | pull-down menu. The default baud rate is 9600. |
| Hardware FC option | Activate Hardware FC to enable Hardware Full Control on your computer. A basic serial port has ground, input, data in, and data out (Receive Data and Translate Data, or RxD TxD GND) connections. When you attempt to transfer at a higher speed for more reliable communications, this device lets you use a special communication protocol to control the flow of data between the devices. This is a device-specific mode. Check the documentation shipped with your hardware device to make sure your device supports this mode before activating it. |
| In Use option | Activate the In Use option to make the local port active. |
| RS Type menu | Select which serial line standard you are using to connect serial ports. The default RS Type is RS-232. |

Remote Ports area

Use the Remote Ports area to connect a serial device that gives you additional ports where you can connect your input and output devices, such as the Lantronix Ethernet Terminal Server.

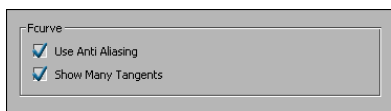
Each serial device connected to your computer has its own IP address, and each port has its own port number. This means that you can have many port numbers for the same IP address. The Remote Ports area has three entry fields:

| Option | Description |
|------------|--|
| IP Address | Enter the IP address of the remote terminal or terminal server connected to your computer. Double-click the IP Address field |

| Option | Description |
|-------------|--|
| | to enter the IP address of the appropriate terminal or terminal server. |
| Port Number | The Port Number column contains the port number for each remote port. The numbers in this column are set by default, and should only be changed if the specified port number is wrong or in use. For example, if the Port number is set to port 3001, and the device that you want to use is connected on port 4001, change the Port number field to 4001. Double-click the Port Number field to set a remote port number. |
| In Use | When a device is connected to a remote port and both the IP address and port number are correct, MotionBuilder activates the In Use column to indicate that the port is being used by a device. Activate the In Use option to indicate that the port is in use. If In Use is not activated after you specify an IP address and port, the IP address or port number is incorrect. |

FCurve preferences

In the Preferences window, the FCurve preferences let you modify options applicable to the FCurves window.



Use Anti Aliasing

The Use Anti Aliasing option activates FCurve anti-aliasing in the FCurves window. Modifying the Use Anti-Aliasing configuration options creates a visual change only, no data is affected.

The default option is active.

Show Many Tangents

The Show Many Tangents option lets the FCurves window display multiple tangents so you can see more than one key tangent at the same time. Modifying the Show Many Tangents configuration options creates a visual change only; no data is affected.

The default option is active.

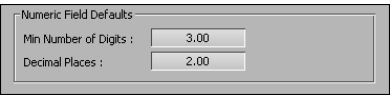
Fields and Values preferences

In the Preferences window, the Fields and Values preferences consist of the following areas:

- [Numeric Field Defaults area](#) on page 25
- [Sliders and Values area](#) on page 26
- [Transformations area](#) on page 26

Numeric Field Defaults area

The Numeric Field Defaults area lets you establish default preferences relating to the display of numeric values.

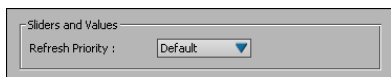


| Field | Purpose |
|----------------------|--|
| Min Number of Digits | The Min Number of Digits field lets you specify the length of values displayed in the MotionBuilder interface. The default setting is 3. |

| Field | Purpose |
|----------------|--|
| Decimal Places | The Decimal Places field lets you specify how many decimal place values display in numerical fields. The default setting is 2. |

Sliders and Values area

The Sliders and Values area lets you set a default rate for any sliders and values that appear in MotionBuilder.

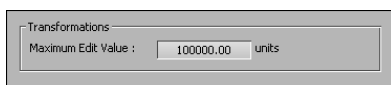


The Refresh Priority menu in the Sliders and Values area lets you choose the refresh rate of values set with sliders, for example, the Materials Opacity slider.

| Refresh Priority value | Purpose |
|------------------------|--|
| Low | Low is the slowest refresh rate. |
| Default | Default is the recommended setting for most systems. |
| High | High has a faster refresh rate, but creates a memory demand on the system. |

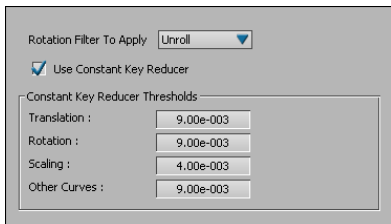
Transformations area

The Transformations area contains the Maximum Edit Value field, which lets you determine the maximum number you can enter into a value field in the FCurves window. The default number is 100000.



Filters preferences

In the Preferences window, the Filters preferences let you set defaults for filters that MotionBuilder applies during the plotting process.



Rotation Filter To Apply menu

The Rotation Filter To Apply menu lets you choose between using the Unroll or GimbalKiller filter during the plotting process.

Modifying the Rotation Filter To Apply configuration options changes your data.

The default option is Unroll.

Use Constant Key Reducer option

The Use Constant Key Reducer option lets you minimize file sizes by eliminating unnecessary keys during the plotting process.

Modifying this option changes your data.

The default option is Active.

Constant Key Reducer Threshold values

Constant keys occur when two keys are placed at the same value in the FCurves window, such as keys with Constant interpolation. When the difference between the values for two key's is greater than the specified threshold, the keys are kept. Any keys under the threshold are discarded.

The default value is 5000e.012. This value is an exponent value.

NOTE Changes made to the Constant Key Reducer Thresholds are effective immediately. There is no need to restart MotionBuilder.

Translation/Rotation/Scaling/Other Curves

The Translation, Rotation, Scaling, and Other Curves fields let you specify a value for translation, rotation, scaling keys, and any other curves, respectively.

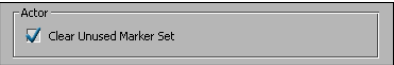
Loading preferences

In the Preferences window, the Loading preferences consist of the following:

- [Actor area](#) on page 28
- [Audio area](#) on page 28
- [File Menu - Recent Files area](#) on page 29
- [Renderer area](#) on page 29
- [Weighting area](#) on page 30

Actor area

The Actor area contains the Clear Unused Marker Set option, which clears any Marker sets not used by Actors after they are loaded in MotionBuilder.

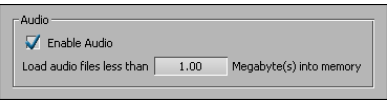


Activating this setting “cleans” old MotionBuilder files that might have been corrupted by large numbers of unused Marker sets.

Clear Unused Marker Set is disabled by default.

Audio area

The Audio area lets you activate or disable MotionBuilder audio.

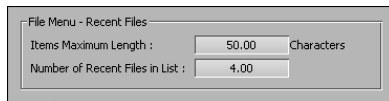


| Audio area option | Function |
|-------------------|---|
| Enable Audio | The Enable Audio option lets you activate or disable audio capabilities. Activate En- |

| Audio area option | Function |
|----------------------------|--|
| | able Audio to use audio in MotionBuilder. The default option is active. |
| Load Audio Files Less Than | The Load Audio Files Less Than field lets you specify a size (in megabytes) threshold beyond which Audio files are not loaded into memory. For example, if the limit is 1.00, a file that is 5 megabytes is read directly from the disk. The default size is 1 Megabyte. |

File Menu - Recent Files area

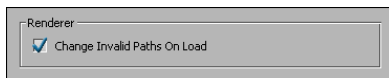
The File Menu - Recent Files area lets you set defaults relating to files recently loaded in MotionBuilder.



| File menu option | Function |
|--------------------------------|--|
| Items Maximum Length | The Items Maximum Length field lets you set the number of characters used in menu items. The default setting is 50. |
| Number of Recent Files in List | The Number of Recent Files in List field lets you specify how many recently loaded files are displayed in the File menu. The default setting is 4. |

Renderer area

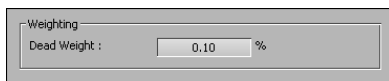
The Renderer area lets you set defaults for output paths.



| Renderer option | Purpose |
|------------------------------|---|
| Change Invalid Paths On Load | The Change Invalid Paths On Load option lets you choose whether invalid output paths are restored to default options when MotionBuilder loads. When activated, MotionBuilder looks for a new path when the old path is not found. The default option is active. |

Weighting area

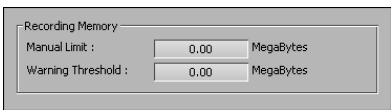
The Weighting area lets you specify thresholds for weighted models.



| Weighting option | Purpose |
|------------------|---|
| Dead Weight | Double-click the Dead Weight field to set a threshold for weighted models, rounding off unassigned values applied to skins. This setting applies to models dropped into the Skin tool. For example, when a model is moved to 100 000 units and the skin stretches, you can correct the stretching if you modify the Dead Weight value. The default value is 0%. Weights under this value are ignored. |

Memory preferences

In the Preferences window, the Memory preferences contain the Recording Memory area, which lets you activate or record memory values.



| Recording memory option | Function |
|-------------------------|---|
| Manual Limit | The Manual Limit value lets you specify the virtual limit of memory used for recording. Double-click the Manual Limit field to set a new Manual Limit value, expressed in megabytes. The default value is 0. |
| Warning Threshold | The Warning Threshold field lets you specify a memory warning value during recording. If the available memory for recording drops below the warning value, Motion-Builder displays a dialog box. To display the memory usage of your system, press Shift-M. Double-click the Warning Threshold field to enter a new Warning Threshold value, expressed in megabytes. The default value is 0. Note: The Warning Threshold is not a limit, it only activates a warning message. |

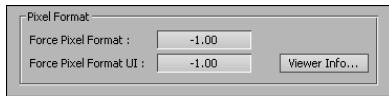
OpenGL preferences

In the Preferences window, the OpenGL® preferences contain the following:

- [Pixel Format area](#) on page 31
- [Share Display List area](#) on page 32
- [Video in Camera Background area](#) on page 34

Pixel Format area

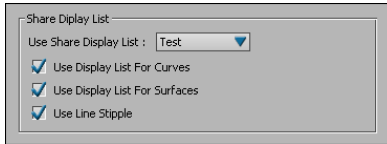
The Pixel format area lets you set default values for the Viewer window display.



| Pixel format option | Function |
|-----------------------|---|
| Force Pixel Format | The Force Pixel Format value is an index of the Viewer window pixel format. For example, you can enter a new value if you want to force your display to show Anti-Aliasing. Double-click the field to enter a new value. This setting only affects the display of the Viewer window. The default value is -1. |
| Force Pixel Format UI | The Force Pixel Format UI value is an index of the pixel format for the interface, as seen in the PixelFormat pane of the Viewer Info window in MotionBuilder. Double-click the field to enter a new value. This setting does not affect the Viewer window display, it affects only the interface. The default value is -1. |
| Viewer Info | Click the Viewer Info button to view the version and capabilities of the OpenGL implementation of your computer as well as the Pixel Format setup. See Viewer Info window on page 35. |

Share Display List area

The Advanced pane lets you set default values for the Share Display List.



Share display list option

Function

Use Share Display List

The Use Share Display List menu lets you choose options that concern the use of your display. If you choose Test, the static geometry is sent to the video driver or card only once for the whole session. Doing this speeds up the display of static geometry with no effect on skinned or shaped models. Select No from the menu only when using problematic or old video drivers or cards. The default option is Test.

Use Display List For Curves

Activate the Use Display List For Curves option to activate hardware acceleration for displaying curves in the FCurves window. The default option is active.

Use Display List For Surfaces

The Use Display List For Surfaces option is like the Use Share Display List but applies to Patches and NURBS. If you select Test from the Use Share Display List menu, then activate Use Display List For Surfaces option, the non-deformed patches and NURBS uses the display list. Disable this option only when using problematic or old video drivers or cards. The default option is active.

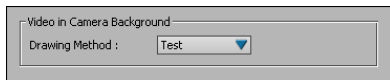
Use Line Stipple

The Use Line Stipple option lets you use stipple or dotted lines in region selection and camera-safe areas. Disable this option only when using problematic video drivers or cards. In certain conditions, some newer video drivers or cards have had machine freeze problems when using line stipple.

| Share display list option | Function |
|---------------------------|---|
| | These problems usually occur when global anti-aliasing is used. The default option is active. |

Video in Camera Background area

The Video in Camera Background area contains the Drawing Method menu, which lets you choose what type of camera background display is used as the default.



| Video in camera background option | Purpose |
|-----------------------------------|--|
| Test | Loads the camera background image in texture memory before displaying. This method is the best for displaying static images. This setting is the default selection |
| Texture | Loads the camera background image in texture memory before displaying. This method is the best for displaying static images. |
| Draw | Use the Draw option for video images, as it does not use texture memory. The Draw option transfers the background image from the main memory to the video memory. The texture video memory is then updated each time the video frames change. This method is the fastest in most "reflection on video" cases, or if your video is used for texturing geometry. |

See [Back Plate pane](#) on page 315 for more information about camera backgrounds.

Viewer Info window

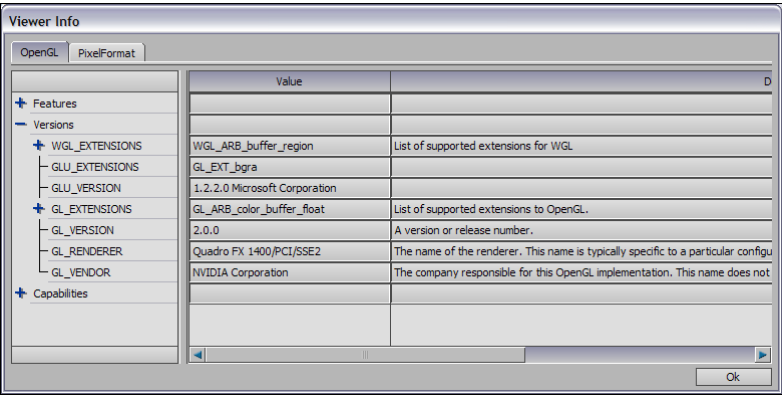
The Viewer Info window lets you view the version and capabilities of your computer’s OpenGL implementation as well as the Pixel Format setup. The Viewer Info window consists of two panes:

- [OpenGL pane](#) on page 35
- [PixelFormat pane](#) on page 37

NOTE You cannot modify information in the Viewer Info window, the information is for reference purposes only.

OpenGL pane

The OpenGL pane contains three menus that you can expand to view the version information for features, versions, and capabilities.



These menus contain further information about Accumulation, Depth, Stencil, and Color buffers.

Features menu

Expand the Features menu to view information about the Display List in the Value and Description fields.

Versions menu

Expand the Versions menu to view information about your OpenGL versions and extensions, as well as the name of the Renderer and the OpenGL vendor in the Value and Description fields.

You can further expand the Versions menu to view the WGL and GL_Extensions.

Capabilities menu

Expand the Capabilities menu to view information about the maximum allowable limits in your OpenGL version for lights, texture sizes and stack depth, attribute stack depth, display list nesting, modelview, projectionview, supported name stack depth, application-defined clipping panes, minimum/maximum size for Anti-Aliased points, and the maximum supported height of the Viewer window.

Buffer menus

You can further expand the Versions menu to view information about Accumulation, Depth, Stencil, and Color buffers:

Accumulation Buffer menu

Expand the Accumulation buffer menu to view information about the number of bitplanes in the color and Alpha channels in the Accumulation buffer.

Depth Buffer menu

Expand the Depth Buffer menu to view information about the number of bitplanes in the Depth buffer.

Stencil Buffer menu

Expand the Stencil Buffer menu to view information about the number of bitplanes in the Stencil buffer.

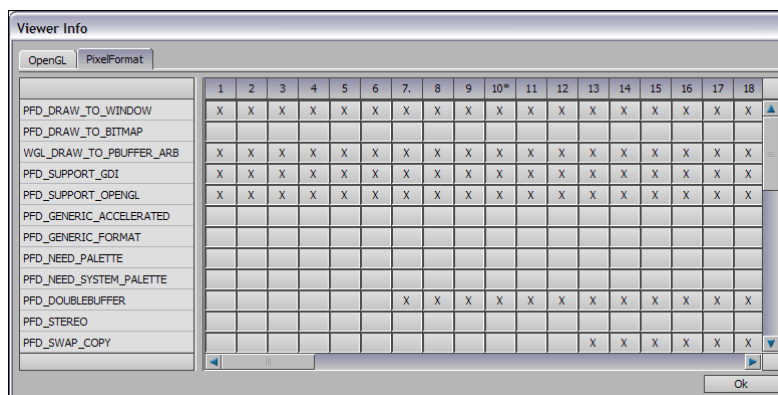
Color Buffer menu

Expand the Color buffer menu to view information about the number of bitplanes in the color and Alpha channels of the Color buffers.

NOTE Some descriptions do not fit within the Viewer Info window. Resize the window or use the scroll bars to move across and down the rows of values.

PixelFormat pane

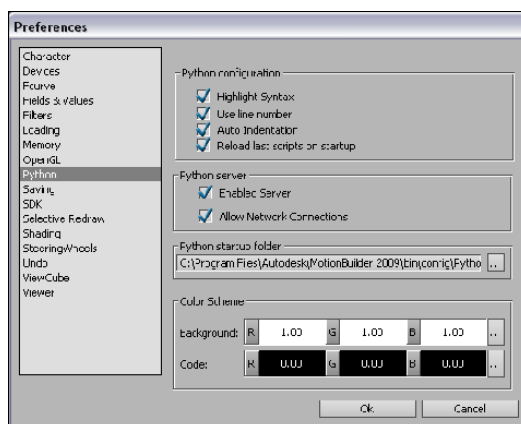
The PixelFormat pane lets you view the setup of your OpenGL card. An X displays in any column that supports the specified value.



NOTE You cannot change anything in the PixelFormat pane; the information is included only as a reference.

Python preferences

The Preferences window include the Python preferences settings.



The Python preferences settings consist of the following:

- Python configuration settings
- Python server settings
- Python startup folder settings
- Python color scheme

| Python configuration settings | Purpose |
|--------------------------------|---|
| Highlight Syntax | To show code colorized (as you type) based on Python syntax types. |
| Use line number | To display line numbers in the Python editor Work-space pane. |
| Auto Indentation | To automatically indent a script where required. |
| Reload last scripts on startup | To load (in the Python Editor) the last scripts when launching application. |
| Python server settings | Purpose |
| Enable Server | To start a server in order to execute Python commands remotely. Note: To be able to execute commands remotely, you must enable Allow Network Connections. |
| Allow Network Connections | To enable network connection. Note: To be able to execute commands remotely, you must Enable Server. |
| Python startup folder settings | Purpose |
| Python startup folder | To set Python path variables. This folder provides a location where you can place any and all scripts that you want to have executed on start-up. This allows you to get around using a .bat file or another form of start-up manipulation. You can provide several |

| Python startup folder settings | Purpose |
|--------------------------------|--|
| | scripts to an artist to configure for example, UI, settings, load/save scenes etc. |
| Python color scheme settings | Purpose |
| Background | To set the color of the Python Editor |
| Code | To set the color of the code |

For information on the Python Editor, see Python Editor.

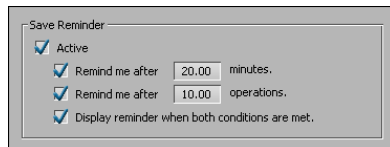
Saving preferences

In the Preferences window, the Saving preferences consist of the following:

- [Save Reminder area](#) on page 39
- [Incremental Backups area](#) on page 41
- [FBX area](#) on page 42

Save Reminder area

The Save Reminder area contains options which let you determine when MotionBuilder reminds you to save your scene.



To remind you to save, a red Save Reminder button appears in the top right corner of the Viewer window. You can click the Save Reminder button to save your file. See [Save Reminder button](#) on page 122 for more information.



Viewer window A. Save Reminder button

The Save Reminder options are disabled by default.

| Save Reminder option | Purpose |
|---|---|
| Active | When the Active option is enabled, the Save Reminder button displays in the Viewer window with a frequency determined by the following options: |
| Remind me after x minutes | The Remind me after x minutes field lets you specify the number of minutes after which you are reminded to save. (Where x is the number of minutes.) |
| Remind me after x operations | The Remind me after x operations field lets you specify the number of operations after which you are reminded to save. (Where x is the number of operations.) |
| Display reminder when both conditions are met | When the Display reminder when both conditions are met option is active, it prompts you to save once you have performed the specified number of operations as well as after the specified number of |

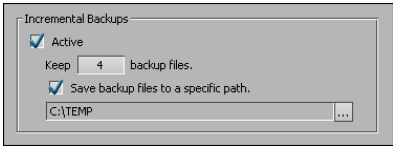
| Save Reminder option | Purpose |
|----------------------|---|
| | minutes since your last save. Otherwise you are prompted to save either after the specified number of operations or the number of minutes since your last save, whichever occurs first. |

Incremental Backups area

The Incremental Backups area lets you create multiple backups of your file every time you save it.

By default, a folder is created where you saved the original file. You can also select different location for this folder. The name of the folder is *n.bck*, where *n* is the original name of your FBX file. For example, if the name of the file was *running.fbx*, the name of the folder will be *running.bck*. See the following table.

The backup files are saved within this folder. The first backup file is named “*n.001*”, where *n* is the name of the original file. Each file after that is named incrementally, as in “*n.002*”, “*n.003*”, “*n.004*”, and so on.

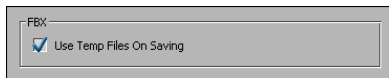


| Incremental backups option | Purpose |
|----------------------------------|---|
| Incremental Backup Active option | The Incremental Backup Active option lets you save backup files of the file on which you are working. This option is active by default. |
| Keep x backup files | The Keep x backup files field lets you choose the maximum number of backup files you want to keep. The default number of files is 4. For example, when you save the file for the fifth time, the first version of the file is deleted, so that only four versions remain in the folder. |

| Incremental backups option | Purpose |
|--------------------------------------|---|
| Save backup files to a specific path | The Save backup files to a specific path option lets you select the location of your backup files. When the option is disabled, the folder containing your saved files is created in the same location as the file you saved originally. When the option is active, the folder is created in the location you specify. The default location is C:\TEMP. |

FBX area

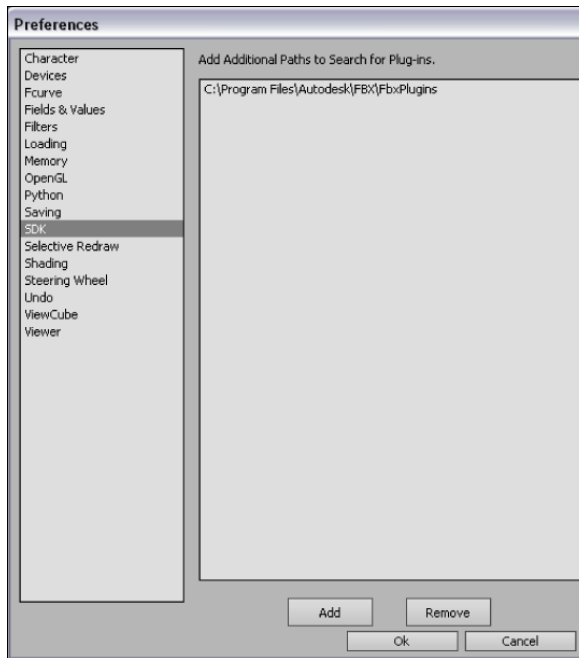
The FBX area contains the Use Temp Files On Saving option, which lets you affect the behavior of the Save operation for FBX files.



| FBX option | Purpose |
|--------------------------|--|
| Use Temp Files On Saving | The Use Temp Files On Saving option is useful if a problem occurs during the save process as activating this setting ensures that the original file is not corrupted. This way you can avoid overwriting an old version with another version, and losing data. Disable this option when you want to overwrite files with the same name. If the file in the specified directory already exists, the old version is replaced with the new one. This option is active by default. |

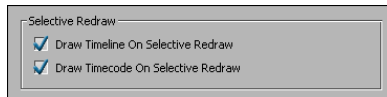
SDK preferences

The SDK area contains options that let you assign a plug-in path so that you can access plug-ins that reside in external directories. See [Setting a plug-in path](#) on page 58 for more information on how to specify a location from MotionBuilder to look for plug-ins.



Selective Redraw preferences

The Selective Redraw area contains options that let you set the defaults for time code and timeline updating.



Draw Timeline On Selective Redraw option

The Draw Timeline On Selective Redraw option lets you specify whether the Timeline is updated. Activate this option to update the timeline. Disable it to achieve faster frame rates by skipping the automatic Timeline update.

This option is active by default.

Draw Time code On Selective Redraw option

The Draw Time code On Selective Redraw option lets you specify whether the time code is redrawn. Activate this option to update the Time code, disable it to achieve faster frame rates by skipping the automatic Time code update.

This option is active by default.

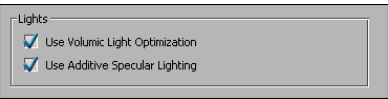
Shading preferences

In the Preferences window, the Shading preferences consist of the following:

- [Lights area](#) on page 44
- [Mesh Tessellation area](#) on page 45
- [Surfaces area](#) on page 45

Lights area

The Lights area lets you set default preferences for Light assets.



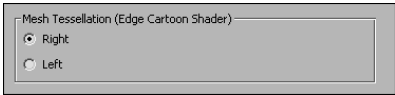
| Lights option | Purpose |
|--------------------------------|---|
| Use Volumic Light Optimization | The Use Volumic Light Optimization option lets you select a slower display method which is necessary for some OpenGL drivers. The default option is active. |
| Use Additive Specular Lighting | The Use Additive Specular Lighting option improves and saturates specular highlights if your video driver or card can support it. The majority of graphics cards support this setting. Disable this option only when using problematic video drivers or cards. When this option is disabled, the standard OpenGL lighting equation is used. The |

| Lights option | Purpose |
|---------------|--|
| | default option is active. See Specularity slider for more information. |

Mesh Tessellation area

The Mesh Tessellation area lets you choose the way MotionBuilder tessellates quad to triangle strips: right or left (|/\| or \|/\|). Most video drivers or cards support the conversion of quad to triangle strips.

Activate these options only when using the Edge Cartoon shader when you need to match the edge of a quad perfectly.

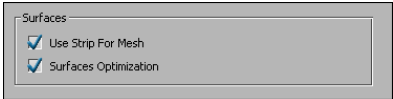


TIP If seams between the geometry and shader appear when you use Patches or NURBS with Edge Cartoon shader, try setting this option to Left. The default option is Right.

See [Edge Cartoon shader settings](#) on page 441 for more information.

Surfaces area

The Surfaces area options let you select default preferences for polygon geometry and NURBS or Patch tessellation.



| Option | Purpose |
|--------------------|--|
| Use Strip For Mesh | Activate the Use Strip For Mesh option to convert polygon geometry to triangle strips to speed up display. Disable this option when using problematic or old video drivers, old video cards, or geometry with strip algorithms. The default option is active |

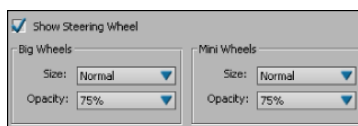
| Option | Purpose |
|-----------------------|---|
| Surfaces Optimization | The Surfaces Optimization option represents the tessellation of Patches and NURBS. This option maximizes Patch and NURBS processing speeds with no loss of quality. Activate this option to avoid having a deformed patch or NURBS evaluated at each frame. Disable this option only if activation causes problems. The default option is active. |

SteeringWheels preferences

In the Preferences window, the SteeringWheels preferences let you specify the default display of the SteeringWheels.

NOTE You must activate the SteeringWheels to make them appear in the Viewer window. The SteeringWheels do not display in the Viewer window by default.

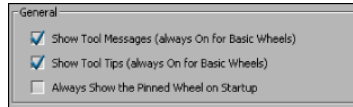
Wheels area



| Option | Function |
|---------------------|--|
| Show SteeringWheels | Activate this option to display the SteeringWheels in the Viewer window. |
| Big/Mini Wheels | |
| Size menu | Use this menu to specify the size of the SteeringWheels. |
| Opacity menu | When the cursor is near the SteeringWheels, it becomes opaque. When the |

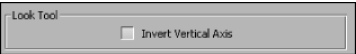
| Option | Function |
|--------|---|
| | cursor is not near it, it is transparent. Use this menu to specify the opacity of the SteeringWheels. |

General area



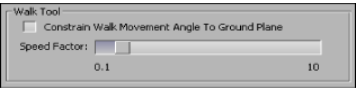
| Option | Function |
|---|--|
| Show Tool Messages | Active this option to show tool messages that are displayed over the Viewer window and give you instructions about using the SteeringWheels tools. Disable this option to tool messages off. Note: Disabling tool messages only affects the messages displayed when the Full Navigation Wheel is in use. |
| Show Tool Tips | Activate this option to display Tool tips, which appear for each wedge and button on a wheel when you hover the mouse over them. The tooltips identify what action is performed if you click the wedge or button. |
| Always show the pinned wheel on startup | This option lets you control the startup placement of the SteeringWheels. Activate this option if you want the wheel to be pinned when it displays; disable this option if you want the wheel to follow the position of the cursor. |

Look Tool area



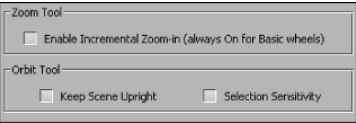
| Option | Function |
|----------------------|---|
| Invert vertical axis | Activate this option to swap the up-down mouse motion of the Look Tool. |

Walk Tool area



| Option | Function |
|---|--|
| Constrain walk movement Angle to ground plane | When active, you can look up and down while walking on the floor; if you disable this option, you will fly in the direction you are looking. |
| Speed Factor slider | Use the slider to sets the speed for the Walk Tool |

Zoom/Orbit areas

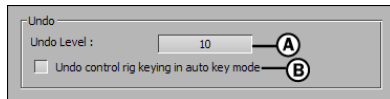


| Option | Function |
|----------------------------|---|
| Enable Incremental Zoom-In | When activated, you can increases the magnification of the model by clicking over the Zoom wedge. If disabled, nothing happens if you single click over the Zoom wedge. |

| Option | Function |
|-----------------------|--|
| Keep Scene Upright | When activated, avoids orienting the scene upside-down when you use the Steering-Wheels. |
| Selection sensitivity | When activated, the objects selected before the Orbit tool are used to calculate the pivot point to use for orbiting. The pivot point is calculated based on the center of the selected objects. |

Undo preferences

In the Preferences window, the Undo preferences let you specify the number of “undos” used by MotionBuilder.



A. Undo Level field B. the Undo Control Rig in Auto Key Mode option

Undo Level value

The Undo Level value lets you set the maximum number of “undos”. You may want to reduce the number of undo levels to save memory and speed up MotionBuilder.

The default value is 10.

Undo Control Rig in Auto Key Mode option

Activate the Undo Control Rig in Auto Key Mode option to be able to undo (*Ctrl* + *Z*) Character keys set with the Auto Key option in the Key Controls window.

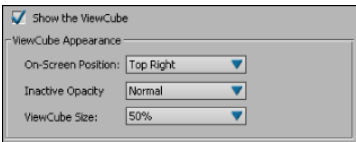
This setting is disabled by default as it can affect system performance.

NOTE If you undo Character keyframes set using the Auto Key option, they are not undone properly. The result depends on whether the Undo Control Rig in Auto Key Mode option is activated or disabled. If the Undo Control Rig in Auto Key Mode option is active, you must undo twice to successfully undo Character keyframes set with Auto Key: the first undo removes transformations, and the second undo removes the keyframe. If the Undo Control Rig in Auto Key Mode option is disabled, performing an undo twice replaces Character keyframes with blank keyframes.

ViewCube preferences

In the Preferences window, the ViewCube preferences let you specify the default display of the ViewCube.

Appearance area

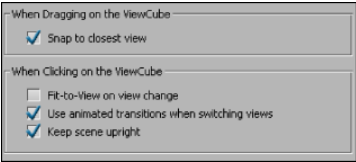


The Appearance area lets you set how the ViewCube displays in the Viewer window.

| Option | Function |
|-------------------------|--|
| Show the ViewCube | Shows or Hides the ViewCube in the Viewer window. |
| On Screen Position menu | Use this menu to choose which corner you can display the ViewCube: Top Right, Bottom Right, Top Left, or Bottom Left. |
| ViewCube Size menu | Use this menu to specify the ViewCube size. |
| Inactive Opacity menu | When the cursor is near the ViewCube, the cube is opaque. When the cursor is not near the ViewCube, additional controls (except the Home button) do not display. |

| Option | Function |
|--------|--|
| | Use this menu to specify the opacity of the ViewCube when the cursor is distant from it. (You have a choice of 0, 25, 50, 75 or 100%). |

Dragging/Clicking areas

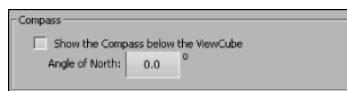


The When Dragging/Clicking in the ViewCube area lets you set behaviors for how the scene displays when you use the ViewCube.

| Option | Function |
|--------------------------------|--|
| When dragging on the ViewCube: | |
| Snap to the closest view | When active, the Viewer window snaps to one of the fixed views when it is close to one of the fixed views. |
| When clicking on the ViewCube | |
| Fit to view on view change | When active, clicking the ViewCube rotates around the center of the scene and zooms out to fit the scene into the Viewer window. When you drag the ViewCube, before the drag, the view changes to look at the scene center (but does not zoom) and continues to use that as the pivot point while dragging. When disabled, clicking or dragging the ViewCube rotates around the current pivot point and does not zoom in or out. |

| Option | Function |
|---|---|
| Use animated transitions when switching views | When active, an animated transition displays when you click on a section of the ViewCube so you can visualize the spatial relationship between the current view and the selected view. Note: When navigating scenes containing vast amounts of geometry, the application frame rate may drop significantly and make it difficult for the system to smoothly animate a viewpoint transition. |
| Keep model upright | When activated, avoids orienting the scene upside-down when you click edges, corners, or faces of the ViewCube. |

Compass area



The compass area lets you indicate which direction is defined as North for the scene. The ViewCube compass North direction is based on the North and Up directions defined by the scene or set in the Angle of North field.

| Option | Function |
|-------------------------------------|---|
| Show the compass below the ViewCube | Activate this option show or hide the compass. |
| Angle of North field | Enter a value (in degrees) to set the angle between the ViewCube FRONT face and the Compass directionNorth. |

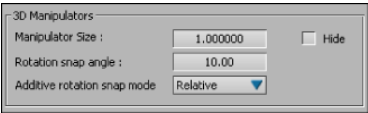
Viewer preferences

In the Preferences window, the Viewer preferences contain the following:

- [3D Manipulators area](#) on page 53
- [Cursor area](#) on page 54
- [Grid area](#) on page 54
- [Schematic View area](#) on page 55
- [Selection area](#) on page 56
- [Viewer Toolbar area](#) on page 56

3D Manipulators area

The 3D Manipulators area lets you activate, disable, and change the appearance of the 3D Manipulators that are shown when objects are selected in the Viewer window.

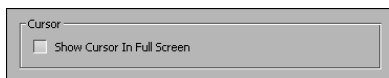


| 3D Manipulators option | Purpose |
|------------------------|--|
| Manipulator size | Enter a new value in this field to make the 3D manipulator handles/arrow appear larger or smaller in the Viewer window. |
| Hide | The Hide option lets you disable the display of the 3D manipulators. The default option is disabled so that the 3D manipulators are shown. |
| Rotation Snap Angle | The Rotation Snap Angle Field lets you specify an increment for the Snap Angle button to use when activated. To set a rotation increment, double-click the Rotation Snap Angle field and enter a value, see Setting a rotation increment on page 57. |

| 3D Manipulators option | Purpose |
|-----------------------------|---|
| | For information on using the Angle Snap button, see Snap Rotation |
| Additive Rotation Snap Mode | Select Absolute from the menu to snap the rotation angle snap at exact increments, so, if you had set 10 in the Rotation Snap Angle field, the rotation would proceed incrementally 20, 30, 40, 50 degrees and so on. Select Relative to have the increments start relative to the position of the object. So, for example, if your object was at 12 degrees to begin with, and you specified a 10 degree angle, the rotation would be 22, 32, 42, 52, and so on. |

Cursor area

The Cursor area contains the Show Cursor In Full Screen option, which turns the mouse pointer on or off when MotionBuilder is in full screen mode. Activate this option to have the mouse pointer appear in full screen mode; disable to hide the mouse pointer.lets you set the default options for cursor actions in the MotionBuilder interface.



Show Cursor In Full Screen is disabled by default.

Grid area

The Grid area lets you customize the grid displayed in the Viewer window. With the Grid options, you can set the color of grid lines, reposition the grid center, and alter the grid's size and spacing.

Grid

Color : R 0.50 G 0.50 B 0.50 ...

Offset : X 0.00 Y 0.00 Z 0.00

Size : X 1000.00 Y 1000.00 Z 1000.00

Spacing : 20.00

Restore Defaults

| Grid area option | Purpose |
|------------------|---|
| Color | The Color values let you set the color of the grid lines. The main grid lines display a shade lighter to act as a guide. |
| Offset | The Offset values let you move the grid center from its default position. Only two components of this offset are used for each grid, for example, you can offset an “XZ” grid along the X and the Z axes, but not along the Y axis. |
| Size | The Size values let you set the size of the grids. For example, an XZ grid uses the X and Z coordinates of “Size” as its width and height. |
| Spacing | The Spacing value lets you set the distance between the grid lines. There is only one value necessary as the spacing is consistent for all dimensions. |
| Restore Defaults | Click the Restore Defaults button to return to the original grid options. |

Schematic View area

The Schematic View area contains the Auto Arrange On by Default option, which lets you activate or disable the Auto arrange function that automatically arranges nodes in the Schematic View.

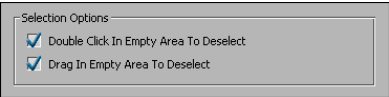
Schematic View

☐ Auto Arrange <On> By Default

The default setting is disabled: nodes in the Schematic View are not arranged automatically.

Selection area

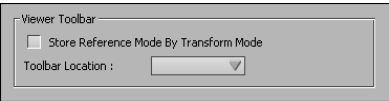
The Selection area lets you configure the method used to deselect objects in the Viewer window.



| Select option | Purpose |
|--|---|
| Double Click in Empty Area to Deselect | Activate the Double Click in Empty Area to Deselect option if you want to deselect all selected objects by double-clicking in an empty area of the Viewer window. |
| Drag in Empty Area to Deselect | Activate the Drag in Empty Area to Deselect option if you want to deselect all selected objects by dragging in an empty area of the Viewer window. |

Viewer Toolbar area

The Viewer Toolbar area lets you modify the toolbar position and set Transform reference modes.



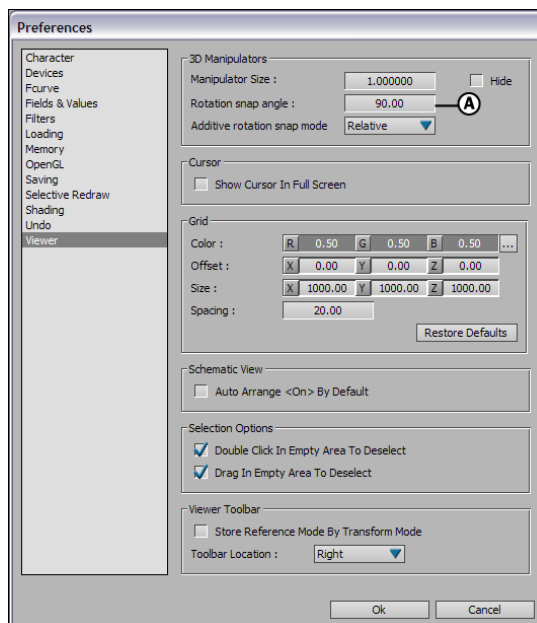
| Viewer toolbar option | Purpose |
|--|---|
| Store Reference Mode By Transform Mode | Activate the Store Reference Mode By Transform Mode option if you want to set a Reference Mode (Local/Global/Additive) specific to each Transformation type. For example, you can set your Translations to be in Local mode, where your Rotations are set to Global. This way, when you |

| Viewer toolbar option | Purpose |
|-----------------------|--|
| | switch back to Translating an object, the mode returns to Local automatically. |
| Toolbar Location | Select either Left or Right from the Toolbar Location menu to choose which side of the Viewer window the Viewer toolbar appears. |

Setting a rotation increment

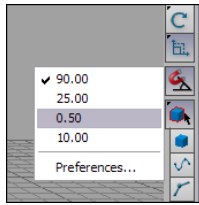
To set a rotation increment:

- 1 In the Preferences window, select Viewer from the Preference list.
- 2 Double-click the Rotation Snap Angle field and enter a value.



Preferences window A. Rotation Snap Angle field.

- 3 If you have set a Snap Angle previously, right-click the Snap Rotation button in the Viewer window to see a list of the last five angles set.



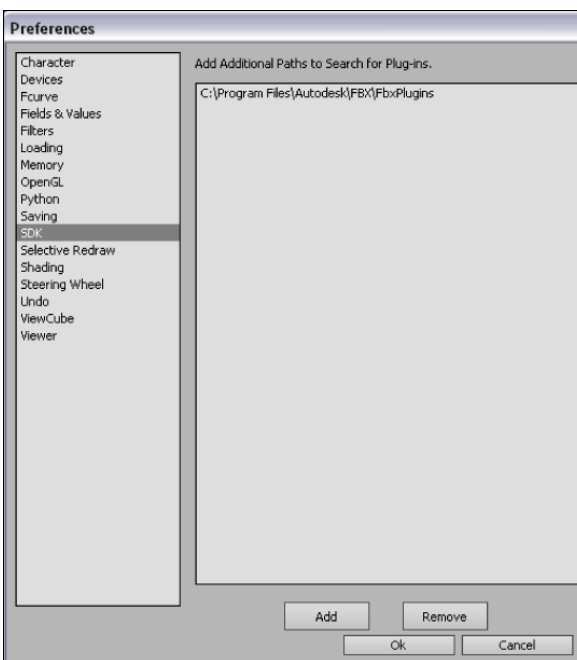
If you want, click one of the angles listed, or click Preferences to open the Preferences window, where you can set a new angle.

Setting a plug-in path

Use the SDK area to assign additional paths for MotionBuilder to search so that you can access plug-ins that reside in external directories.

To set a plug-in path:

- 1 Select Settings > Preferences from the MotionBuilder menu bar.
- 2 Select SDK from the Preferences window. The SDK Path pane appears.



- 3 Click Add to open a file browser and navigate to where your plug-in resides.
- 4 Click Ok. Any plug-ins found in the specified location are now available to MotionBuilder.

NOTE You must restart MotionBuilder for the path to appear.

To remove a plug-in from this list, select the path in the SDK pane and click Remove. (This also requires a restart.)

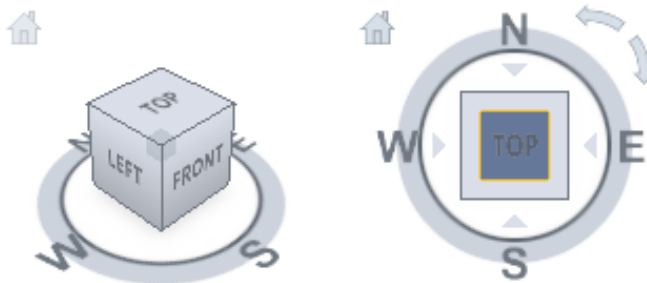
Viewing Assets and Navigating in 3D Space

Viewing Assets in 3D Space

The ViewCube lets you change the orientation and view objects in the Viewer window. It tools let you adjust the detail of objects and create views that define an area of a model as well as use preset views to restore a known view or orientation.

ViewCube

The ViewCube is a 3D navigation tool that appears in the top-right corner of the Viewer window. While the ViewCube is inactive, it displays the current view of the model based on the current UCS and the North direction defined by the WCS of the model.



Position your mouse over the ViewCube to activate it. When the ViewCube is active, you can switch to one of the preset views, roll the current view, or change to the Home view of the model. While the ViewCube is inactive, it gives you visual feedback about the current view of objects in the Viewer window as view changes occur.

See [ViewCube](#) on page 73 for more information.

Navigating in 3D Space

SteeringWheels are tracking menus that let you access different 3D navigation tools from a single tool.

SteeringWheels

SteeringWheels save you time by combining many common navigation tools into a single interface. They are contextual to the scene that you are viewing.



NOTE You must activate the SteeringWheels to make them appear in the Viewer window. The SteeringWheels do not display in the Viewer window by default. See [SteeringWheels preferences](#) on page 46 for more on how to show the SteeringWheels.

SteeringWheels are divided into different sections known as wedges. Each wedge on a wheel represents a single navigation tool that lets you pan, zoom, or manipulate the current view of a model in different ways.

See [SteeringWheels](#) on page 63 for more information.

SteeringWheels

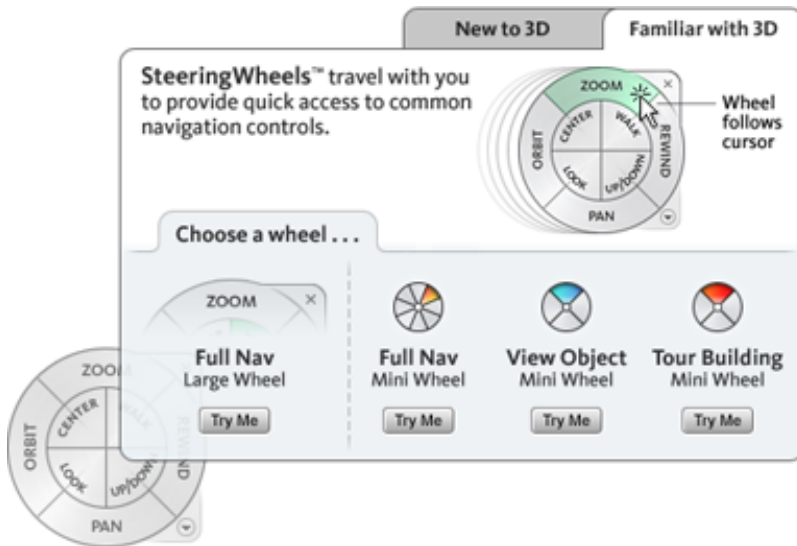
4

SteeringWheels are tracking menus that allow you to access different 3D navigation tools from a single tool.



NOTE You must activate the SteeringWheels to make them appear in the Viewer window. The SteeringWheels do not display in the Viewer window by default. See [SteeringWheels preferences](#) on page 46 for more on how to activate the SteeringWheels.

SteeringWheels First Contact balloon



The first time you open MotionBuilder after installation, the First Contact balloon for appears. The First Contact balloon introduces you to the wheels and explains how you can use them.

Using the SteeringWheels

You can display a wheel by pressing *Ctrl-Shift-N* on the keyboard or activate the Show SteeringWheels option from the [SteeringWheels preferences](#) on page 46.

NOTE You must activate the SteeringWheels to make them appear in the Viewer window. The SteeringWheels do not display in the Viewer window by default.



Once you set the SteeringWheels to display, use the available navigation tools by either clicking over one of the wedges on the wheel or clicking and holding down the mouse button. Once the button is held down, drag over the Viewer window to reorient the current view. Releasing the button returns you to the SteeringWheel.

NOTE Pressing and dragging on the wheel sectors is the main way to use the SteeringWheel.

Showing/hiding the SteeringWheels

To show or hide the SteeringWheels in the Viewer window:

- 1 Right-click the SteeringWheels and select Properties from the contextual menu that appears.
- 2 Deactivate the Show the SteeringWheels option.
- 3 Click Ok.

For more on SteeringWheels preferences see [SteeringWheels preferences](#) on page 46

Controlling the appearance of the SteeringWheels

You can control the appearance of the wheels by changing the current mode, or by adjusting the size and opacity.

The SteeringWheels are available in two different modes: big and mini. To change the current mode of a SteeringWheel, right-click the wheel and select a different mode.

You can also adjust the opacity and size for the wheels. The size of a wheel controls how large or small the wedges and labels appear on the wheel; the opacity level controls the visibility of the objects in the model behind the wheel. Change the settings in the [SteeringWheels preferences](#) on page 46.

Control Tooltips and messages for SteeringWheels

Tooltips are displayed for each wedge and button on a wheel as the you hover the cursor over them. Tooltips appear below the wheel and identify what action the wedge or button performs if you click it.

NOTE You can activate or disable Tooltips in [SteeringWheels preferences](#) on page 46.

Similar to tooltips, tool messages are displayed when you use one of the navigation tools from a wheel. Tool messages are displayed over the Viewer window to provide instruction for using the active navigation tool. Like tooltips, you can turn tool messages on or off in the [SteeringWheels preferences](#) on page 46.

Disabling tool messages only affects the messages that are displayed when using the Full Navigation wheel.

SteeringWheels contextual menu

Right-click the SteeringWheel to open the SteeringWheels contextual menu.

| Option | Function |
|--------------------|--|
| Mini view object | Displays the mini version of the View Object wheel. See View Object wheels on page 69 for more information. |
| Mini tour building | Displays the mini version of the Tour Building wheel. See Tour Building wheels on page 70 for more. |
| Mini navigator | Displays the mini version of the Full Navigation wheel. See Navigation wheels on page 67 for more information. |

| Option | Function |
|---------------------|---|
| Full view object | Displays the View Object wheel. See View Object wheels on page 69 for more information. |
| Full tour building | Displays the Tour Building wheel. See Tour Building wheels on page 70 for more information. |
| Full navigator | Displays the Full Navigator wheel. See Navigation wheels on page 67 for more information. |
| Increase walk speed | Increases the walk speed used for the Walk tool by two times. |
| Decrease walk speed | Decreases the walk speed used for the Walk tool by one half. |
| Close | Closes the SteeringWheels. (Press <i>Ctrl-Shift-N</i> to reopen it.) |

Navigation wheels

The Full Navigation wheels combine the 3D navigation tools found on the View Object and Tour Building wheels.



The Full and Mini Navigator SteeringWheels

The Full Navigation wheel is divided into the following wedges:

| Wedge | Function |
|---------|---|
| Zoom | Adjusts the magnification of the current view. |
| Rewind | Restores the most recent view. You can move backward or forward through previous views. |
| Pan | Repositions the current view by panning. |
| Orbit | Rotates the current view around a fixed pivot point. |
| Center | Specifies a point on a model to adjust the center of the current view or change the target point used for some of the navigation tools. |
| Walk | Simulates walking through a model. |
| Look | Swivels the current view. |
| Up/Down | Slides the current view of a model along the Y |
| | axis of the screen. |

The Mini Navigation wheel is divided into the following wedges:

| Wedge | Function |
|--------------------------|--|
| Zoom (Top wedge) | Adjusts the magnification of the current view. |
| Walk (Upper right wedge) | Simulates walking through a model. |

| Wedge | Function |
|-----------------------------|---|
| Rewind (Right wedge) | Restores the most recent view. You can move backward or forward through previous views. |
| Up/Down (Lower right wedge) | Slides the current view of a model along the Y axis of the screen. |
| Pan (Bottom wedge) | Repositions the current view by panning. |
| Look (Lower left wedge) | Swivels the current view. |
| Orbit (Left wedge) | Rotates the current view around a fixed pivot point. |
| Center (Upper left wedge) | Specifies a point on a model to adjust the center of the current view or change the target point used for some of the navigation tools. |

View Object wheels

The View Object wheel is for 3D navigation; it includes the orbit 3D navigation tool. Use the View Object wheel to examine 3D objects from the outside.



The Full and Mini View Object SteeringWheels

Center

Specifies a point on a model to adjust the center of the current view or change the target point used for some of the navigation tools.

Zoom

Adjusts the magnification of the current view.

Rewind

Restores the most recent view orientation. You can move backward or forward through previous views.

Orbit

Rotates the current view around a fixed pivot point.

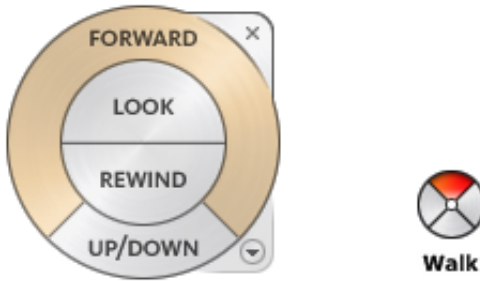
The mini View Object wheel is divided into the following wedges:

| Wedge | Function |
|----------------------|---|
| Zoom (Top wedge) | Adjusts the magnification of the current view. |
| Rewind (Right wedge) | Restores the most recent view. You can move backward or forward through previous views. |
| Pan (Bottom wedge) | Repositions the current view by panning. |
| Orbit (Left wedge) | Rotates the current view around a fixed pivot point. |

To switch back to the Full View Objects wheel, right-click the wheel and click Full View Object Wheel.

Tour Building wheels

The Tour Building wheels are designed for 3D navigation of scenes where the viewer moves through the scene, such as a building.



The Full and Mini Tour Building SteeringWheels

The Full Tour Building wheel is divided into the following wedges:

| Wedge | Function |
|---------|--|
| Forward | Adjusts the distance between the current point of view and the defined pivot point of the model. Clicking once moves forward as far as the object you clicked. |
| Look | Swivels the current view. |
| Rewind | Restores the most recent view. You can move backward or forward through previous views. |
| Up/Down | Slides the current view of a model along the Y axis of the screen. |

The Mini Tour Building wheel is divided into the following wedges:

| Wedge | Function |
|----------------------|---|
| Walk (Top wedge) | Simulates walking through a scene. |
| Rewind (Right wedge) | Restores the most recent view. You can move backward or forward through previous views. |

| Wedge | Function |
|------------------------|--|
| Up/Down (Bottom wedge) | Slides the current view of a model along the Y axis of the screen. |
| Look (Left wedge) | Swivels the current view. |

The ViewCube is a 3D navigation tool that appears in the top-right corner of the Viewer window. While the ViewCube is inactive, it displays the current view of the scene based on the current North direction defined by the scene.

Controlling the appearance of the ViewCube

The ViewCube is displayed in one of two states: inactive and active.

When the ViewCube is inactive, it is transparent over the Viewer window. When the ViewCube is active, it is opaque and hides some objects in the Viewer window.



In addition to controlling the inactive opacity level of the ViewCube, you can also control its size, on-screen position, and the default ViewCube orientation. The settings used to control the appearance of the ViewCube are located in the Preferences window. You can also access the ViewCube Preferences if you right-click the ViewCube and select Properties from the contextual menu. See [ViewCube preferences](#) on page 50.

Using the Compass

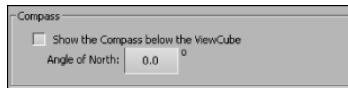
The ViewCube compass shows which direction North is defined for the scene. The North indicated by the compass is based on the North settings in the ViewCube properties.



You can specify the North Angle [Compass area](#) on page 52 settings in the Preferences window. You can also access the ViewCube Preferences if you right-click the ViewCube and select Properties from the contextual menu. See [ViewCube preferences](#) on page 50.

To display the ViewCube compass:

- 1 Right click the ViewCube and select Properties. The ViewCube Preferences window displays.
- 2 Activate Show compass below the ViewCube in the Compass area.



Preferences window: Compass area.

For more on the ViewCube properties, see [ViewCube preferences](#) on page 50.

Changing the view of a scene with the ViewCube

The ViewCube provides twenty-six defined areas you can click to change the current view of a model. These areas are categorized into three groups: corner,

edge, and face. Six of the twenty-six defined areas represent standard orthogonal views of a model: top, bottom, front, back, left, and right. Orthogonal views are set by clicking one of the faces on the ViewCube.



You use the other twenty defined areas to access angled views of a model. Clicking one of the corners on the ViewCube reorients the current view of the scene to a three-quarter view.

Rolling a face view



When you view a model from one of the face views, two additional icons are displayed near the ViewCube. These are the roll arrows. You can use the roll arrows to roll or rotate the current view 90 degrees in the positive or negative directions around the center of the view.

ViewCube contextual menu

Right-click the ViewCube to display the ViewCube contextual menu, which gives you access to ViewCube settings.

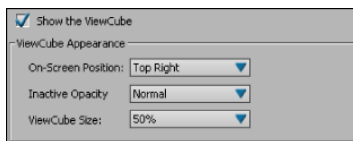
| Option | Function |
|--------|--|
| Home | The default Home position is the existing orientation of the default view (southeast corner of the scene). You can also define a |

| Option | Function |
|--------------------------|--|
| | view of the model as the Home view so you can easily return to the familiar view by clicking the Home icon or by clicking Set Current View as Home in the contextual menu. |
| Set Current View as Home | Defines the Home view of the model based on the current Viewer window position. |
| Properties | Opens the Preferences window ViewCube preferences on page 50 where you can configure the ViewCube's default settings. |
| Help | Provides information on the ViewCube. |

Showing/hiding the ViewCube

To show or hide the ViewCube in the Viewer window:

- 1 Right-click the ViewCube and select Properties from the contextual menu that appears.
- 2 Deactivate the Show the ViewCube option.



ViewCube preferences

- 3 Click Ok.

Managing Files

An *.fbx* file is a collection of assets, animation, and MotionBuilder settings. Assets may include a model created in another 3D software package and exported using an FBX plug-in, animation data saved using MotionBuilder, or any other assets created and saved using MotionBuilder including lights, cameras, control rigs, and so on.

This book describes the more common file operations within MotionBuilder that deal with adding, loading, merging, and saving assets from *.fbx* files.

This section also discusses importing and exporting full scenes and importing and exporting animation or motion capture using other data file formats. Preferences specific to saving or backing-up *.fbx* files are also discussed, as well as topics on batch processing, audio, and version control.

- [Opening and loading](#) on page 79
- [Merging](#) on page 101
- [Saving](#) on page 109
- [Importing](#) on page 125
- [Exporting](#) on page 135
- [Batch processing](#) on page 151
- [Version control](#) on page 207

Opening and loading

6

MotionBuilder provides the following methods of adding and loading scenes and assets:

- Select File > Open, File > FBX plug-in Import, or File > Import from the MotionBuilder menu bar to select a file using the file browser
- Select a previously saved file from the list of recently opened files in the File menu.
- Drag an asset or *.fbx* file from the Asset browser into the Viewer window or Scene browser.
- Merge a file with an existing scene using the Merge functions. See [Merging](#) on page 101.

Opening a file

This section describes how to open (or load) *.fbx* files created or modified in MotionBuilder and other software.

There are three ways to open files:

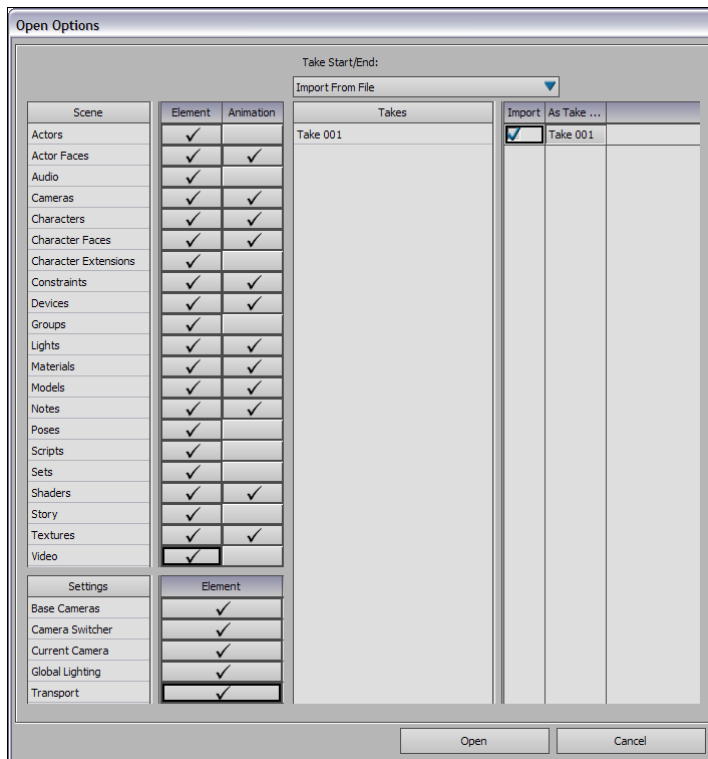
| Method | Description |
|---------------------------|--|
| File > Open | Use this method to opening an FBX file saved in MotionBuilder. |
| File > FBX Plug-in Import | Use this method to open an FBX file saved with the FBX Plug-in inside another software application, for example, 3ds Max or Maya. See Installing the latest FBX Plug-ins . |

| Method | Description |
|---------------|--|
| File > Import | Use this method to import motion files, for example .c3d. (You can also import FBX files to bring in animation.) |

Opening an FBX file

To open an .fbx file in MotionBuilder:

- 1 Select File > Open from the MotionBuilder menu bar.
- 2 Select a file using the Open File file browser.
- 3 Click Open. The Open Options window appears.



The Open Options window.

- 4 Disable any elements of the file you do not want to load with the file.
- 5 Click Open.

The file loads in MotionBuilder.

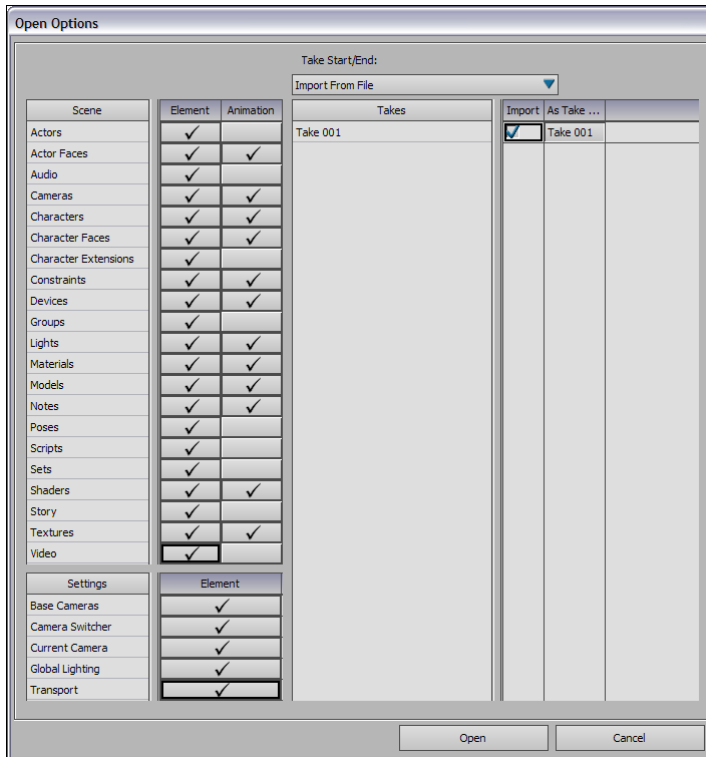
NOTE To open a file into an existing scene, see [Merging](#) on page 101.

Opening a file from another 3D package

You can open .fbx, .3ds, .dae, and .obj files with the FBX Plug-in Import method. For all other formats, save your file in the originating software (such as Maya) as an FBX file using the FBX Plug-in. See Installing the latest FBX Plug-ins.

To open a file from another 3D package:

- 1 Select File > FBX Plug-in Import from the MotionBuilder menu bar.
- 2 Select a file using the Open File file browser.
- 3 Click Open. The Open Options window appears.



The Open Options window.

- 4 Disable any elements of the file you do not want to load with the file.
- 5 Click Open.

The file loads in MotionBuilder.

NOTE To open a file into an existing scene, see [Merging](#) on page 101.

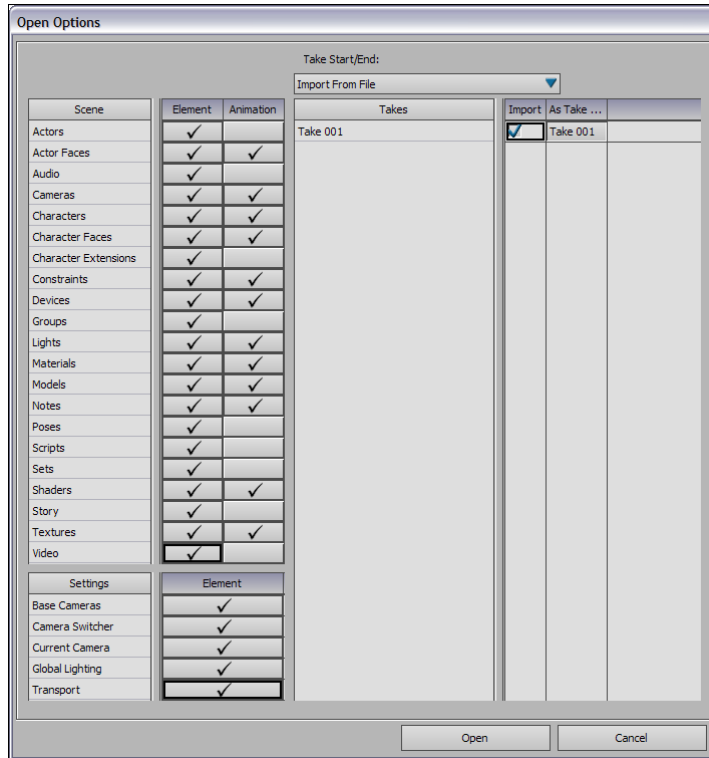
Opening a motion (MoCap) file

You can open .fbx, .bvh, .htr, .trc, and .c3d files with the FBX Import method.

To open a motion file:

- 1 Select File > FBX Plug-in Import from the MotionBuilder menu bar.

- 2 Select a file using the Open File file browser.
- 3 Click Open. The Open Options window appears.



The Open Options window.

- 4 Disable any elements of the file you do not want to load with the file.
- 5 Click Open.

Adding assets to a scene

You can load any asset in your scene by dragging it from the Asset or Scene browser into the Viewer window.

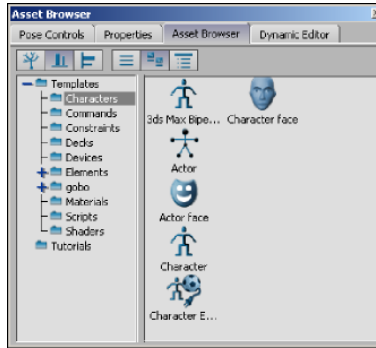
NOTE The Note and Skeleton Root asset both require a few more steps than is usual for you to add them correctly. Refer to the section on each asset for instructions.

You can add assets using one of the following methods:

- Drag an asset into the Viewer window
Depending on the selected asset, the asset's settings appear in the Navigator window, letting you set the asset's properties.
For example, if you drag a light asset from the Asset browser into the Viewer window, a light is added to the scene and its settings display in the Navigator window. The light is placed where you release the mouse button in the Viewer window. See [Dragging and dropping assets and files](#) on page 94.
- Drag an *.fbx* file into the Viewer window
You can drag *.fbx* files into the Viewer window to add their assets to your scene if you create a path to their directories in Asset browser. A contextual menu displays letting you choose whether to Open or Merge the *.fbx* file. See Adding a favorite path.
- [Types of assets](#) on page 225
- [Dragging and dropping assets and files](#) on page 94
- [Merging files dragged into the Viewer window](#) on page 103

Adding a Characters folder asset

The Character assets help you create a complete map of your character model's structure and link it to a motion source for animation.



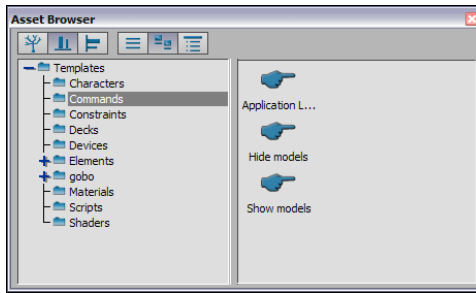
Asset Browser: Characters folder

There are five types of assets in the Asset browser Character folder: Character, Actor, Actor Face, Character Extension, Character face.

- [Adding a Character asset](#) on page 1081.
- [Creating an Actor](#) on page 1164.
- [Attaching an Actor Face to a head model](#) on page 1418.
- [Creating a Character Extension](#) on page 1154.
- Adding a Character Face.

Adding a Commands folder asset

The Asset browser Commands folder contains assets you can use in the Story window to insert Command clips that let you build animation. There are three types of Command assets: Application Launch, Hide Models, and Show Models

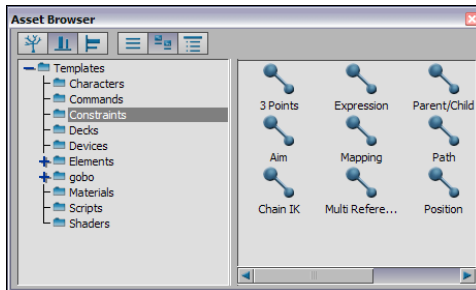


Asset Browser: Commands folder

See [Creating command clips](#) on page 1557 for information on how to add these three assets to your scene.

Adding a Constraints folder asset

The Asset browser's Constraints folder contains constraints that you can use to create relationships between objects in your scene .

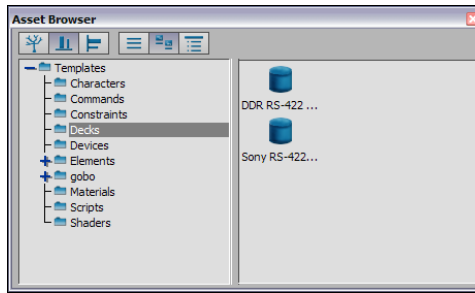


Asset Browser: Constraints folder

See [Adding a constraint asset](#) on page 824.

Adding a Decks folder asset

Decks let you control, monitor, and synchronize the recording or playback of a VTR (Video Tape Recorders) from within MotionBuilder.



Asset Browser: Decks folder

MotionBuilder supports two decks:

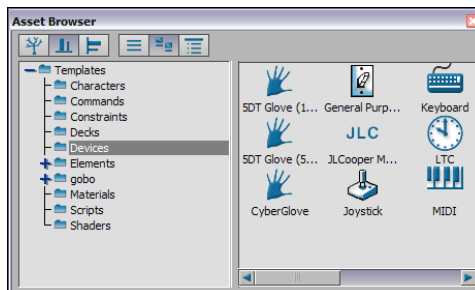
- DDR RS-422 Compatible
- Sony RS-422 Compatible

To add a deck:

- 1 Select either of the supported decks.
- 2 Drag a deck into the Viewer window from the Asset browser Decks folder.
The Decks settings pane appear in the Navigator window.

Adding a Devices folder asset

A device is either a special software component or a separate piece of hardware that connects to your computer.



Asset Browser: Devices folder

For information on how to use a device in your scene, see [Adding a device](#) on page 1021.

Adding an Elements folder asset

All Assets in the Elements folder are added in a similar way. The following is the basic procedure:

To add an Elements folder asset to a scene:

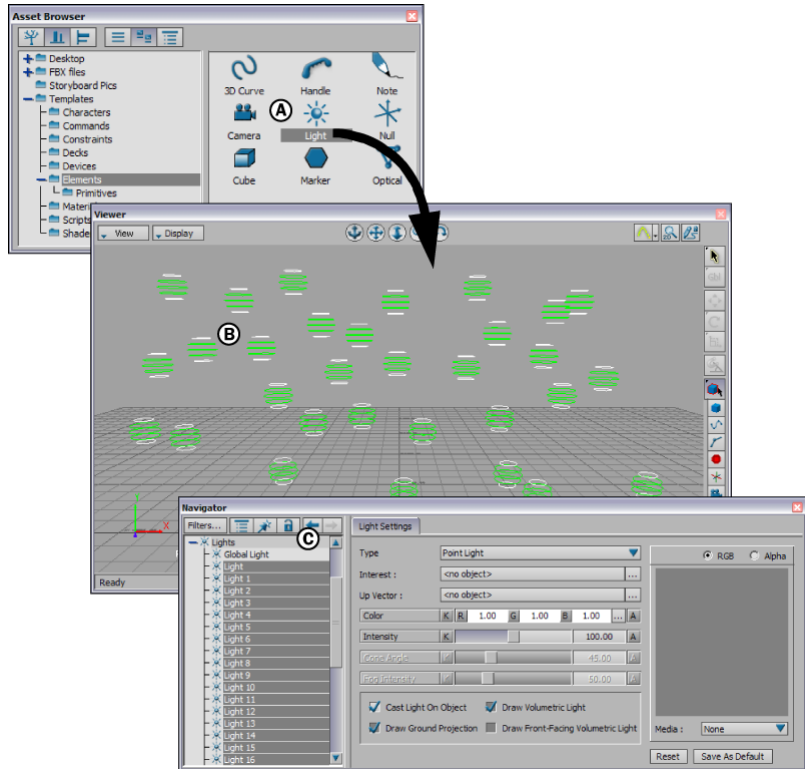
- 1 Drag an Elements folder asset from the Asset browser's Elements folder into the Viewer window.
- 2 The asset appears where you have dragged it. The Navigator window updates to display settings for the asset.

To add multiple assets to your scene:

- 1 Double-click the asset in the Asset browser. The cursor becomes a cross hair.

NOTE This procedure applies only to the 3D Curve, Camera, Cube, Light, Marker, Null, Optical, Plane, Skeleton node, and Skeleton root assets.

- 2 Click anywhere in the Viewer window to place assets at that point. The Navigator window updates to display settings for those assets.



Double-clicking an Element in the Asset browser (A) lets you add multiple instances of the asset wherever you click in the Viewer window (B). The related settings display in the Navigator window (C).

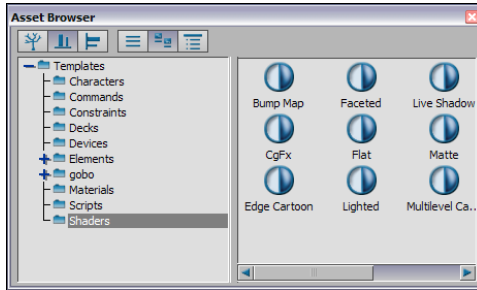
- 3 If you are creating a 3D Curve, you must press Enter to accept the operation or press Escape to cancel it. For more information, see [Creating a 3D curve](#) on page 921.

There is more specific information on adding Element assets in their respective sections.

- [Connecting a Handle to an object](#) on page 543.
- [Adding and removing lights](#) on page 350.
- [Attaching and removing Notes](#) on page 231.
- [Creating a skeleton](#) on page 1120.

Adding Shader assets

Shaders control the way the surface interacts with the lighting in the scene, creating color, specularity, reflection, transparency, shadowing,



Asset Browser: Shaders folder

- [Applying a shader to a model](#) on page 424.

Loading motion data

There are two ways to add motion data to your scene, using the menu bar and dragging a motion file from the Asset browser.

To load motion data using the menu bar:

- 1 Select File > Open from the MotionBuilder menu bar.
- 2 Browse for your motion file using the Open File dialog box. When you have located a file, select it and click Open.
- 3 The Open options window appears. Choose which aspects of the motion file you want to import and click Open.

The motion file loads in your scene. For information on connecting Motion data to an Actor or character, see [Loading poses](#) on page 91.

To load motion data using the Asset browser:

- 1 Drag a motion file from the Asset browser's Elements folder into the Viewer window.

- 2 A contextual menu appears where you have dragged the file, asking you if you want to open or merge the file, if there is already something in the scene.
- 3 Select the take you want to use in the scene.

Loading poses

To add a pose to a scene:

- 1 Select File > Open in the menu bar.
- 2 Navigate to select the *.fbx* file containing your poses from the Open File dialog box.

Or drag an *.fbx* file containing poses into the Pose Controls window from the Asset browser. When dragging, make sure you release the *.fbx* file over a folder name or existing pose.

- [Creating a pose](#) on page 1293
- [Saving a pose](#) on page 115
- [Pose Controls window](#) on page 1296

Loading audio files

There are two ways to load audio files in MotionBuilder, using the menu bar and the Transport Controls:

Menu bar

To add a audio file to a scene using the menu bar:

- 1 Select File > Import Audio from the menu bar and navigate to select an audio clip.

Transport Controls

To add a audio file to a scene using the Transport Controls:

- 1 Right-click the Action Timeline in the Transport Controls and select Audio > Open Audio Clip from the contextual menu.
- 2 Browse for a *.wav* or *.mp3* file.

The Navigator window displays the Audio settings with either the Audio Settings pane.

TIP If audio files are already in the Asset or Scene browsers, you can drag them into the Viewer window.

Loading video files

There are two ways to load video files in MotionBuilder, using the menu bar and the Scene browser

NOTE MotionBuilder supports *.avi*, *.qt*, and *.mov* video formats.

To load video files, do one of the following:

- Select File > Import Video from the menu bar and navigate to select a video file.
- Right-click the Scene browser in the Navigator window and select Insert Video from the contextual menu, then browse for a video clip.

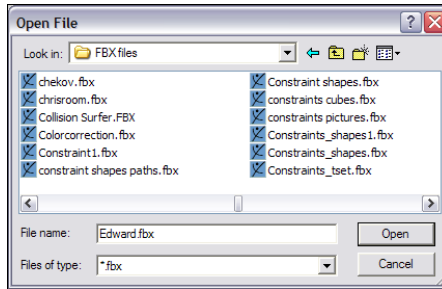
TIP If video files are already in the Asset or Scene browsers, you can drag them into the Viewer window.

Loading assets from *.fbx* files

You can load only specific elements from an *.fbx* file, instead of opening the whole file.

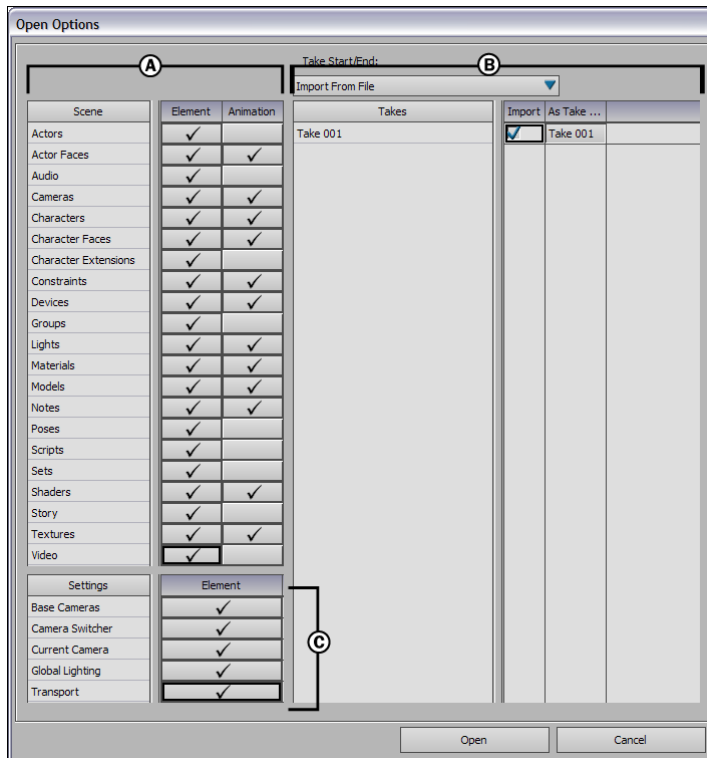
To load assets from an *.fbx* file:

- 1 Select File > Open from the MotionBuilder menu bar. The Open File dialog box appears.



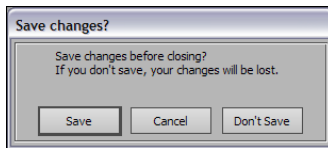
Open File browser

- 2 Using the File browser, select the file containing the assets you want to load and click Open. The Open Options dialog box appears.



Open Options dialog box A. Open Assets area B. Open Takes area C. Settings area

- 3 Use the Open Options dialog box to select which assets, settings, and takes to load. The Open Options dialog box consists of the following areas:
 - [Open options dialog box](#) on page 96
 - [Open Settings area](#) on page 98
 - [Open Takes area](#) on page 99
- 4 Click Open to open the selected *.fbx* file and load the selected assets, settings, and takes.
- 5 If there are objects, models, or other elements already in your scene, the Save Changes dialog box appears confirming that you want to replace your scene with the file you are loading.



Save changes dialog box

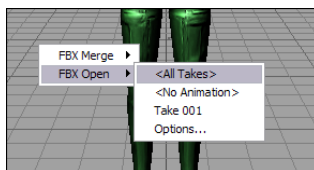
Dragging and dropping assets and files

You can drag *.fbx* files and assets into the Viewer window to open them.

To drag and drop assets or files:

- 1 Drag an *.fbx* file into the Viewer window from the Asset browser to open them.

The FBX Open contextual menu appears where you dropped the file. Expand this menu to see the open options.



FBX Open options

NOTE

If there is anything already in the scene, there is a second option: FBX Merge.

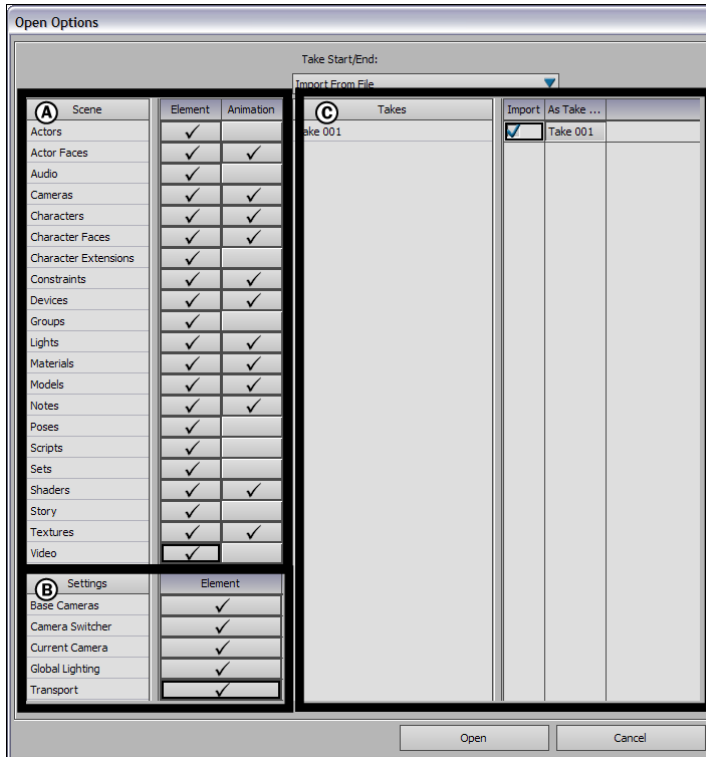
2 Select from the following options:

| Option | Description |
|--------------|---|
| All Takes | Replaces the current scene with the assets, settings, and takes from the <i>.fbx</i> file. All assets and models are loaded with their animation. If something is already in your scene, a save dialog box appears for you to save it before the new scene is opened. |
| No Animation | Replaces the current scene with the assets and settings from the <i>.fbx</i> file. All keyframe animation on assets and models are not loaded. Takes are also not loaded. |
| Take 001 | This part of the contextual menu lists the takes in the <i>.fbx</i> file. Selecting the take name replaces the current scene with the keyframe animation on assets and models associated with the selected take. |
| Options | Opens the Open Options dialog box, letting you select the assets, settings, and takes to load. For more information on the Open Options dialog box, see Loading assets from .fbx files on page 92. |

3 If you select Options, the Open Options dialog box appears to let you select specific assets, settings, and takes to load from the new scene. For more information on the Open Options dialog box, see [Loading assets from .fbx files](#) on page 92.

Open options dialog box

The Open options dialog box appears when after you select Options in the Open File file browser. The Open Options dialog box lets you select specific assets, settings, and takes to load from the new scene.



The Open Options window. A. Assets area B. Open settings areas C. Open takes area

The Open Options dialog box is split into three areas:



- Assets area
- Open settings area
- Open takes area

Assets area



The Open Asset area of the Open Options dialog box provides a list of every MotionBuilder asset that you can load from the *.fbx* file being opened.

Although each asset is listed in the Open Assets area, it does not indicate that the *.fbx* file being loaded contains these assets. For example, if the *.fbx* file you are loading does not contain Light assets, the Lights element is still listed.

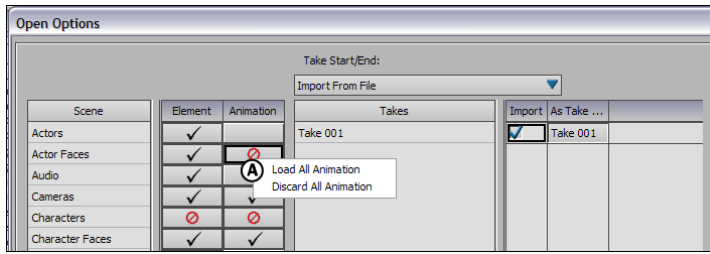
In the Open Assets area, the following symbols indicate whether the assets are loaded or ignored (Element column):

| Symbol | Description |
|---|---|
|  | Loads the corresponding assets from the <i>.fbx</i> file. |
|  | Does not load the corresponding assets. |

For each asset's animation, the following symbols indicate whether the animation is loaded or ignored (Animation column):

| Symbol | Description |
|--|--------------------------------------|
|  | Loads the asset's animation. |
|  | Does not load the asset's animation. |

For example, the Open options in loads all Actor Faces without their animation and all custom cameras with their animation. The Characters and their animations are not loaded from the *.fbx* file.



Changing loading options. A. Right-click the Animation column heading to select or deselect all items in the column.

You can right-click the heading of each column to select or deselect all items in a column.

Open Settings area

The Open Settings area lets you choose MotionBuilder settings that you can load from the *.fbx* file being opened.

Each setting affects everything from the timing options in the Transport Controls, to the position of Producer cameras. The Settings area consists of the following:

| Setting | Description |
|-----------------|---|
| Base cameras | Activate to load the Producer cameras from the <i>.fbx</i> file. See Producer cameras on page 277. |
| Camera switcher | Activate to load the Camera Switcher from the <i>.fbx</i> file. In order to load camera switches, you must also load the take where the camera switches were set. See Camera switcher on page 335. |
| Current camera | Activate to switch the current camera to the current camera specified in the <i>.fbx</i> file. For example, if the <i>.fbx</i> file was saved with the Producer Front camera as the current camera, the scene switches to the Producer Front camera when the <i>.fbx</i> file is loaded. See Making a camera current on page 274. |

| Setting | Description |
|-----------------|--|
| Global lighting | Activate to load the default Global lighting from the <i>.fbx</i> file. The Global lighting consists of the default ambient color and the scene's fog settings. To view the scene's Global lighting, select Global Light from the Lights folder in the Scene browser. See Global lights on page 373. |
| Transport | Activate to load the timing options that include the frame rate and playback speed. Timing options are shown in the Transport Controls window. See Timing Controls on page 622. |

Open Takes area

The Open Takes area shows all the takes stored in the *.fbx* file that you are opening. You can also set how the start and end of each take is determined as well as the name given to each take.

Take Start/End

Use this field to select how the start and end of each take is determined. Take Start/End gives you the following options:

| Option | Description |
|------------------|---|
| Leave As Is | Leaves the take start and end times unchanged. If you are creating a new take, the take start and end times are imported from the file. |
| Import From File | Uses the start and end timecodes specified by the <i>.fbx</i> file being loaded. |
| Frame Animation | Frames the start and end of the animation for each take. |

Take list

Use the Take list to select which takes to load from the *.fbx* file. The Take list is split into the following columns:

| Option | Function |
|-----------|--|
| Take name | Shows the name of the take as it was saved in the <i>.fbx</i> file. You cannot change this column. |
| Import | Marks the take for loading. When disabled, the take is not loaded. |
| As Take | Changes the name of the take when loaded. |

Merging

7

MotionBuilder provides the following methods of merging an *.fbx* file with the current scene:

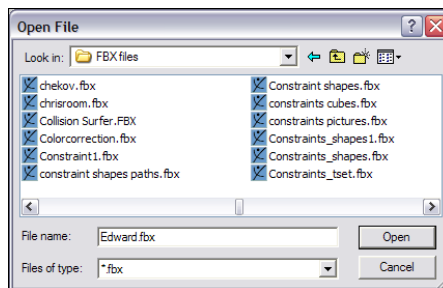
- Select File > Merge from the MotionBuilder menu bar. See [Merging assets from .fbx files](#) on page 101.
- Drag an *.fbx* file from the Asset browser into the Viewer window and select Merge from the contextual menu that appears. See [Merging files dragged into the Viewer window](#) on page 103.

Both methods let you select the assets, settings, and takes that are merged, appended, and replaced.

Merging assets from *.fbx* files

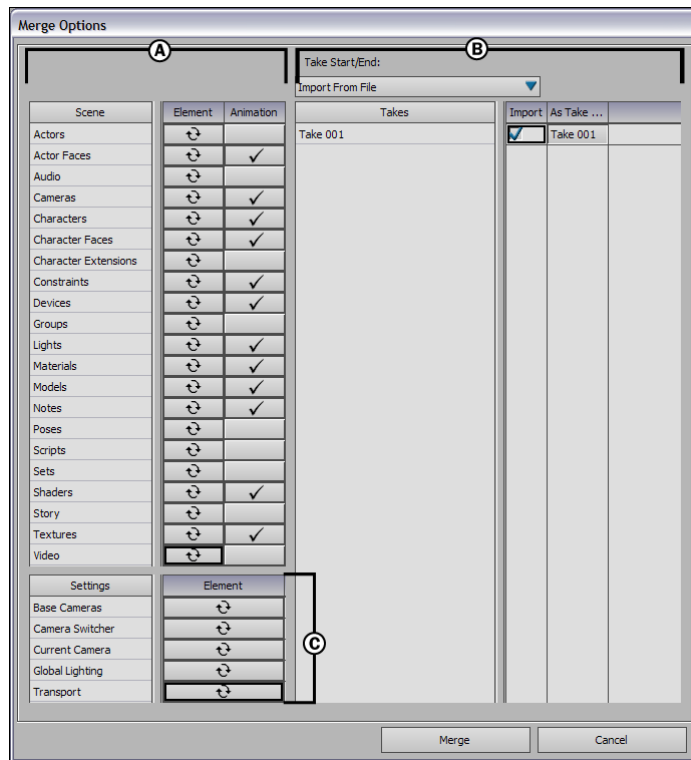
To merge assets from an *.fbx* file with the current scene:

- 1 Select File > Merge from the MotionBuilder menu bar. The Open File dialog box appears .



Open File dialog box

- 2 Using the File browser, select the file containing the assets you want to merge, append, or replace and click Open. The Merge Options dialog box appears.

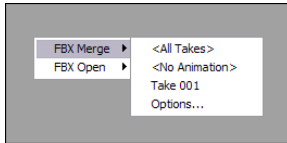


Merge Options dialog box A. Merge Assets area B. Merge Takes area C. Merge Settings area

- 3 Use the Merge Options dialog box to select which assets, settings, and takes to merge with the current scene. The Merge Options dialog box consists of the following areas:
 - [Merge Assets area](#) on page 103
 - [Merge Settings area](#) on page 105
 - [Merge Takes area](#) on page 106
- 4 Click Merge to open the selected *.fbx* file and load the selected assets, settings, and takes.

Merging files dragged into the Viewer window

You can merge *.fbx* files by dragging them from the Asset browser into the Viewer window where a contextual menu appears with merging options .



FBX Merge options

All Takes

Merges the current scene with the assets, settings, and takes from the *.fbx* file. All assets and models are loaded with their animation.

No Animation

Merges the current scene with the assets and settings from the *.fbx* file. All keyframe animation on assets and models are not loaded. Takes are also not loaded.

Take 001






















This part of the contextual menu lists the takes in the *.fbx* file. Selecting the take name merges only keyframe animation on assets and models associated with the selected take.

Options

Opens the Merge Options dialog box, letting you select the assets, settings, and takes to merge. See [Merging assets from .fbx files](#) on page 101.

Merge Assets area




The Merge Assets area provides a list of all MotionBuilder assets that you can merge, replace, or append to your current scene .

| Scene | Element | Animation |
|----------------------|---|-----------|
| Actors |  | |
| Actor Faces |  | ✓ |
| Audio |  | |
| Cameras |  | ✓ |
| Characters |  | ✓ |
| Character Faces |  | ✓ |
| Character Extensions |  | |
| Constraints |  | ✓ |
| Devices |  | ✓ |
| Groups |  | |
| Lights |  | ✓ |
| Materials |  | ✓ |
| Models |  | ✓ |
| Notes |  | ✓ |
| Poses |  | |
| Scripts |  | |
| Sets |  | |
| Shaders |  | ✓ |
| Story |  | |
| Textures |  | ✓ |
| Video |  | |




Assets area in the Merge Options dialog box

Although each asset is listed in the Merge Assets area, it does not indicate that the *.fbx* file being merged contains assets of the same type. For example, if the *.fbx* file you have selected does not contain Character Extensions, the Character Extensions option is still listed.

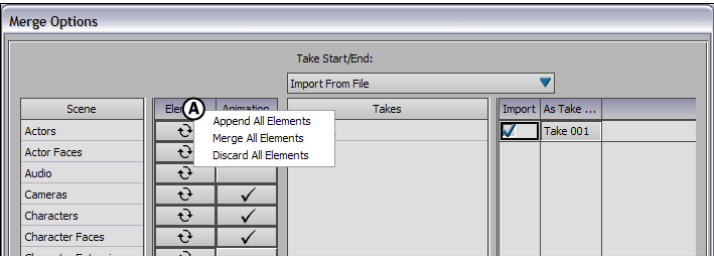
In the Merge Assets area, the following symbols indicate whether the assets are appended, merged, or discarded (Element column):

| Symbol | Description |
|---|---|
|  | Appends the corresponding assets from the <i>.fbx</i> file. Assets with the same name are not replaced. |
|  | Merges the corresponding assets from the <i>.fbx</i> file, replacing any assets with the same name. |
|  | Does not merge the corresponding assets. |

For each asset’s animation, the following symbols indicate whether the animation is loaded, merged, or discarded (Animation column):

| Symbol | Description |
|---|---|
|  | Loads the asset’s animation. This symbol is linked to the append setting in the asset column. |
|  | Merges the asset’s animation. This symbol is linked to the merge setting in the asset column. |
|  | Does not load the asset’s animation. |

For example, the Merge options in appends all Cameras and their animation, merges all Characters and their animations, and appends Character Faces but without their animations.








Changing merging options. A. Right-click the Element column heading to change all items in the column.

You can right-click the heading of each column to set all items to append, replace, or discard.



Merge Settings area

The Merge Settings area lets you choose MotionBuilder settings to merge with your file.

| Settings | Element |
|-----------------|---|
| Base Cameras |  |
| Camera Switcher |  |
| Current Camera |  |
| Global Lighting |  |
| Transport |  |

Merge Settings area in the Merge Options dialog box

For each setting, the following symbols indicate whether the setting is merged or discarded:

| Symbol | Description |
|---|--|
|  | Replaces the setting in the current scene with the <i>.fbx</i> file settings. |
|  | Does not load the setting from the <i>.fbx</i> file, leaving the setting in the current scene unchanged. |

Each setting affects everything from the timing options in the Transport Controls, to the position of Producer cameras. The settings are identical to the settings in the Open Options dialog. See [Open Settings area](#) on page 98.

Merge Takes area

The Merge Takes area shows all the takes stored in the *.fbx* file that you are merging.

Take Start/End

Use the Take Start/End field to select how the start and end of takes are set when they are merged. Take Start/End gives you the following options:

| Option | Description |
|-------------|---|
| Leave As Is | Leaves the take start and end times unchanged. If you are creating a new take, the take start and end times are imported from the file. |

| Option | Description |
|------------------|---|
| Import From File | Uses the start and end time codes specified by the <i>.fbx</i> file being loaded. |
| Frame Animation | Frames the start and end of the animation for each take. |

Take list

The Take list is split into the following columns:

| Option | Function |
|-----------|---|
| Take name | Shows the name of the take as it was saved in the <i>.fbx</i> file. You cannot change this column. |
| Import | Marks the take for merging. When active, the corresponding take replaces any takes with the same name. When disabled, the take is not merged. |
| As Take | Changes the name of the take when merged. This is useful if your scene has a take with the same name and you don't want to replace it with the take being merged. |

Saving

8

MotionBuilder provides the following methods of saving objects, assets, and takes as *.fbx* files:

- Select File > Save from the MotionBuilder menu bar to save your scene with the same name as the last *.fbx* file that was opened or saved.
- Select File > Save As to save the current scene using a new name.
- Select File > Save Selection to save only the selected objects and assets.

Regardless of the saving method you choose, you have further save options that let you select the assets, settings, and takes to save. You can also specify Saving options such as embedding media and saving a separate file per take.

Saving an FBX file as ASCII/Binary

Whenever you save your FBX file using the File > Save or Save As options an FBX file, you can select either ASCII or Binary format from the Save File window. MotionBuilder will use the format you last selected as the default.

NOTE We do not recommend that you use the Save as ASCII option to edit FBX files with a text editor. Doing so risks making your file unstable or corrupt.

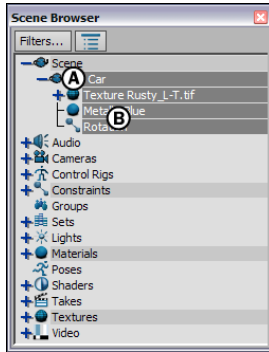
ASCII versus Binary files

While binary is the normal format for FBX files, ASCII files give you a "plain language" version of the file format, which let you search the file for information retrieval. You can specify ASCII format for ORSDK or Python files as well.

Saving a selection of assets

To save a model and all of its assets:

- 1 Right-click the model in the Scene browser and choose Select Branch from the contextual menu. The model and its constraint are selected .



Branch selected in the Scene browser A. Old Car model B. Old Car's associated assets

- 2 With the branch selected, select File > Save Selection.

The saving procedure is identical to selecting File > Save As. See [Saving assets to an .fbx file](#) on page 117.

TIP You do not have to select takes or associated materials (material and texture assets) when selecting assets for Save Selection. Take and material embedding are already specified during the saving process.

Saving an Actor and Marker set

If you use the same sensor positions for all your captures, you can start from a previously saved Marker set to map new motions to an Actor. You can save the Marker set data in an *.hik* file using the Export option in the Marker Set menu.

To save an Actor and its Marker set:

- 1 In the Scene browser, right-click an Actor with a defined Marker set and choose Select Branch from the contextual menu.
- 2 From the menu bar, select File > Save Selection.
- 3 In the Save File dialog box that appears, choose a directory in which to save your Marker set and Actor settings, type a name in the File name field, then click Save.

The Save Selection Options dialog box opens, letting you choose additional options for saving the file.

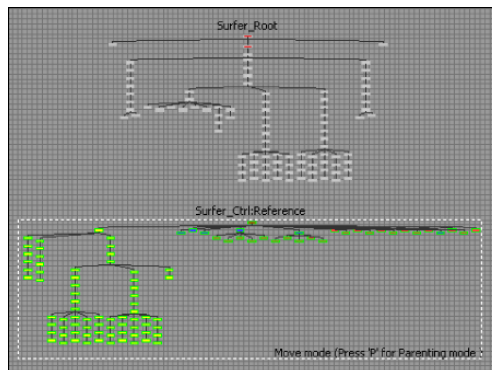
- 4 In the Save Selection Options dialog box, disable the existing takes in the Export column, then click Save.
Only your Marker set and Actor settings data are saved in an *.fbx* file.

Saving a Control rig

When you save a Control rig, you have two options. You can save only the data that makes up a Control rig, or you can save the data and the Control rig effectors that visually represent the rig in the Viewer window.

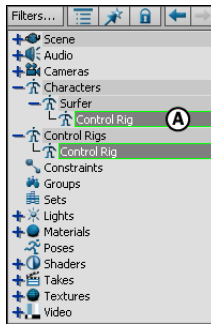
To save both the effectors and the Control rig data:

- 1 In the Viewer window, switch to Schematic view (Ctrl-W). Select all of the nodes in the Control rig you want to save.



Select the nodes of Surfer's Control rig in the Schematic view.

- 2 In the Scene browser, Ctrl-click to select the Control rig asset .



Scene browser A.
Select the Control rig
to save.

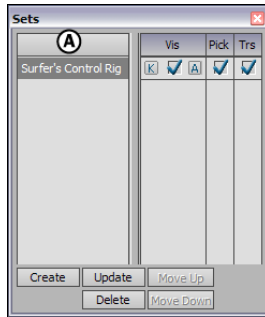
NOTE If you select the Control rig in the Scene browser, you do not select the Control rig effectors that display in the Viewer window which contain animation data and visually represent the rig.

- 3 Create a set containing these selected items.

The new set is listed in the Sets window and in the Scene browser. You can expand the set in the Scene browser to ensure that you have included all of the nodes of the Control rig, as well as the Control rig data.

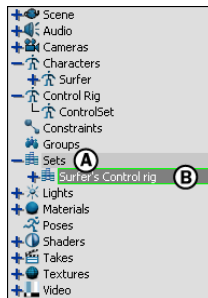
NOTE You can also add any Auxiliaries, pivots, constraints, handles, or any other objects and settings associated with your Control rig in this set.

- 4 Right-click the set, select Rename from the contextual menu, and rename the set to reflect the name of your Control rig.



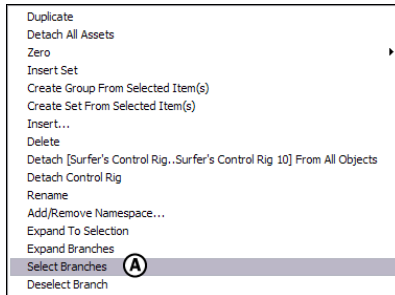
Sets window A. Renamed set containing Control rig

- 5 Deselect anything you have selected. In the Scene browser, expand the Sets heading and select the set containing the Control rig.



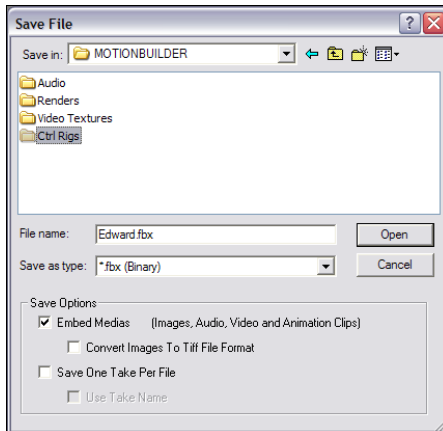
Scene browser A. Expand the Sets heading. B. Select the Control rig set.

- 6 Right-click the set and choose Select Branches from the contextual menu.



Sets contextual menu A. Select Branches

- 7 Select File > Save Selection from the menu bar to save this Control rig.
- 8 In the Save File dialog box that appears, navigate to the directory of your choice, name the *.fbx* file, and click Save .



Save File dialog box

- 9 Click Save in the Save Selection Options dialog box that appears.
The Control rig is now saved as an *.fbx* file including both the data and the markers that display in the Viewer window.

- [Control rigs](#) on page 1239
- [Creating a Control rig](#) on page 1245
- [Attaching a Control rig to a character](#) on page 1247

Saving a pose

To save selected poses:

- 1 In the Scene browser Poses folder, Ctrl-click to select the poses you want to save.
- 2 From the menu bar, select File > Save Selection, then navigate to the directory of your choice and save the file with an appropriate name.
The selected poses are saved in an *.fbx* file.

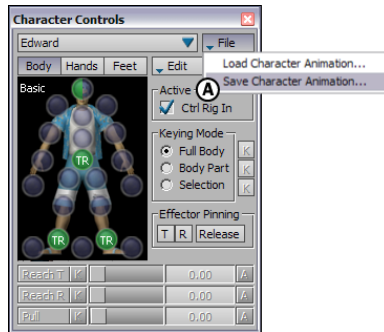
To save all poses:

- 1 Right-click the Poses folder in the Scene browser, and choose Select Branch from the contextual menu.
- 2 From the menu bar, select File > Save Selection, then navigate to the directory of your choice and save the file with an appropriate name.
All poses from the Poses folder are saved in an *.fbx* file.

Saving character animation

To save character animation:

- 1 In the Character Controls window, select a character with animation in the Current Character menu. Select File > Save Character Animation in the Character Controls.

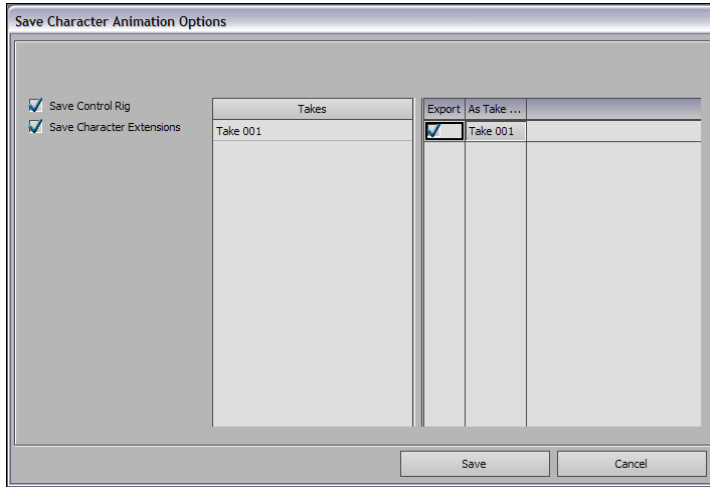


Character Controls A. Select the Save Character Animation option

The Save File dialog box appears.

- 2 Browse to the location you want to save the file, enter a file name, then click Save.

The Save Character Animation Options dialog box appears .



Save Character Animation Options dialog box

- 3 Select the options you want to use, and make sure the take you want to save is selected in the Takes list.

For more information on these options, see [Save Character Animation Options dialog box](#) on page 1391.

- 4 Click Save.

The character's animation is saved as an *.fbx* file. Now that you have saved character animation using the Save Character Animation option, you can transfer it to any character using the Load Character Animation option. See [Loading poses](#) on page 91 for more information.

You can also copy or retarget this animation to other characters, use it as a Character Input, or use it as a character clip in the Story window.

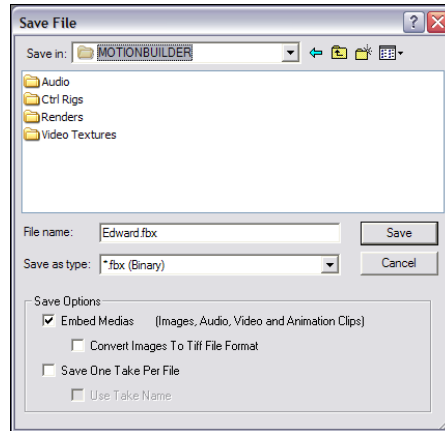
- [Loading poses](#) on page 91
- [Save Character Animation Options dialog box](#) on page 1391

Saving assets to an *.fbx* file

To save assets to an *.fbx* file:

- 1 Select File > Save to save the current MotionBuilder scene with the same name as the last *.fbx* file that was opened or saved.

If you are working on a scene that is yet to be saved or if you select File > Save As, the Save File dialog box appears, letting you specify the *.fbx* file name and saving location .



Save File dialog box

- 2 Select the appropriate Save options from the Save File dialog box. The following table lists the available Save options:

- **Embed Medias**

Activate to embed image files, video clips, and audio clips in the saved *.fbx* file. Disable to save only the path where media files are located.

Since only the path is saved, you must make sure the media files are not moved or deleted from the path specified by your scene, otherwise the *.fbx* file that you save is unable to locate the media. If you transfer *.fbx* files between computers, it is recommended that you embed media.

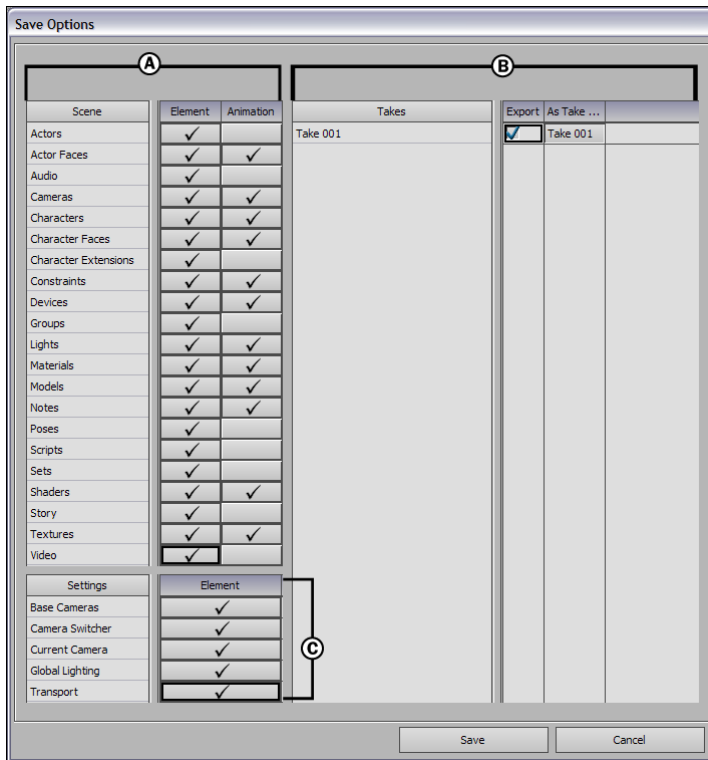
When Embed Medias is activated, the additional option Convert Images To Tiff File Format lets you embed all images using the *.tif* file format regardless of their original format.

- **Save One Take Per File**

Activate to save each enabled take in the Save Takes list as a separate *.fbx* file. The name of each new *.fbx* file is given the original file's name and the name of the take it contains, unless you select the Use Take Name option. When activated, each *.fbx* is saved using the take name.

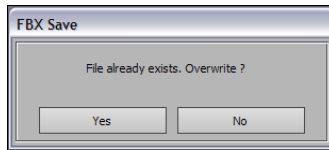
For example, if you entered *sample.fbx* as the file name and you have two takes named “Take1” and “Take2”, activating One Take Per File would save two files named *Sample-Take1.fbx* and *Sample-Take2.fbx*. In addition, if you activate Embed Media, all media used in the file is embedded in each *.fbx* file saved.

- 1 Click Save to display a second Save Options dialog box .



Save Options dialog box A. Save Assets area B. Save Takes area C. Save Settings area

- 2 Use the Save Options dialog box to select which assets, settings, and takes to save. The Save Options dialog box consists of the following areas:
 - [Save Assets area](#) on page 119
 - [Save Settings area](#) on page 120
 - [Save Takes area](#) on page 122
- 3 Click Save to save the selected assets, settings, and takes to the specified *.fbx* file.
- 4 If the *.fbx* file that you are saving already exists, the FBX Save dialog appears .



FBX Save dialog box

If you are saving more than one *.fbx* file, this dialog box includes the Yes to All button that replaces existing *.fbx* files with the same names.



Save Assets area

The Save Assets area provides a list of all MotionBuilder assets that you can save .

| Scene | Element | Animation |
|----------------------|---------|-----------|
| Actors | ✓ | |
| Actor Faces | ✓ | ✓ |
| Audio | ✓ | |
| Cameras | ✓ | ✓ |
| Characters | ✓ | ✓ |
| Character Faces | ✓ | ✓ |
| Character Extensions | ✓ | |
| Constraints | ✓ | ✓ |
| Devices | ✓ | ✓ |
| Groups | ✓ | |
| Lights | ✓ | ✓ |
| Materials | ✓ | ✓ |
| Models | ✓ | ✓ |
| Notes | ✓ | ✓ |
| Poses | ✓ | |
| Scripts | ✓ | |
| Sets | ✓ | |
| Shaders | ✓ | ✓ |
| Story | ✓ | |
| Textures | ✓ | ✓ |
| Video | ✓ | |

Assets area in the Save Options dialog box

For both the Save Assets and Save Settings areas, the following symbols indicate whether a setting, asset, or the asset's animation is saved to the *.fbx* file:

| Symbol | Description |
|--|---|
|  | Saves the corresponding assets, settings, or animation to the <i>.fbx</i> file. |
|  | Does not save the corresponding assets, settings, or animation to the <i>.fbx</i> file. |

You can right-click the heading of each column to set all items to save or discard.

Save Settings area

The Save Settings area lets you choose MotionBuilder settings to save with your file.

| Settings | Element |
|-----------------|---------|
| Base Cameras | ✓ |
| Camera Switcher | ✓ |
| Current Camera | ✓ |
| Global Lighting | ✓ |
| Transport | ✓ |

Save Settings area in the Save Options dialog box

The Save Settings area consists of the following settings:

| Setting | Description |
|-----------------|--|
| Base Cameras | Activate to save the Producer cameras to the <i>.fbx</i> file. See Producer cameras on page 277. |
| Camera Switcher | Activate to save the current Camera Switcher from the <i>.fbx</i> file. In order to save the camera switches, you must also save the take where the camera switches were set. See Camera switcher on page 335. |
| Current Camera | Activate to save which camera is the current camera. See Making a camera current on page 274. |
| Global Lighting | Activate to save the default Global lighting to the <i>.fbx</i> file. The Global lighting consists of the default ambient color and the scene's fog settings. To view the scene's Global lighting, select Global Light from the Lights folder in the Scene browser of the Navigator window. See Global lights on page 373. |
| Transport | Activate to save the timing options such as the frame rate and playback speed of your scene. Timing options are shown in the Transport Controls window. See Timing Controls on page 622. |

Save Takes area

The Save Takes area shows all the takes in the scene. Use the Save Takes area to select which take(s) to be saved with your *.fbx* file.

Take name

Shows the name of the take as it appears in MotionBuilder. You cannot change this column.

Export

Marks the take for saving. When active, the corresponding take is saved to the *.fbx* file.

As Take

Renames the take as it is saved to the *.fbx* file. If the Save One Take Per File and Use Take Name options are active, the name of the take in the As Take column is used over the take name in the scene.

Save Reminder button

The red Save Reminder button appears at the top of the Viewer window to prompt you to save. You can specify the saving preferences in the Preferences window.



Viewer window A. Save Reminder button

To show the Save Reminder menu, click the down arrow. The Save Reminder menu contains the following options:

| Option | Description |
|-------------|--|
| Snooze | Resets the save reminder without saving your file. |
| Turn Off | Disables the save reminder. |
| Preferences | Opens the Preferences window so that you can access additional Save Reminder preferences. See Save Reminder area on page 39. |

Importing

9

In addition to opening the *.fbx* file format, MotionBuilder lets you import the following motion data, scene, and skeleton file formats:

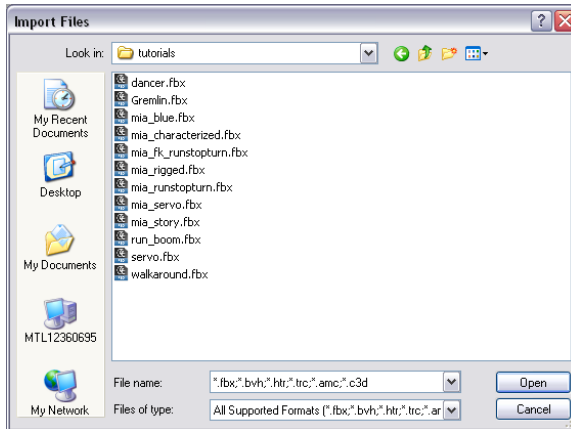
| Import Format | Description |
|-------------------------|--|
| 3Ds MaxScene (*.3ds) | 3ds Max® file format that you must open using the File > FBX Plug-in Import method. See Opening a file from another 3D package on page 81. |
| Acclaim (*.asf, *.amc) | Acclaim format is a dual format where an <i>.asf</i> file contains a definition of a skeleton and one or more <i>.amc</i> files contain the motion data used by the skeleton. You can retain dummy nodes when loading Acclaim files. See Opening a file from another 3D package on page 81 and Acclaim .asf and .amc format limitations on page 133. |
| Autodesk (*.fbx) | Autodesk <i>.fbx</i> file format (the native file format of MotionBuilder). See Opening an FBX file on page 80. |
| Biovision (*.bvh) | Biovision file format for hierarchical or skeletal-based data. See To open a motion file on page 82. |
| Collada (*.dae) | Sony Collada file format. See Opening a file from another 3D package on page 81. |
| Motion Analysis (*.htr) | Hierarchical Transformation Rotation, a hierarchical skeleton data format captured using Motion Analysis capture hardware. See To open a motion file on page 82. |

| Import Format | Description |
|-------------------------|---|
| Motion Analysis (*.trc) | Motion Analysis .trc format. See To open a motion file on page 82. |
| Obj (*.obj) | Autodesk Objects file format. See Opening a file from another 3D package on page 81. |
| Vicon (*.c3d) | Motion data file created with Vicon capture hardware. See Opening a motion (MoCap) file on page 82. |

Some file formats provide additional options that display beneath the Create and Merge options in the Import Option dialog box.

Importing Files

To import files, select File > Import from the MotionBuilder menu bar. The Import Files dialog box displays letting you choose one or more files for import.

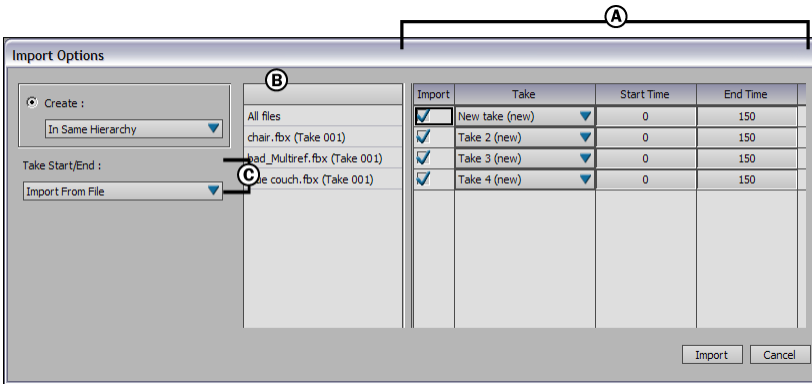


Import Files dialog with many files selected

To select more than one file, select the file type, click the first file and Ctrl-click each file that you want to add to your selection.

Import Options Dialog

If you select a motion file or skeleton file format, the Import Options dialog box displays when you click Open.



A. Import table B. Create or Merge area C. Custom import options

The Import Options dialog box has the following three areas:

- [Import table](#) on page 127
- [Create or Merge area](#) on page 129
- [Custom import options](#) on page 130

The Import Options dialog box also displays when you select Options from the Import contextual menu. The Import contextual menu appears when you drag one or more recognized motion file formats over the Viewer window. When you drag, all motion files must be of the same format.

Import table

The Import table lists all the selected files for import, their start and end frames, samples, sample rate, and other options. The Import Table is the same for all data formats except scenes and *.fbx* files.

The top row, called All Files lets you change the value of a given column for all files at the same time. Values for each file are clamped to their absolute

minimum or maximum. For example, if you enter 30000 as the sample rate, the sample rate for all files is set to this maximum.

| Column | Description |
|-----------------|---|
| Files to Import | Lists all the selected files dragged from the Asset browser or selected using the Import File dialog box. |
| Import column | Use the Import check boxes to select which files to import. |
| Take column | Displays the name of the take where each animation is imported. If you import to a take that already has animation, it is replaced by the take you are importing. If you want to import to a new take, select New Take from the list of takes. You can also rename the take using this field. |
| Start and End | The Start and End time codes are expressed in the same time format as is shown in the Transport Controls. You can change the start and end time of each imported file to ensure, for example, that each animation starts at frame 0. |
| Samples | Displays the number of samples found in each imported file. You can change the duration by changing the number of samples. |
| Sampling Rate | The Sampling Rate field shows the frame rate from the imported file. Change the value in this column to speed up or slow down your animation based on the file's original sampling rate. Select Custom to use the adjacent Custom field to enter your own frame rate. |

| Column | Description |
|--------|---|
| Custom | The Custom column lets you enter your own frame rate for the imported file. |

Create or Merge area

The options in the Create or Merge area change if you select an object before attempting to import files.

For example, if you select an object before performing File > Import, the available create and merge options change. All Create options are listed in the following table:

| Create Option | Description |
|-------------------------|--|
| In Same Hierarchy | Imports all motion files into the same hierarchy, over many takes. |
| In Separate Hierarchies | Creates a separate hierarchy for each motion file. Each file is imported into a separate take. |

The default choice, either Create or Merge, changes as well. If an object is selected, Merge is selected. If no object is selected, Create is automatically selected. The available Merge options also change if an object was selected before merging. All merge options are listed in the following table:

| Merge Options | Description |
|-----------------------|--|
| In Selected Hierarchy | Finds the root node and merges data into the entire hierarchy. Only available when one model is selected. |
| In All Models | Imports motion into the hierarchies of all models in your scene. This is the only merge option when nothing is selected. |

| Merge Options | Description |
|--------------------------------|--|
| In Selected Models Only | Merges data with only the selected nodes or models. |
| In Selected Model and Children | Imports into a hierarchy starting with the selected node, treating the selected node as a root node. This is useful for importing only arm, leg, or upper body motion. Only available when one model is selected. |
| In Prefix Group | Finds the top node with the same prefix and imports the motion as if you selected In Selected Hierarchy. If the selected node has the prefix, this merge option is the same as selecting In Selected Model and Children. If no nodes are found with the prefix, this merge option operates the same as In Selected Hierarchy. Only available when one model is selected. |

Create Unmatched Models

When importing files, Import checks the names, node type, and structure of the selected hierarchy. Activate Create Unmatched Models to create nodes to match the hierarchical structure of the imported file.

When disabled, data imports only to recognized nodes. If any differences are found between what you are importing and what is selected, the import stops.

Custom import options

The area beneath the Create and Merge options displays additional options that are available depending on the file format that you are importing. This topic lists the more commonly used file formats and their options.

3Ds Max scene (*.3ds)

3ds max file format is a scene format that opens its own custom dialog boxes.

Acclaim (*.asf, *.amc)

The Acclaim format is a dual file format where the *.asf* file contains a definition of the skeleton and the *.amc* file contains the motion data used by the skeleton. It is possible to have multiple *.amc* files for a single *.asf* file.

When importing any Acclaim format, you can select only one *.asf* file and zero or more *.amc* files. If you choose to select no *.amc* files, a dialog box warns you that you are loading a skeleton with no data. If you continue, a skeleton structure is imported without animation.

When importing this format, three additional import options appear:

- Create a Reference Node
- Import Base rotation as Pre Rotation
- Import Base translation as Rotation pivot offsets

Acclaim ASF and AMC file import and export support the following:

- Base rotation is imported as Pre-Rotation, and Pre-Rotation is exported as Base Rotation.
- Base translation is imported as Rotation Offset and Rotation offset is exported as Base Translation.
- Rotation order

NOTE If you do not activate the Base Translation on Rotation Offset option, no translation limits are applied to the file export. If you do not activate the Base Rotation on Pre Rotation, no rotation limits are applied to the file export. This is because limits are applied to the original animation data. When these options are disabled, the animation is resampled and the original limits are lost

See [Acclaim .asf and .amc format limitations](#) on page 133.

Autodesk (*.fbx)

The Autodesk *.fbx* file format, in this context, refers to an *.fbx* animation file. An *.fbx* animation file contains only skeleton-based animation that are commonly created for the Animation Trigger window. See [Animation Trigger window](#) on page 1692.

When importing *.fbx* animation files, the Import table contains only the start and end columns.

NOTE Password protection for .fbx files is no longer supported in MotionBuilder. However, you can still import password protected files saved in earlier versions by entering the correct password when prompted.

Biovision (*.bvh)

The Biovision format is a file format for hierarchical or skeletal-based data. When importing this format, an additional import option (Create Reference Node) lets you create a reference node when importing your .bvh or .htr skeleton.

Motion Analysis (*.htr)

The Motion Analysis .htr format stands for Hierarchical Transformation Rotation. It is a hierarchical skeleton data format captured using Motion Analysis capture hardware.

When importing this format, an additional import option (Create Reference Node) lets you create a reference node when importing your .bvh or .htr skeleton.

NOTE If a green property appears on an imported bone, it represents the Bone Length Data (HTR_BoneLength)

Motion Analysis (*.trc)

The Motion Analysis .trc format is an optical capture format. When importing this format, an additional option lets you import data as optical segments.

Vicon (*.c3d)

The Vicon .c3d format is an optical data format captured using Vicon capture hardware. Two additional import options let you import data as optical segments and keep the Actor prefix when naming each optical marker..

Importing .bvh files into 3ds Max

You can use the FBX Plug-in to import .bvh files into 3ds Max.

To import a .bvh file into 3ds Max:

- 1 Create a BIPED within Character Studio.

- 2 Go to the BIPED settings under Motion. Select Motion Capture.
- 3 Open the Motion Capture tab. Ten icons appear.
- 4 Click the first icon (top left, a folder and a camera) to display a file browser.
- 5 Select `bvh` as the File of Type.
- 6 Browse and select the `.bvh` file that you saved in MotionBuilder.
In 3ds max v4.0 and 4.2, you can use the Key Reduction option so that the file uses less memory.
- 7 Activate the Point option under Knee and Elbow in Limb Orientation.
- 8 Click OK in the dialog box.
- 9 Play back the animation on the Biped.

Only one rotation order per file is supported.

Acclaim `.asf` and `.amc` format limitations

The following limitations apply to Acclaim ASF and AMC import and export:

- SphericXYZ Rotation Order is not supported on export.
- When you export a bone with Degrees of Freedom (DOF) information not supported by ASF or AMC, for example, Post Rotation, all limits are deleted.

NOTE If you do not activate the Base Translation on Rotation Offset option, no translation limits are applied to the file export. If you do not activate the Base Rotation on Pre Rotation, no rotation limits are applied to the file export. This is because limits are applied to the original animation data. When these options are disabled, the animation is resampled and the original limits are lost

Point Cache support

MotionBuilder supports models with Point caching, however, the support is view-only: you can see Point caches created in other packages, but cannot create or edit them in MotionBuilder.

A model's Point cache files are stored in the Scene browser's Deformers folder.

To deactivate a Point cache deformation:

- 1 In the Navigator window, expand the Deformers folder.
- 2 Double-click the Point Cache deformation.
- 3 In the Properties window, disable the Point Cache deformation's Active option.

NOTE The Point cache information is stored in a separate .fbc file. You must always store this file in the same location as its associated .fbx file.

Point Cache limitations

You cannot see FCurve information about vertices on the model, as the Point cache information streams directly from the .fbc file.

Because Point caching overwrites the object's other deformers, you are unable to modify an object's skin in the Skins window.

If you are exporting from Maya or 3ds Max and activate the Split mesh for per-vertex normals option in the FBX Exporter window, this may create problems with Point caching.

Exporting

10

Exporting motion files is a method of transferring data from MotionBuilder to a variety of different motion file formats. MotionBuilder lets you export the following motion data, scene, and skeleton file formats:

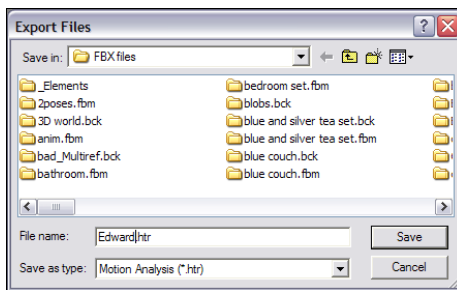
| Import Format | Description |
|-------------------------|---|
| 3D Studio Scene (*.3ds) | 3ds max® file format is a scene format that opens its own custom dialog boxes. See Exporting options for scenes on page 141. |
| Acclaim (*.asf, *.amc) | Acclaim format is a dual format where an .asf file contains a definition of a skeleton and one or more .amc files contain the motion data used by the skeleton. |
| Biovision (*.bvh) | Biovision file format for hierarchical or skeletal-based data. |
| DXF scene (*.dxf) | AutoCAD file format, which is a scene format that opens its own custom dialog boxes. See Exporting options for scenes on page 141. |
| Motion Analysis (*.htr) | Hierarchical Transformation Rotation, a hierarchical skeleton data format captured using Motion Analysis capture hardware. |
| Motion Analysis (*.trc) | Motion Analysis .trc format. |
| Obj (*.obj) | Objects file format for loading object information into Maya. |

| Import Format | Description |
|---------------|---|
| Vicon (*.c3d) | Motion data file created with Vicon capture hardware. |

Some file formats provide additional options that display beneath the Existing Files options in the Export Option dialog box.

Exporting motion files

To export motion files, select the root of the skeleton or the collection of sensors containing the data that you want to export, then select File > Export. The Export Files dialog box appears, letting you choose a file format and enter a file name for exporting.



Export Files dialog box

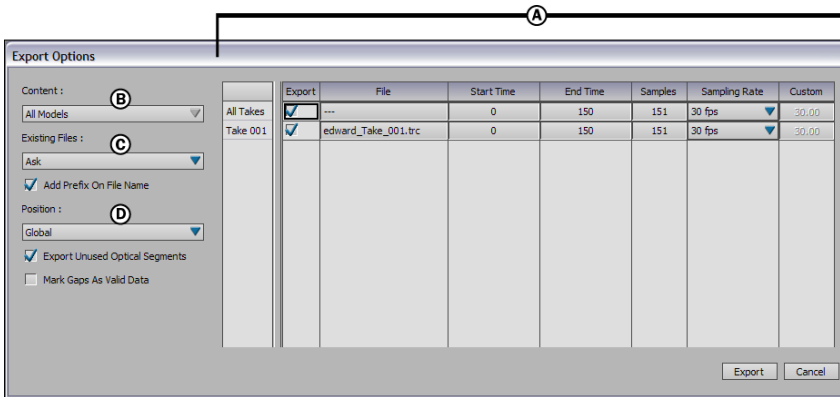
Export options depend on the file format you are exporting. Warning dialog boxes appear and the export is aborted if you do not select the proper node for the file format selected.

For example, you must select the root to export hierarchical formats (Biovision *.bvh*, Motion Analysis *.htr*, Acclaim *.asf* and *.amc*). The root node is where the translation occurs since translation is only saved for the root node.

When specifying a file name, the file name is added as a prefix to the name of the take being exported. To name each file with the same name as the take, delete the asterisk and type only the file format. For example, to export all takes with their take name and the *.bvh* extension, type “.bvh”.

Export Options dialog box

If you select a motion file or skeleton file format, the Export Options dialog box displays when you click Save.



Export Options dialog box with two takes A. Export Table B. Content area C. Existing Files area D. Additional Export Options

The Export Options dialog box is split into the following areas:

- [Export Table](#) on page 137
- [Content area](#) on page 139
- [Existing Files area](#) on page 139
- [Additional export options](#) on page 140

If you export a 3ds max scene (.3ds), or a DXF Scene (.dxf), custom dialog boxes display. The Export Options dialog box does not display when exporting scenes. See [Exporting options for scenes](#) on page 141.

Export Table

The Export Table lists all the selected takes for export, their start and end frames, samples, sample rate, and other options. The Export Table is the same for all data formats except scenes and .fbx files. See [Exporting options for scenes](#) on page 141.

The top row is the All Takes Row. It lets you change the value of a given column for all files at the same time. Values for each file are clamped to their

absolute minimum or maximum. For example, if you enter 30000 as the sample rate, the sample rate for all files is set to its maximum.

Files to export

Lists all takes in the current MotionBuilder scene.

Export

Use the Export check box to select the takes to export.

File

Displays the name of the file where each take is exported. You can rename the file using this field.

Start and End

The Start and End time codes are expressed in the same time format as is shown in the Transport Controls. You can change the start and end to change the part of the take that you are exporting.

Samples

Displays the number of samples, which is calculated by multiplying the duration (based on the start and end) by the sampling rate. You can change the duration by changing the number of samples or Sampling Rate. This changes the End timecode.

Sampling Rate

The Sampling Rate field, by default, is set to the frame rate as shown in the Transport Controls, or the frame rate of the selected optical model (if exporting optical data). Changing the Sampling Rate changes the End timecode. Select Custom to use the adjacent Custom field to enter your own sampling rate.

Custom

The Custom column lets you enter your own sampling rate for the exported file.

Content area

The options in the Content area changes if you select a node or the root of a hierarchy before attempting to export files. All Content options are listed in the following table:

| Content Options | Description |
|-----------------------------|--|
| Selected Models Only | Exports data from only the selected models in your scene. |
| All Models | Exports data from all models in your scene. |
| Selected Model and Children | Treats the selected node as a root node and exports its data and the data of its children. This is useful for exporting arm, leg, or upper body motion. Only available when one model is selected. |
| Prefix Group | Finds the top node in the hierarchy with the same prefix and exports all nodes in the hierarchy. Only available when one model is selected. |
| Hierarchy | Finds the root node and exports the entire hierarchy. Only available when one model is selected. |

Existing Files area

The options in the Existing Files area let you select how to deal with files that have the same name as the files you are exporting. There are three possible choices:

| Existing Options | Description |
|------------------|--|
| Ask | If a file is found with the same name, a dialog box displays asking if you want to Overwrite, Cancel, or Cancel All. |

| Existing Options | Description |
|------------------|--|
| Overwrite | If a file is found with the same name, the file is automatically overwritten with the file you are exporting. |
| Merge | The merge option is supplied only when exporting Acclaim .asf files. The selected .asf file is read for the skeleton definition and the new .amc files are created based on this definition. |

Additional export options

The area beneath the Existing Files options displays additional options that display depending on the file format that you are exporting. This section lists some of the more common file formats and their options.

Acclaim (*.asf, *.amc), Biovision (*.bvh), Motion Analysis (*.htr),

An additional option lets you export position data in either local (based on the location of the immediate parent) or global coordinates (based on the center of the scene). See [Motion Analysis .htr format limitations](#) on page 143 and [Acclaim .asf and .amc format limitations](#) on page 143 for a list of limitations that affect the export of these files.

Autodesk (*.fbx)

When exporting .fbx animation files, the Export table contains only the start and end columns.

Motion Analysis (*.trc), Vicon (*.c3d)

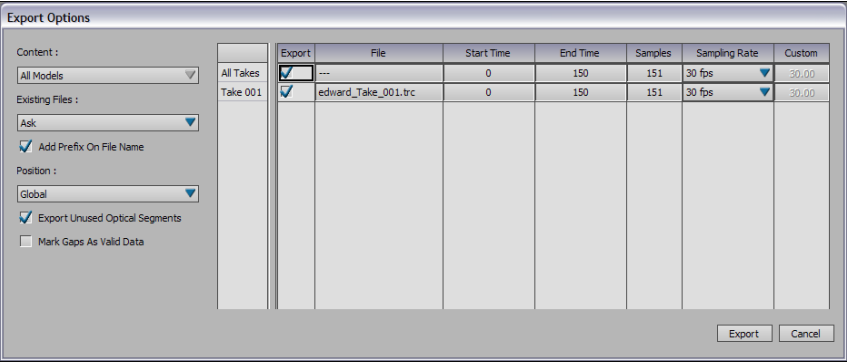
Two additional options let you export position data in either local or global coordinates, and mark gaps as valid data.

Exporting options for scenes

Depending on the scene you are exporting, other dialog boxes may appear, prompting you to enter additional information.

Use the file browser to choose a location and give the scene a descriptive file name. Make sure you save your scene with the proper extension. Otherwise, you may not be able to load your exported scene into other software packages.

Click OK to export your scene using the selected scene format. The Export Options dialog box appears, letting you select which parts of the scene you want to export.



Exporting options when exporting scenes

Depending on the scene format you are exporting, there may be limits to what can be exported.

Export BVH animation to Character Studio

If you want to use BIPED in Character Studio, you may have to export your animation as a Biovision (BVH) file. Before exporting your animation, you must create a biped-type skeleton with the proper naming conventions in MotionBuilder. You must also plot the animation onto the skeleton itself.

Character Studio imposes names for the skeleton’s bones (nodes). If your skeleton does not use the following names (alternate names are shown in parentheses), then Character Studio rejects the skeleton when you import the *.bvh* file.

You must export your scene in *.bvh* format in order to bring it back into Character Studio.

NOTE Before you export a model from 3ds max, make sure that you reset all transformations, the pivot, and the scale of your model.

| | |
|--------------------------|--|
| Hips | Origin of the entire skeleton. Parent to LeftHip, RightHip, and Chest. |
| LeftHip (LeftUpLeg) | Must be child of Hips and parent to LeftKnee. |
| LeftKnee (LeftLowLeg) | Must be child of LeftHip and parent to LeftAnkle. |
| LeftAnkle(LeftFoot) | Must be child of LeftKnee. |
| RightHip (RightUpLeg) | Must be child of Hips and parent to RightKnee. |
| RightKnee (RightLowLeg) | Must be child of RightHip and parent to RightAnkle. |
| RightAnkle (RightFoot) | Must be child of RightKnee. |
| Chest | Must be child of Hips and parent to LeftCollar, RightCollar, and Neck. |
| LeftCollar | Must be child of Chest and parent to LeftShoulder. |
| LeftShoulder (LeftUpArm) | Must be child of LeftCollar and parent to LeftElbow. |
| LeftElbow (LeftLowArm) | Must be child of LeftShoulder and parent to LeftWrist. |
| LeftWrist (LeftHand) | Must be child of LeftElbow. |

| | |
|----------------------------|--|
| RightCollar | Must be child of Chest and parent to RightShoulder. |
| RightShoulder (RightUpArm) | Must be child of RightCollar and parent to RightElbow. |
| RightElbow (RightLowArm) | Must be child of RightShoulder and parent to RightWrist. |
| RightWrist (RightHand) | Must be child of RightElbow. |
| Neck | Must be child of Chest and parent to Head. |
| Head | Must be child of Neck. |

Motion Analysis .htr format limitations

The following limitations affect the export of Motion Analysis **.htr** files:

- Limits are not supported.
- Only one rotation order per file is supported.

Acclaim .asf and .amc format limitations

The following limitations affect the export of Acclaim **.asf** and **.amc** files:

- Limits are not supported
- Spheric XYZ Rotation Order is not supported
- Files without Base Poses (Rotation Offset) must have the Write Translation option active on export.
- Translation resets to the Translation Base Pose because MotionBuilder does not use the Translation Candidate.

Optimizing characters in 3ds Max for export to MotionBuilder

This section provides information about how to build characters, skeletons, apply skinning, and so on, in 3ds max so it is read correctly by MotionBuilder.

To create a character in 3ds Max:

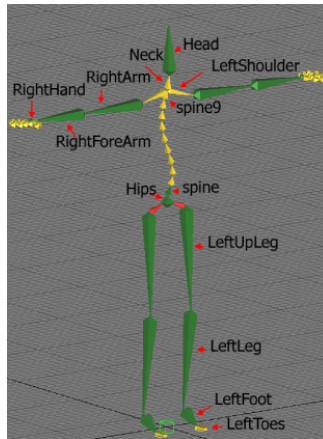
- 1 Build a mesh.
- 2 Apply the UV mapping.
- 3 Create a morph.
- 4 Build a skeleton. See [Optimizing 3ds Max skeletons for export to MotionBuilder](#) on page 144.
- 5 Skin the character. See [Optimizing 3ds Max skinning for export to MotionBuilder](#) on page 147.
- 6 Build the Mesh.
- 7 Once the mesh model is completed, reset the pivot and transform it in the Hierarchy pane.

Optimizing 3ds Max skeletons for export to MotionBuilder

This section describes how to create a skeleton in 3ds max 6.0 and 7.0 in order to use it in MotionBuilder.

To build a skeleton:

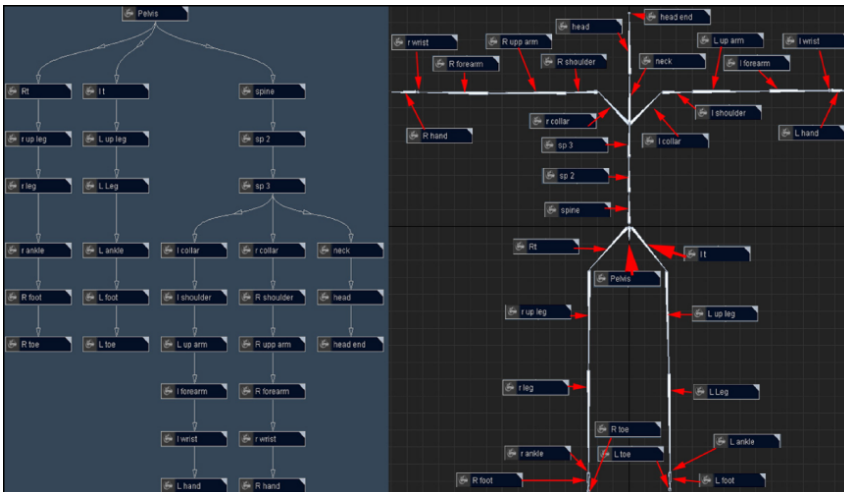
- 1 Create a skeleton in In 3ds max without IK chains (history independent). See Refer to the following example.



3ds max Hierarchy example

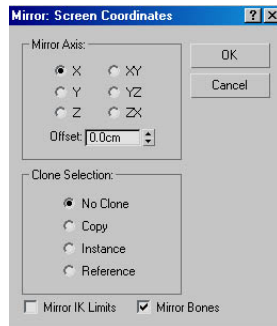
NOTE The green bones represent bones that must be dropped into the base slots of the Define pane in the Character Tool in MotionBuilder.

- 2 Build the skeleton using a standard hierarchy such as in the [Example skeleton with IK chains](#), on page ?.



Example skeleton with IK chains

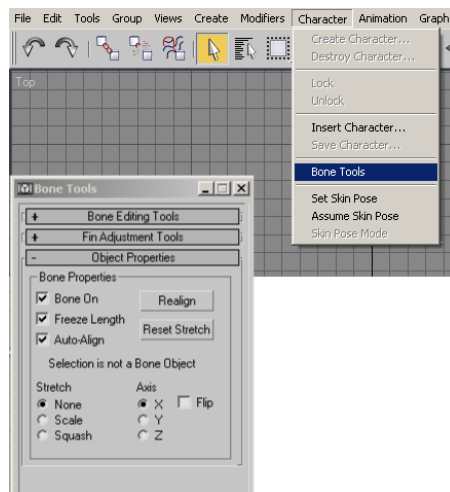
- 3 Select the Mirror Bones option if you are mirroring bone chains to prevent negative scaling on the bones.



Select the Mirror Bones option.

NOTE We recommend that you export skeletons and mesh before skinning (vertex assignment) your characters so you can detect any negative and/or uniform scaling. Negative scaling of objects with weighting applied to them is not supported in MotionBuilder.

- 4 Select all the bones.
- 5 Select Character > Bone Tools from the 3ds max 5.0 menu bar.



Bone Tools in 3ds max

NOTE Bones are considered Geometry, which lets you use Scale and Squash channels. However, these channels are not supported in MotionBuilder.

The skeleton is now ready to be exported into MotionBuilder. Use the *.fbx* file format for merging back into 3ds max.

You can export geometry as bones in MotionBuilder, but it is treated as bones and is only visible in X-Ray mode.

Optimizing 3ds Max skinning for export to MotionBuilder

The following are some tips to preparing 3ds Max skinning so it can be read correctly in MotionBuilder.

- If you use the 3ds Max FBX Exporter to export to MotionBuilder, use the FBX200602_MB75 option for your export. Otherwise, NURBS are lost and mesh normals may be inverted.
In FBX200602_MB75 mode, normals in normal per polygon/vertex mode are transformed to normals per vertex and hard edges become smooth edges.
- 3ds max Weighting is supported only when applied to an Editable mesh.
- Skin and Physique are the only two 3ds max weighting modifiers supported by MotionBuilder.
- You can apply both Skin and Physique modifiers to two different objects in the same scene.
- Negative scaling on meshes that act as weight on a skeleton is not supported.

Skin Modifier Issues

Absolute and Relative weighting of the skin modifier is supported.

When bones are removed from “Bones list” of the Skin Modifier, the modifiers become unstable. This instability continues in MotionBuilder. Be sure to not remove any bones after their initial assignment.

Physique Modifier Issues

Only Rigid envelopes are supported in MotionBuilder. Deformable and Partial blending envelopes are automatically converted to rigid envelopes in MotionBuilder.

Optimizing Maya scenes for export to MotionBuilder

If you use the Maya FBX Plug-in to export to MotionBuilder, make sure that you use the FBX200602_MB75 version option for your export. If you do not do this, NURBS are lost and mesh normals may be inverted.

In FBX200602_MB75 mode, normals in normal per polygon/vertex mode are transformed to normals per vertex and hard edges become smooth edges.

See the Maya FBX Plug-ins documentation for details on each export version.

Cameras

MotionBuilder retains the Focal Length values of Maya cameras when you save a scene even if there are no keyframes set.

Converting



FBX Converter

To convert FBX files to or from different versions of MotionBuilder, you must use the FBX Converter. The FBX Converter was included with earlier versions of MotionBuilder, but now you must download it from the Autodesk web site.

The FBX Converter is a free utility lets you transfer FBX files between different versions of MotionBuilder. It also lets you convert you FBX files to OBJ, DXF, and other 3DS files to the FBX file format, and vice versa. This lets you transfer your entertainment, design, or visualization project data from one 3D application to another – including any professional 3D animation package.

The FBX Converter is available for Windows 2000 and Windows XP.

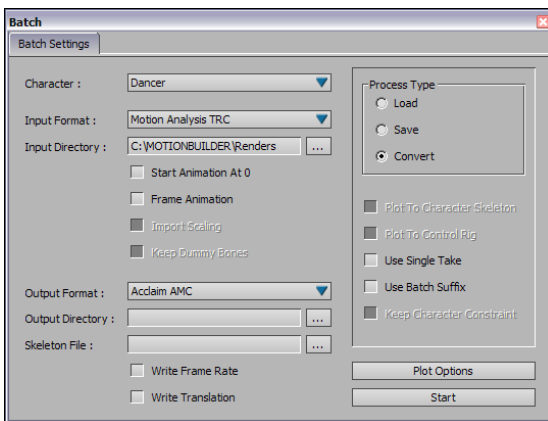
To download the FBX Converter:

- 1 Got to *the Autodesk web site*.
<http://usa.autodesk.com/adsk/servlet/index?siteID=123112&id=6839916>
- 2 Select the FBX Converter link and to download the software.

Batch processing

12

The Batch window lets you convert multiple data files between different formats. You can batch load a series of data files onto the current character, or save all your takes to a specified data format.



Batch window

You can also save all takes mapped to a selected Actor, Character, or Control rig as separate motion files, and convert files from one format to another.

Before using the Batch window, you must have a character with mapped data from one of the data files that you want to load, save, or convert. All data files or takes must be from the same capture session, and from the same device.

When you import a motion file and map its motion to an Actor and then to a character, you are creating a guide for converting the other data files.

For example, if you have four motion files stored in Motion Analysis *.trc* format to convert to Acclaim *.amc* format, you can manually convert each file by loading each *.trc* motion file, mapping the data to an Actor and then a character, plotting the data to the character, then exporting each character as an *.amc* file.

The Batch window simplifies this process by letting you base all conversions on a single mapped character. To convert the same four *.trc* files previously mentioned, you only need to load the first *.trc* file, map its data to an Actor, then to a Character. You can use the Character as a guide to automatically convert the remaining motion files to *.amc* format.

NOTE You cannot use the Batch window to convert *.fbx* files created with FBX Plug-ins versions 200611 and later. If you want to perform a batch conversion, you must first use the FBX Plug-ins or FBX Converter to save the files in MB 7.5 / 2006.08 format and then perform the batch conversion. You can download the FBX Plug-ins and the FBX Converter at www.autodesk.com/fbx.

The Batch window is divided into two areas:

- [Batch Input and Output area](#) on page 155
- [Batch Process Type area](#) on page 157

NOTE You cannot import biped animation and map it to a quadruped, or vice versa. For more information, see [Bipeds and quadrupeds](#) on page 1096

- [Batch loading motion files](#) on page 152
- [Batch saving files](#) on page 153
- [Batch conversion](#) on page 153
- [Batch errors](#) on page 160

Batch loading motion files

You can use the Batch window to load a series of data files onto the current character.

To batch load motion files:

- 1 Select the character on which you want to plot a group of files, then click Load.
- 2 Choose the format of the files you want to load (Input Format), the directory containing the files you want to load (Input Directory), and the Skeleton File used by the selected Input Format. See [Batch Input and Output area](#) on page 155.

- 3 Select Plot To Character or Plot To Control Rig if you want to plot the motion in your scene. See [Batch Process Type area](#) on page 157.
- 4 Click Start to load all the files from the Input directory and create a new take for each file.

When using Optical data, you must link your selected Character to an Actor with a Marker set that was specifically created for the group of files you want to load. The Actor input must be active.

Batch saving files

Use the Batch window to save all your takes to a specified data format, or save all takes mapped to a selected Actor, Character, or Control rig as separate motion files.

To batch save files:

- 1 Select the Character asset linked to the model with the data you want to save, then click Save.
- 2 Choose the format to which you want to convert each take (Output Format), select the directory to save the processed data files (Output Directory), and select a Skeleton File, if you are using Acclaim .amc format. See [Batch Input and Output area](#) on page 155.

The Batch process saves the data from the selected Character by default. If you would rather save the motion files from the Character's Control rig, activate the Save From Control Rig option. See [Batch Process Type area](#) on page 157.

- 3 Click Start to save a new file to the specified Output Directory for each take.

Batch conversion

Use the Batch window to convert multiple data files between different formats.

To batch convert files:

- 1 Select the Character asset you want to use to convert data files, then click Convert.

- 2 Select the file format you want to convert (Input Format), select the directory containing the files you want to convert (Input Directory), then select the skeleton used by the selected Input Format (Skeleton File). See [Batch Input and Output area](#) on page 155.
- 3 Choose the format to which you want to convert each take (Output Format) and the directory in which you want to save the processed files (Output Directory). See [Batch Input and Output area](#) on page 155.
- 4 Activate the Use Single Take function to use only one take to convert all files. Use Single Take if your computer is low in memory and cannot load many takes. See [Batch Process Type area](#) on page 157.
- 5 To complete the process, click Start to load all files from the Input directory. Load and save a new file to the Output directory for each Input file.

When using Optical data, you must specify a reference for an Actor when using the Batch window to do a batch convert. For example, if you convert from optical data to a character skeleton, you should specify the optical root as the Actor reference.

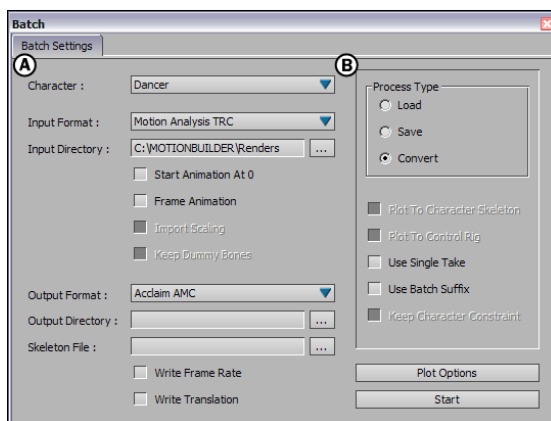
NOTE You cannot use the Batch window to convert .fbx files created with FBX Plug-ins versions 200611 and later. If you want to perform a batch conversion, you must first use the FBX Plug-ins or FBX Converter to save the files in MB 7.5 / 2006.08 format and then perform the batch conversion. You can download the FBX Plug-ins and the FBX Converter at www.autodesk.com/fbx.

Batch window

The Batch window lets you convert multiple data files between different formats. You can batch load a series of data files onto the current character, or save all your takes to a specified data format.

The Batch window is divided into two areas:

- [Batch Input and Output area](#) on page 155
- [Batch Process Type area](#) on page 157



Batch window A. Batch Input and Output area B. Batch Process Type area.

Batch Input and Output area

The Input and Output area lets you specify the input and output format and directory, as well as the skeleton.

| Option | Function |
|-----------------------|--|
| Character menu | The Character menu displays all Character assets used in a scene. Use the Character menu to select a Character in a scene. |
| Input Format menu | Use the Input Format menu to specify the format of the files you want to load. All files used in a batch process must be the same format. For example, you cannot batch input Vicon .c3d and Acclaim .amc files together; you must perform two separate processes. |
| Input Directory field | Double-click the Input Directory field to type the path of the directory containing the files you want to load. You can also click the Open Directory (...) button to |

| Option | Function |
|-----------------------------|---|
| | open an Open Directory window to browse for the directory. |
| Start Animation at 0 option | Activate the Start Animation at 0 option to correct any time shifts that affect animation keys. The Start Animation at 0 option sets the start time for all .fbx files loaded in the Batch window at time 0. |
| Frame Animation option | Activate the Frame Animation option to set the timeline start and end time to correspond with the start and end time of the animation data in the currently loaded motion file. |
| Import Scaling option | Since most motion file formats contain only translation and rotation animation data, MotionBuilder automatically sets any scaling animation data to a default setting of 1.0 upon file loading. Because this default setting can create errors with character appearances in certain situations, it is best to disable the Import Scaling option. This lets you leave the scaling animation of loaded motion files untouched. |
| Keep Dummy Bones option | When the Process Type is set to either Load or Convert and the selected input format is Acclaim .amc format, the Keep Dummy Bones option is active. Enable this option to retain the file's dummy bones. |
| Output Format menu | Use the Output Format menu to specify the format of the files that you want to convert. |
| Output Directory field | Double-click the Output Directory field to type the path of the directory in which you want to save the processed data files. You |

| Option | Function |
|-------------------------|--|
| | can also click the Open Directory (...) button to open an Open Directory window to browse for the directory. All processed files are saved in this directory. |
| Skeleton File field | Double-click the Skeleton File field to specify a skeleton file to be used by Input or Output Format if you are using the Acclaim .amc format. The Acclaim .amc format requires a skeleton file. This setting is specific to Load or Merge processes only. If no file is chosen, MotionBuilder creates a new file. If a file already exists, a merge is created. |
| Write Frame Rate option | Activate the Write Frame Rate option to write the frame rate in Acclaim .amc files. When Write Frame Rate is active, you are loading, converting, or saving with the frame rate specified in MotionBuilder. |
| Write Translation | Activate the Write Translation option to save any translation animation data included with Acclaim .amc motion file formats. This lets you save anything describing animation translations, for example, the movement of a prop or slight stretching between the bones. Activating this option ensures that MotionBuilder always saves the translation animation data. |

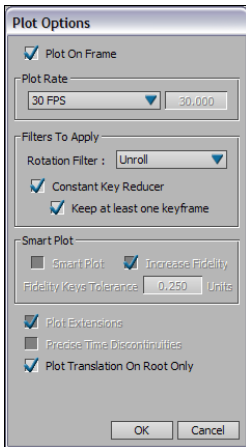
Batch Process Type area

The Process Type area lets you select options for the type of batch process you are using.

| Option | Description |
|-------------|--|
| Load option | Activate the Load option to import motion files into separate takes. By default, the |

| Option | Description |
|---|--|
| | name of each take inherits the name of each file. See the Use Single Take option in this table for information on adding the suffix (batch) to each file. |
| Save option | Activate the Save option to save the data plotted to a Character or Control rig to individual data files. Each take saves in a separate file. By default, the name of each file is inherited from the name of each take. You do not have to link the Character you select to an Actor or other source. All takes must contain data plotted to the Character. Otherwise, nothing is saved for the take. |
| Convert | Activate the Convert option to convert data files. This is similar to loading and plotting a collection of data files to a Character, then saving the plotted results to individual data files. Using Convert simplifies the loading of motion files in one format and saving in another, into a single step. |
| Plot To Character Skeleton/Control Rig option | These options are only available when batch loading files. If neither of these options are selected, no data is plotted in your scene. Select either Plot To Character or Plot to Control Rig to determine the location to which you want to plot your data when you batch load files. |
| Save From Control Rig option | This option is only available when batch saving files. Use this option when you do not want the Batch process to save the plotted motion from the selected Character. |
| Keep Character Constraint option | This option is available when you are batch saving using .fbx files. Enable Keep Charac- |

| Option | Description |
|-------------------------|--|
| | ter Constraint to save the Character within each .fbx file. |
| Use Single Take option | This option is only available when you are batch converting files. Activate the Use Single Take function to use only one take to convert all files. Use Single Take if your computer is low in memory and cannot load many takes. To complete the process, click Start to load all files from the Input directory. Load and save a new file to the Output directory for each Input file. |
| Use Batch Suffix option | This option is available when you are batch loading, saving, and converting files. Activate the Use Batch Suffix option when you want the batch suffix to appear on your files. For example, if Use Batch Suffix is active when you save two .c3d files named "run_walk" and "walk_stand", the new files are named run_walk(batch).c3d and walk_stand(batch).c3d. |
| Plot Options button | Click Plot Options to open the Plot Options window , where you can set the options for plotting animation to the Skeleton or to the Control rig. Click Plot Options to open the Plot Options window , where you can set the options for plotting animation to the Skeleton or to the Control rig. All of the options in the Plot Options window are identical to those found in the Plot Properties window. See Plot Properties window on page 1665. |



| Option | Description |
|--------|---|
| Start | Click Start when you are ready to load, save, or convert your batch files. Make sure you have all necessary options selected in the Batch window. |

Batch errors

When batch loading, saving, or converting, there may be situations in which a Batch Error dialog box opens, informing you of one of the following errors:

Input Actor is not specified

The Character source is not set to Actor Input, or the Actor that the Character is using as its source does not have a Marker set.

Actor input markerset is not correctly associated with models

Indicates a problem with the Actor that the Character uses as its source. The Actor's Marker set was not set up properly, and it may be missing required mapping.

Can't open ASF skeleton file

This message appears when you try to batch load or convert with an Acclaim .amc file that does not have a matching .asf skeleton file. Use the Skeleton File field to specify the path name of the skeleton file(s).

Not enough memory to complete operation

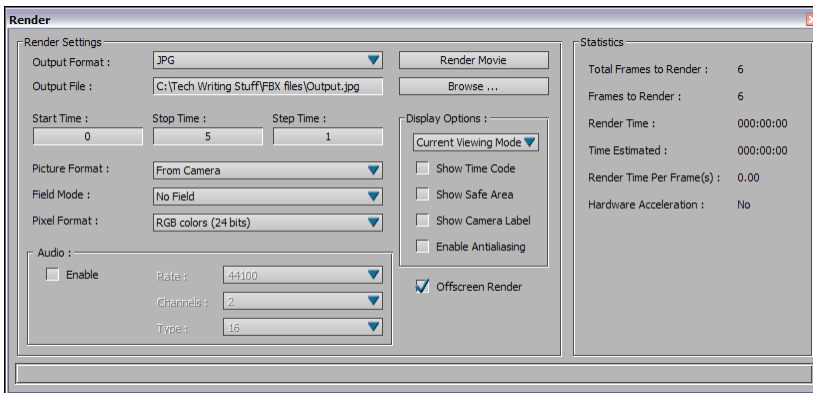
When batch loading, this message appears if you fill all available memory. If this message appears while performing a batch convert operation, activate Use Single Take to use the same take for all conversions.

NOTE You cannot use the Batch window to convert .fbx files created with FBX Plug-ins versions 200611 and later. If you want to perform a batch conversion, you must first use the FBX Plug-ins or FBX Converter to save the files in MB 7.5 / 2006.08 format and then perform the batch conversion. You can download the FBX Plug-ins and the FBX Converter at www.autodesk.com/fbx.

Rendering

13

In MotionBuilder, you can always view your animations in real-time as you work. You can also use the rendering tools, such as the Render window after you have completed your animation to render the scene and create test clips of your animation



Render window

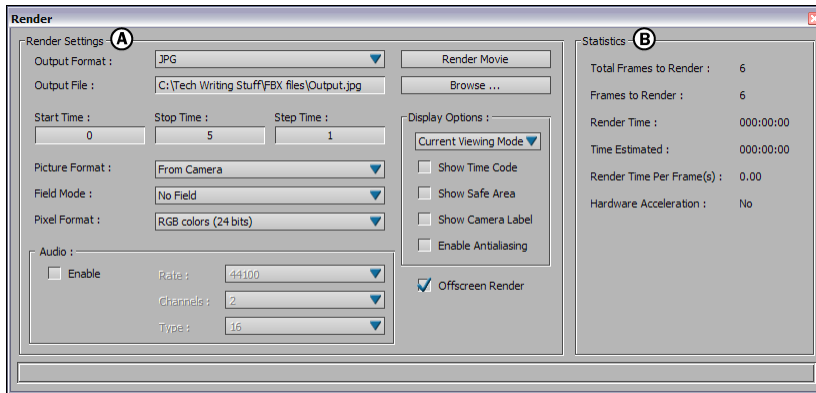
The main topics in this section include:

Render window

The Render window lets you do the following:

- Render takes to *.avi* or *.swf* files, or to a series of *.tif*, *.tiff*, *.jpg*, or *.tga* files.
- Create and modify settings for capturing *.avi*, *.swf*, *.tif*, *.tiff*, *.jpg*, or *.tga* files.
- Create test clips of your animation.

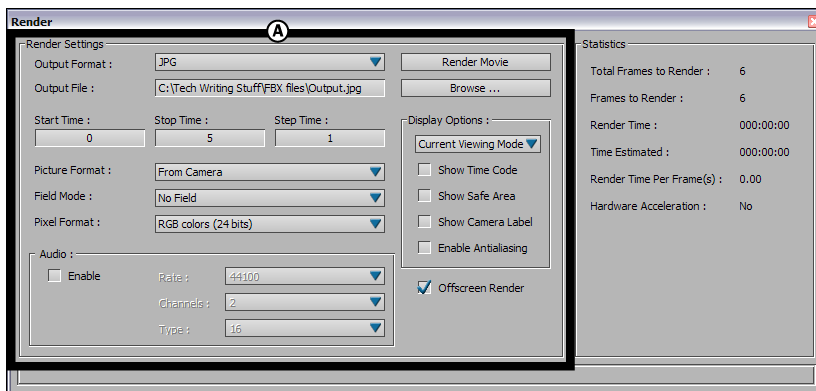
The Render window consists of two areas (A and B): the [Render Settings area](#) on page 162, and the [Statistics area](#) on page 168.



Render window A. Render Settings area B. Statistics area

Render Settings area

The Render Settings area lets you modify the length, speed, size, color, and format of your rendered files.



Render window A. Render Settings area

Output Format menu

The Output Format menu lets you select from the following render file formats:

| Format | Description |
|-------------|--|
| AVI | Renders all specified frames to a single <i>.avi</i> file. When you select AVI as the Output Format and click Render Movie, the Video Compression dialog box appears. See Video Compression dialog box on page 171. |
| SWF (Flash) | Renders the scene as a <i>.swf</i> movie file. When you select SWF (Flash) as the Output Format and click Render Movie, Flash Render Options dialog box appears. See Flash Render Options dialog box on page 173 for more information. |
| TGA | Renders each specified frame to a separate <i>.tga</i> file. The file name of the first frame is <i><name>0000.tga</i> (where <i><name></i> is specified in the Output File Name field). The next frame is saved to <i><name>0001.tga</i> , then to <i><name>0002.tga</i> , and so on. |
| JPG | Renders each specified frame to a separate <i>.jpg</i> file. The file name of the first frame is <i><name>0000.jpg</i> (where <i><name></i> is specified in the Output File Name field). The next frame is saved to <i><name>0001.jpg</i> , then to <i><name>0002.jpg</i> , and so on. |
| TIF/TIFF | Renders each specified frame to a separate <i>.tif</i> file. The file name of the first frame is <i><name>0000.tif</i> (where <i><name></i> is specified in the Output File Name field). The next frame is saved to <i><name>0001.tif</i> , then to <i><name>0002.tif</i> , and so on. |

| Format | Description |
|--------|---|
| YUV | Renders the take in YUV color format, ideal for television output. |
| MOV | Renders all specified frames to a single <i>.mov</i> file. When you select MOV as the Output Format and click Render Movie, the Compression Settings dialog box appears. See Compression Settings dialog box on page 177. |

Output File field

Use the Output File field to enter the path and name of the output file. Click Browse to navigate your file system, and select where to save the rendered file.

If you type in the path and file name, remember to name your file using the proper extension so the rendered file can be loaded by other software.

Browse button

Click Browse to open a file browser to let you locate the directory where you can save your rendered file.

Start, Stop, and Step Time fields

The Start, Stop, and Step Times appear in frames per second or timecode format depending on the settings in the Transport Controls window.

Use the Start Time field to set the starting frame or timecode. All animation before the start frame or timecode is not included in the rendered file.

Use the Stop Time field to set the end frame or timecode. All animation after the stop timecode is not included in the rendered file. When you click Render Movie, the scene is rendered from the Start Time until the Stop Time.

Use the Step Time field to set the increment used when rendering between the Start and Stop Times. By default, the increment is set to one frame.

Picture Format menu

Use the Picture Format menu to select the resolution of the image to be rendered.

Changing the image size also changes the size of the preview window. MotionBuilder supports many resolutions from D1 NTSC (720 x 486) to full screen (1280 x 1024).

You can also set the image format by selecting the From Camera option and configuring the Current Camera's settings. See [Camera settings](#) on page 291 for more information on configuring camera settings.

Field Mode menu

Depending on the format you choose in the Format Mode menu, you may also want to select a field rendering mode from the Field Mode menu.

NOTE Field Mode is not available when rendering .swf files.

Pixel Format menu

Use the Pixel Format menu to select the color depth of your image. Selecting the color depth may change the Hardware acceleration shown in the Statistics area. MotionBuilder supports standard color depths.

Audio area

Activate the Enable option so you can render the audio in your scenes.

NOTE The Audio option is available only when creating .avi and .mov renders.

Rate menu

The Rate menu lets you set a sampling rate for your computer's audio hardware.

Channels menu

The Channels menu lets you choose whether the render is a stereo or mono file. You have two choices:

| Option | Description |
|------------|--|
| 2 (Stereo) | Stereo audio sources contain separate left and right channels and display two waveforms. |
| 1 (Mono) | Mono audio sources contain a single channel and display one waveform. |

Type menu

The Type menu lets you select the number of bits used by your computer's audio hardware. You have the choice between 8 and 16-bits.

Render Movie button

Click Render Movie to render your scene to the selected Output File, using the selected Output Format.

Depending on what type of Output Format you have selected in the Render Settings pane, additional dialog boxes may appear first to let you define other settings. For example, when you select AVI as the Output Format, the Video Compression dialog box appears.

Refer to the descriptions of each format under [Output Format menu](#) on page 163 for more information on the additional dialog boxes.

Display Options menu

The Display Options menu contains options concerning what information you want to appear on the rendered take.

Select the appropriate render type from the Display Options menu. The following selections let you choose what is visible in the final render.

| Option | Description |
|----------------------|---|
| Current Viewing Mode | Select Current Viewing Mode to make the final render show whatever is currently |

| Option | Description |
|-------------|---|
| | shown in the Viewer window, including skeletons, markers, selected items and so on. |
| Normal | Select Normal to make the final render with only the model, without skeletons or markers. |
| Models Only | Activate Models Only to hide all markers, Nulls, skeletons, cameras, and other objects that are related to the MotionBuilder interface. |
| X-Ray | Select X-Ray to have the final render show everything that is shown in the Viewer window's X-Ray mode. |

Show Time Code

Activate Show Time Code to have the timecode appear on the rendered take.

Show Safe Area

Activate Show Safe Area to have the Safe areas display in the rendered take.

Show Camera Label

Activate Show Camera Label to have the Camera label (the white text in the bottom left corner of the Viewer window) display in the rendered take.

Enable Antialiasing

Activate Enable Antialiasing to add a slight blur when rendering. See [Anti-aliasing and oversampling](#) on page 333 for more information.

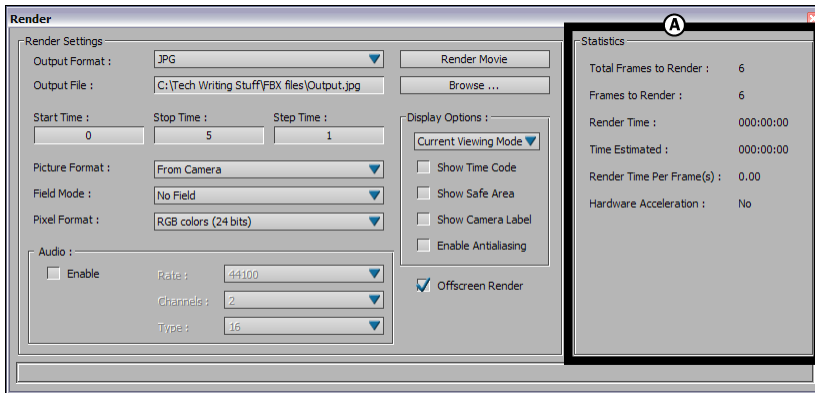
Pixel Format, Antialiasing, Show Time Code and Safe Area are not available when rendering *.swf* files.

Offscreen Render

Activate Offscreen Render to hide the Render Preview window while rendering. When Offscreen Render is activated, the render progress bar at the bottom of the Render window indicates the status of the rendering process. Hiding the Render Preview window saves system resources. This option is active by default.

Statistics area

The Statistics area displays the render status while your scene plays in the Render window.



Render window A. Statistics area

The Statistics area is only provided as a reference. You can modify the Statistics fields using the options in the Render Settings pane.

| Field | Description |
|------------------------|--|
| Total Frames to Render | Gives the total number of frames between the Start and Stop times. |
| Frames to Render | While rendering, acts as a counter showing how many frames remain to render. |
| Render Time | Indicates the elapsed rendering time, measured in seconds. |

| Field | Description |
|--------------------------|--|
| Time Estimated | Estimates the amount of time remaining to render the rest of your take. |
| Render Time Per Frame(s) | Shows the amount of time it takes to render each frame. |
| Hardware Acceleration | Displays the hardware accelerator used to render. The accelerator shown depends on your computer system. |

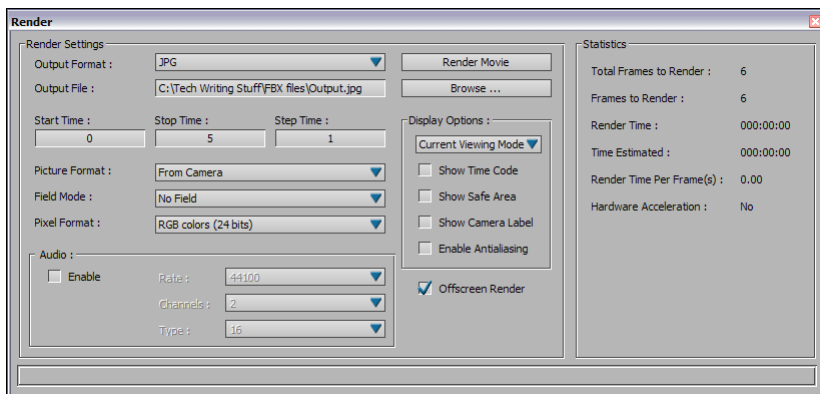
- [Video Compression dialog box](#) on page 171
- [Flash Render Options dialog box](#) on page 173
- [Compression Settings dialog box](#) on page 177

Rendering a scene

You can use the render window to create test clips or stills of your animation.

To render a scene:

- 1 Select File > Render from the menu bar. The Render window appears .

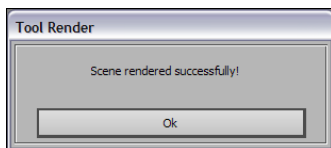


Render window

NOTE If your current video buffer mode does not support an Alpha channel, a warning message appears each time you open the Render window. Click Hide this Message if you do not want this message to appear again.

- 2 Click Browse to set the destination path for your rendered file(s).
- 3 Set a start and stop time in the Render window's Start and Stop Time fields.
- 4 Set a Picture format. See [Picture Format menu](#) on page 165 for information about Picture formats.
- 5 Select an output format from the Output Format menu. See [Output Format menu](#) on page 163 for a description of the different Output formats you can use.
- 6 Click Render Movie. Depending on which output format you select, a window may appear with specific compression formats settings. Adjust these as needed.
- 7 Click Ok.

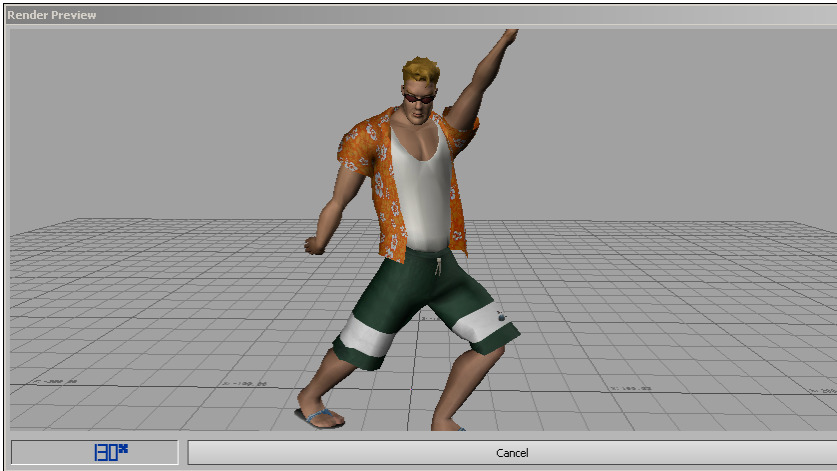
The selected segment of the scene is rendered into the format specified in the Output Format menu and saved to the destination specified in the Render window Output File field. A window appears to tell you the scene has rendered successfully .



A window appears to tell you the scene has rendered successfully.

Render Preview window

When the Offscreen Render option is deactivated, the Render Preview window opens as you render your scene, showing a preview of the frames being rendered . It also shows a frame count in frames per minute or timecode format, depending on the settings in the Transport Controls window.



Render Preview window

Depending on what Output Format you select in the Render Settings, the Render Preview window appears after you click Render Movie, or after you click Render Movie and define additional settings in the resulting dialog boxes.

For example, if AVI is selected as the Output Format when you click Render Movie, the Video Compression dialog box appears first, asking you to select the type of Video compression. The Render Preview window then appears after you click Ok.

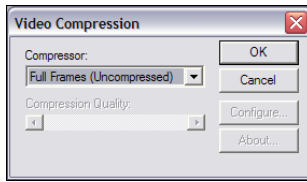
When rendering is completed, a dialog box appears to tell you that the scene was rendered successfully.

NOTE If you want to render with an Alpha channel but your buffer does not support Alpha channels, MotionBuilder switches to a software-generated Alpha channel.

- [Render window](#) on page 161
- [Render Settings area](#) on page 162

Video Compression dialog box

The Video Compression dialog box appears when you have selected AVI, click the Render Movie button in the Render window .



Video Compression dialog box

The Video Compression dialog box contains a menu with different file formats to which you can output your file. The types of compression available depend on your computer system.

If you select the Indeo video 5.10 codec, a compression slider appears, and the Configure button is enabled.

Click Ok in the Video Compression dialog box to confirm that you want to render.

Compression Quality Slider

A Compression Quality slider appears when you use certain output formats, for example, the Indeo video 5.10 codec.

Use this slider to adjust the amount of compression used when the file is output to this format, with 100 being maximum compression and minimum image quality, and 0 being minimum compression and maximum image quality.

Configure Button

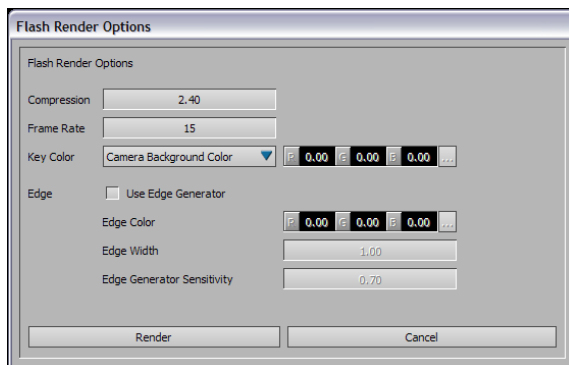
The Configure button is activated when you select certain compression formats, such as the Indeo video 5.10 codec.

Click Configure to display a Configuration window. Depending on the compression standard used, the Configure window shows different settings related to the compression format. For further information, consult the documentation that accompanies the compression format.

- [Render window](#) on page 161
- [Render Settings area](#) on page 162

Flash Render Options dialog box

The Flash Render Options dialog box appears when you render a take with SWF (Flash) selected in the Output Format field.



Flash Render Options dialog box

This dialog box lets you add internal and external edges to your character, set the compression and frame rates, and select the Key Color for your *.swf* file.

During rendering, Internal and External edges do not show in the Render Preview window, however, they do appear in the rendered clip.

Flash versions 4.0 and higher can play the rendered *.swf* file.

Compression

The Compression field lets you define the compression factor for your *.swf* file. This compression rate also affects the error rate for lines in the rendered image.

A higher compression rate displays images with less linear definition, and produces a smaller file size. With a lower compression rate, the rendered lines better fit your curve region, but the final file size is significantly larger.

Frame Rate

Use the Frame Rate field to set the frame rate per second for the output *.swf* file. The default frame rate is fifteen.

Flash movies typically use a frame rate of 12 frames per second. To achieve a similar frame rate, set MotionBuilder to 30 frames per second, and specify a step of 2 in the Step Time field. This forces the renderer to generate a frame

at every second frame, resulting in a Flash movie with a frame rate of 15 frames per second.

Key Color

Use the Key Color menu to select a color to be rendered as transparent. The Key Color menu contains the following options:

Camera Background Color

Renders the background color of the camera transparent. When this option is selected, any other objects or materials in your file that are the same color as the background color are also transparent in the output file.

Specific Color

Lets you define your own color to be interpreted as transparent using the RGB color value fields beside the Key Color menu.

No Color Key

Your file renders without a Key Color.

Edge

The Edge area includes the Use Edge Generator option, as well as fields to define the Edge Color, Edge Width, and Edge Generator Sensitivity.

Use Edge Generator

Activate Use Edge Generator to make the Render window analyze color differences so that borders are added between shaded areas in your scene.

Use Edge Generator uses the color difference between two regions to determine if an edge is displayed. The Edge Generator Sensitivity value lets you adjust at which point the color difference creates an edge.

Edge Color

Use the Edge Color fields to select the display color for Edge Generator borders.

Edge Width

Use the Edge Width field to define the Edge Generator border's thickness.

Edge Generator Sensitivity

Use the Edge Generator Sensitivity field to determine the degree of color variance required for a border to be added between two shaded areas. A lower value in this field results in fewer edges being added to your scene.

- [Flash Renderer limitations](#) on page 175
- [Rendering a scene](#) on page 169

Flash Renderer limitations

The Render window lets you render your takes as Macromedia Flash®.swf movie files. However, not all scenes, models, and shaders translate well into Flash .swf movies.

To successfully export your scene as a Flash movie, you should take note of the limitations described in the following sections.

Multi-material Models

The Flash Renderer does not support models with multiple materials or textures. Try to use only two or three colors, as the Flash Renderer must convert the material or texture data into vectors.

All models should be either single material models or have one of the compatible shaders applied to them. If you attempt to export a model with many materials, it may render as gray. You can hide all models you do not want to export.

Textures

Only very simple textures should be used with the Flash Renderer. Ideally, there should be only two or three colors, no gradients, no anti-aliasing, and only simple images, such as a star.

If you have several pixels with different colors, the vector creation process (picture-to-Flash conversion) generates several regions. The file size is much larger than an .avi render.

The Flash Renderer takes the rendered picture and finds a uniform color region. The color must match perfectly; the Flash Renderer does not support color thresholds.

Shaders

You can render a Flash *.swf* file using shaders, with a few exceptions. The following shaders do not work with the Flash Renderer:

- Live Shadow shader
- Matte shader
- Reflection shader
- Selective Lighting shader
- Shadow Map shader
- Wire Frame shader

To render a file using the remaining shaders, follow the procedures provided for each shader, in the following sections.

Edge Cartoon Shader

Before you use an Edge Cartoon shader for rendering, try to generate edges with the Use Edge Generator option in the Flash Render Options dialog box. Edges created in this way take up less space than those rendered with the Edge Cartoon shader. See [Edge](#) on page 174 for more information on Edge generation.

NOTE If you use the Edge Cartoon shader with Flash rendering, you can get better results if you set a larger Minimum Width value. The larger the Minimum Width value, the more pixel space the Edge Generator uses to create a uniform region for the entire continuous edge.

Flat Shader

There are no problems with the Flat shader when you use the Flash Renderer.

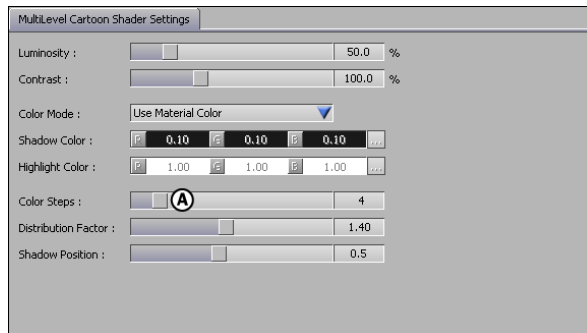
Lighted Shader

Rendering with the Lighted shader is good for low polygon models. No gradients appear when you render with a Lighted shader; they appear only as a flat color.

Multilevel Cartoon Shader

The Multilevel Cartoon shader lets you apply a posterized effect with full control over the luminosity, contrast, and number of steps in the gradient between the shadow and highlight colors.

The Flash Renderer only supports up to four Color Steps between the Shadow Color and Highlight Color . If you specify more than four steps, the gradient between the Shadow and Highlight Color adjusts automatically to only four steps.



Multilevel Cartoon Shader Settings A. Color Steps

For the best results, use two or three steps, with increased steps resulting in a complex rendering of the .swf file.

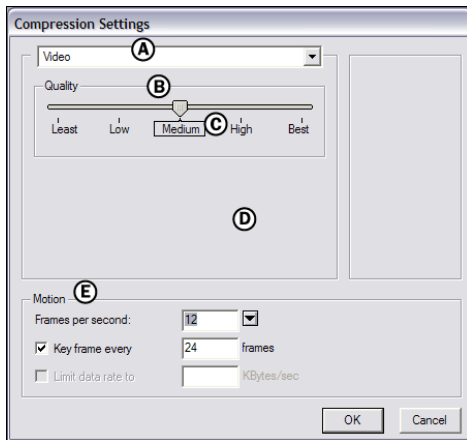
Particle Shader

If you use the Particle shader when rendering, always use the Matte Display Mode, as the Flash Renderer is vector-based and cannot support particles.

- [Render window](#) on page 161
- [Flash Render Options dialog box](#) on page 173

Compression Settings dialog box

If you select MOV from the Output Format menu in the Render Settings area and click Render Movie, the Compression Settings dialog box opens to let you set the compression options for the render file.



Compression Settings dialog box **A.**
Compression Settings menu **B.** **Depth menu** **C.**
Quality slider **D.** **Options area** **E.** **Motion area**

The Compression Settings dialog box includes the following options:

Compression Settings menu

Choose a compression type from the compression settings menu:

- Animation
- Cinepak
- Component Video
- DV- PAL
- DV-DVCPRO-NTSC
- DV-DCVPRO-PAL
- H261
- H263
- Intel® Indeo Video 4.4
- Motion JPG A
- Motion JPG B
- MPEG-4 video

- None
- Photo JPG
- Sorenson Video
- Sorenson Video 3
- Video

Depth

The Depth menu only appears if you select Animation, Cinepak, Graphics, Motion JPG A/B, None, Photo JPG, and Sorenson Video 3 formats. Use this menu to set the color depth for your render.

Quality

The Quality slider only appears if you select Animation, Cinepak, DV- PAL, DV-DVCPRO-NTSC, DV-DCVPRO-PAL, Graphics, H261, H263, Intel Indeo Video 4.4, Motion JPG A/B, MPEG-4 Video, None, Photo JPG, Sorenson Video, Sorenson Video 3, and Video formats. Use the Quality slider to set the resolution of your render, from Least to Best.

Options

Click the Options button to set extra options specific to the compression format you set.

H263

The H263 Encoder options let you specify the encoded image resolution.

Intel Indeo Video 4.4

The Intel Indeo Video 4.4 Encoder Configurations options let you set encoder controls, transparency and activate an access key.

Motion JPG A/B

The Motion JPG A/B Field settings options let you specify the field numbers and dominance when using the Motion JPG format.

Photo JPG

The Photo JPG options let you optimize the render for streaming, and let you use RFC 2035 compatibility for less error correction.

Sorenson Video/Sorenson Video 3

The Sorenson Video settings option lets you view information about the render's compression quality, with information about things such as the key frame size and the frame dropping rate.

Motion

The Motion area of the Compression Settings dialog box lets you control the frame rate of your render, as well as some specific controls that vary depending on the compression format chosen.

- [Render window](#) on page 161
- [Render Settings area](#) on page 162

Rendering a .tga, .tif, .tiff, or .yuv file

You can render your scene as a *.tga*, *.tif*, *.tiff*, or *.yuv* file.

To render a *.tga*, *.tif*, *.tiff*, or *.yuv* of your scene:

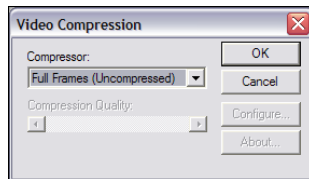
- 1 Select File > Render from the menu bar. The Render window appears.
- 2 Select *.tga*, *.tif*, *.tiff*, or *.yuv* from the Output menu.
- 3 Set a start and stop time in the Render window's Start and Stop Time fields.
- 4 Click Render Movie. An image file is created for each frame specified in step 3.

Rendering an .avi or .mov file

You can render files in the *.avi* or *.mov* movie format.

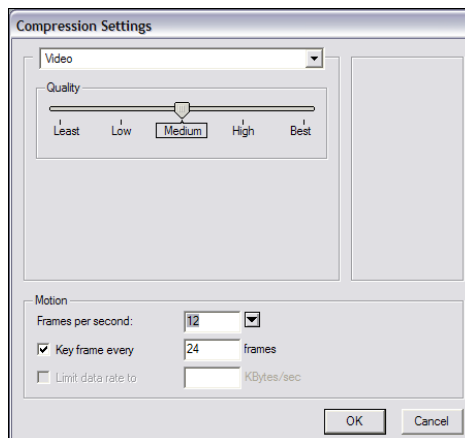
To render a movie in .mov or .avi format:

- 1 Select File > Render from the menu bar. The Render window appears.
- 2 Select .avi or .mov from the Output menu.
- 3 Set a start and stop time in the Render window's Start and Stop Time fields.
- 4 Click Render Movie.
 - If you selected .avi as your file format, the Video Compression dialog box appears. See [Video Compression dialog box](#) on page 171 for more information.



Video compression dialog box

- If you selected .mov as your file format, the Compression settings dialog box appears. See [Compression Settings dialog box](#) on page 177 for more information.



Compression Settings dialog box

- 5 Select the appropriate compression settings in the dialog box.

- 6 Click Ok.

The selected segment of the scene is rendered into *.avi* or *.mov* format and saved to the destination specified in the Render window Output File field.

Rendering scenes as .jpgs

You can render scenes as *.jpg* images.

To render a scene as *.jpg* images:

- 1 Select File > Render from the menu bar. The Render window appears.
- 2 Select JPG from the Output menu.
- 3 Set a start and stop time in the Render window's Start and Stop Time fields.
- 4 Click Render Movie. The Image Options window appears .

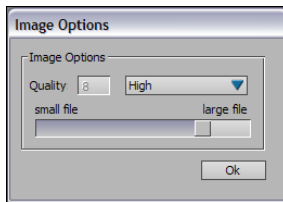


Image Options window

- 5 Use the Render slider bar to set the final size of the rendered *.jpg* image(s). You can also select a preset of Low, Medium, High, or Maximum from the Quality menu.
- 6 Click Ok.

The selected segment of the scene is rendered into *.jpg* format and saved to the destination specified in the Render window Output File field.

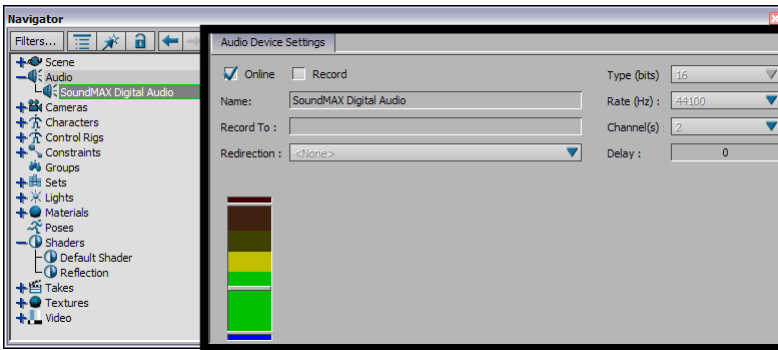
NOTE An image file is created for each frame specified in step 3.

Audio

14

The Audio settings let you load and view audio files and devices, as well as record audio files (in .wav format).

The Audio settings in the Navigator window change depending on what is selected in the Scene browser .



Audio Device Settings

- If the Audio folder is double-clicked, the Global Audio settings appear with a field for setting the playback delay.
- If an audio device is double-clicked in the Scene browser, the Audio Device Settings appear with information and settings that correspond to your computer's default audio device.
- If an audio file is double-clicked in the Scene browser, the Audio Settings appear with information and settings that correspond to the audio file you just clicked.

Before you use the Audio settings, ensure that Enable Audio is activated in the Preferences window's Loading pane.

NOTE MotionBuilder supports .wav and .mp3 files. If the QuickTime® Runtime Library is installed, MotionBuilder supports many more file formats for playback. (The QuickTime Runtime library is installed when you install Apple QuickTime. Install QuickTime from www.apple.com/quicktime/).

- [Connecting to an audio device](#) on page 184

Connecting to an audio device

MotionBuilder recognizes all audio hardware connected to the computer and displays it in the Audio folder.

To connect an audio device:

- 1 Select your audio device in the Scene browser Audio folder.
- 2 Activate the Online option to start communication with the Audio device when you are ready to start recording.
Once Online is activated, the audio input displays in the Record area.
- 3 Test the levels and settings before you click Record.

NOTE Activating Online does not start the recording process, it simply makes MotionBuilder open the connection to the selected audio hardware.

To set a new audio device:

- 1 If you have installed new audio hardware, reset your default audio device using your computer's audio settings.
- 2 Restart MotionBuilder.
- 3 Choose the audio device that is selected as the default device on your computer with the Audio settings Destination menu.

- [Accessing audio from disk or memory](#) on page 192
- [Recording audio](#) on page 187

Loading audio files

There are two ways to load audio files, through the Menu bar and through the Transport controls.

To open an audio file using the Menu bar:

- 1 In the MotionBuilder Menu bar, Select File > Import Audio.
The Import Audio file browser appears.
- 2 Browse for a *.wav* or *.mp3* file.
- 3 Click Open.
- 4 The file is loaded in your scene and the Audio settings appear in the Navigator window.

To open an audio file using the Transport Controls:

- 1 Right-click the Action Timeline in the Transport Controls and select Audio > Open Audio Clip from the contextual menu.
The Import Audio file browser appears.
- 2 Browse for a *.wav* or *.mp3* file. Click Open.
- 3 The file is loaded in your scene and the Audio settings appear in the Navigator window.

NOTE If audio files are already in the Asset or Scene browsers, simply drag them into the Viewer window.

- [Playing audio files](#) on page 185
- [Connecting to an audio device](#) on page 184

Playing audio files

You can load and play *.wav* and *.mp3* audio files.

To play an audio file:

- 1 Load an audio file into the Audio settings.

- 2 Double-click the audio file in the Scene browser.
- 3 Click Play in the Audio settings or Transport Controls to preview the audio file.
- 4 Click Stop to stop the file.

NOTE MotionBuilder supports .wav and .mp3 files but if you install the QuickTime® Runtime Library, MotionBuilder supports many more file formats for playback. (The QuickTime Runtime library is installed when you install Apple QuickTime. Install QuickTime from www.apple.com/quicktime/).

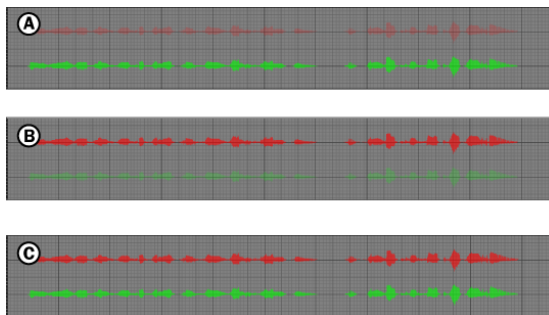
- [Playing back audio channels](#) on page 186

Playing back audio channels

The Use Channel menu lets you select Left, Right, or Left+Right channel playback.

NOTE When you select only one channel, it plays in both speakers.

- Select the Right channel, to show only the red (right) waveform in the Waveform area.
- Select the Left channel, to show only the green (left) waveform in the Waveform area.
- Select Left + Right to play the Left and Right channels together; both the green and red waveforms are shown in the Waveform area.



Waveform channels A. Left channel only B. Right channel only C. Both channels

If a channel is disabled it is still displayed, but it is grayed-out.

- [Accessing audio from disk or memory](#) on page 192
- [Loading audio files](#) on page 185
- [Playing audio files](#) on page 185

Recording audio

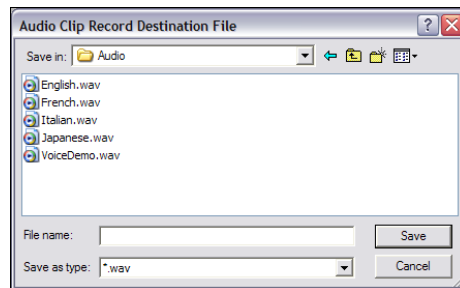
Use the Audio settings to record audio files in .wav format.

To record .wav files with the Audio settings:

- 1 Select the hardware that you want to use to record a .wav file in the Scene browser.

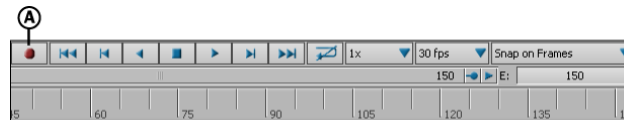
TIP When recording, monitor the audio levels to make sure that a waveform appears. Otherwise, your .wav file may be inaudible.

- 2 Activate both the Online and Record options.
- 3 A dialog box appears so you can select a location to save your .wav file .



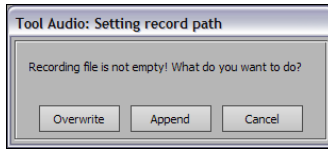
Audio Clip Record Destination File window

- 4 When you are ready to record, click Record in the Transport Controls .



Transport Controls A. Record button

- 5 Both the path and file name of the new *.wav* file appear in the field beside the Record button.
- 6 Select Overwrite or Create in the Record Path dialog box .



Record Path dialog box

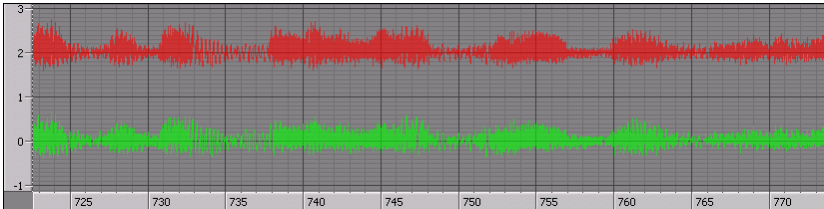
- 7 If you select Create, the Record Path dialog box appears asking if you want to copy the current take.
- 8 Cue the audio for recording using the Record button in the Transport Controls window.
- 9 Click Play to begin recording, and click Stop to end it.
- 10 A *.wav* file is created and added to the chosen directory as well as to the Audio folder in the Scene browser.
To hear your recorded *.wav* file, select the *.wav* file from the Audio folder, and click Play in the Transport Controls window.

To record in mono or stereo:

- 1 Before recording, select an option from the Audio Device Properties area Use Channel menu:
 - Select 1 to record in mono. Mono audio sources contain a single channel and display one waveform.
 - Select 2 to record in stereo. Stereo audio sources contain separate left and right channels and display two waveforms.
 - [Creating an audio delay](#) on page 191
 - [Connecting to an audio device](#) on page 184

Audio waveform

A waveform is a graphical depiction of the continuous fluctuation in the amplitude of a sound over time. Waveforms show us the sound's volume as time progresses; the larger the waveform, the louder the sound.



Audio waveform

Red waveforms are used to depict the right channel and green waveforms depict the left channel.

- [Navigating the Audio waveform area](#) on page 189
- [Loading audio files](#) on page 185
- [Playing audio files](#) on page 185

Navigating the Audio waveform area

You can navigate the Waveform area by Ctrl-dragging left, right, up, and down to zoom in and out. You can also scroll the waveform by Shift-dragging up and down.

There are two areas where you can scrub or shuttle through an audio file: on the audio waveform or in the Transport Controls:

To shuttle through an audio file's waveform:

- 1 Activate Enable Shuttle in the Audio Settings.

NOTE If more than one audio file is used in the scene, only one of these files can have shuttling activated.

- 2 J-drag in the Viewer window or audio waveform.

The speed at which the track shuttles varies depending on the distance between where you click, and how far you drag.

The further you drag to the right, the faster the track shuttles forward. The further you drag to the left, the faster the track shuttles backward.

TIP The audio file shuttles at the speed set in the Transport Controls. Disable shuttling if your disk access is slow.

To scrub through a track to hear the audio on a specific frame:

- 1 Select Snap on Frames in the Transport Controls.
- 2 Move the timeline indicator back and forth.
You can also use the Previous frame and Next frame buttons to scrub through the track frame by frame.

- [Navigating the Audio waveform area](#) on page 189
- [Connecting to an audio device](#) on page 184
- [Caching audio](#) on page 191

Creating an audio offset

To trigger a .wav file so it plays at a time other than the beginning of the take, enter a value in the Audio Settings In Point field.

To create an audio offset:

- 1 Load an audio file in the Audio settings.
- 2 Double-click the In Point field, and enter a value or drag right on the value until the In Point timecode equals the amount of time you want to offset the audio file.
The waveform moves to the appropriate place in the Waveform area.

NOTE The In Point field displays the same measurement as the Frame Rate field in the Transport Controls window.

- [Loading audio files](#) on page 185

- [Creating an audio delay](#) on page 191
- [Accessing audio from disk or memory](#) on page 192

Creating an audio delay

You can create an audio delay if you are streaming live audio with the Voice device to compensate for the time it takes the voice device to process the phonemes of the live audio.

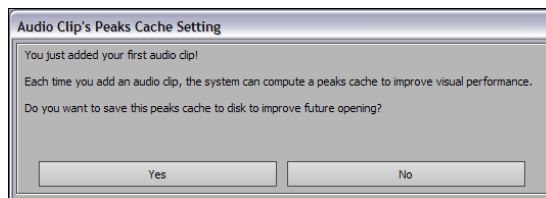
To create an audio delay:

- 1 Before recording or playing audio, select an audio device from the Redirection menu.
- 2 Enter a value to in the Delay field.
- 3 Record or play your audio.

- [Loading audio files](#) on page 185
- [Creating an audio offset](#) on page 190
- [Accessing audio from disk or memory](#) on page 192

Caching audio

The first time you load an audio file, the Audio Clip's Peaks Cache Setting dialog box appears .



Audio Clip's Peaks Cache Setting dialog box

NOTE This option is only offered the first time you load an audio file.

If you choose to save your audio cache files, they are saved to the same location where your audio files are stored.

- [Loading audio files](#) on page 185
- [Accessing audio from disk or memory](#) on page 192

Accessing audio from disk or memory

If you do not have much available memory on your computer, it may be more efficient to access large *.wav* files from disk. However, if your hard disk has a slow access time, it may not be possible to play the *.wav* file in real-time.

To access your audio file from either disk or memory:

- 1 Load an audio file in the Audio settings.
- 2 In the Audio settings Media Access menu, choose either Disk or Memory.

- [Caching audio](#) on page 191
- [Creating an audio delay](#) on page 191

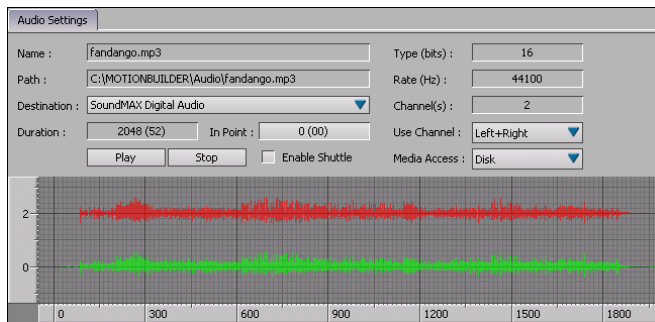
Audio settings

The Audio settings display in the Navigator window when an audio clip is selected from the Scene browser. It is divided into two areas:

- [Audio Properties area](#) on page 192
- [Audio Waveform area](#) on page 195

Audio Properties area

When an audio clip is selected from the Audio folder, the Audio Properties area shows the selected clip's settings .



The .wav file's settings display in the Audio settings.

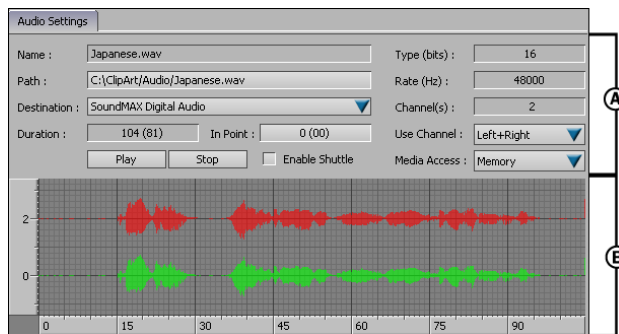
| Setting | Description |
|-------------|--|
| Name | Shows the name of the audio file currently loaded in the Audio settings. |
| Path | Shows the location of the selected audio file. |
| Destination | Lets you choose the audio device that is selected as the default device on your computer. |
| Duration | Shows the length of the audio clip, and uses the same measurement as what is set in the Frame Rate field in the Transport Controls. |
| In Point | Lets you enter a value to offset the beginning of the .wav file, letting you start the file at a time other than the start of the take. For example, if you want the .wav file to begin several minutes into the take, double-click the In Point field, and enter a value or drag right on the value until the In Point timecode equals the amount of time you want to offset the audio file. The waveform moves to the appropriate place in the Waveform area. The In Point field |

| Setting | Description |
|----------------|--|
| | displays the same measurement as the Frame Rate field in the Transport Controls window. |
| Play | Previews the audio file. |
| Stop | Stops the audio file from playing. |
| Enable Shuttle | Activates audio shuttling. If more than one audio file is used in the scene, only one of these files can have shuttling activated. Disable shuttling if your disk access is slow. |
| Type | Shows the bit rate used by your computer's audio hardware. |
| Rate | Shows the sampling rate (in Hertz) of your computer's audio hardware. |
| Channel | Shows you whether the audio clip is stereo or mono. There are two settings: 1 (mono) or 2 (stereo). |
| Use Channel | Lets you select channel playback. There are three options: Left, Right, or Left+Right. If you select the Right channel, only the red (right) waveform is shown in the Waveform area. If you select the Left channel, only the green (left) waveform is shown in the Waveform area. When you select only one channel, it plays in both speakers. Select Left + Right to play the Left and Right channels together; both the green and red waveforms are shown in the Waveform area. |
| Media Access | Lets you choose between loading the .wav file directly from disk and loading the .wav |

| Setting | Description |
|---------|--|
| | file into memory.If you do not have much available memory on your computer, it may be more efficient to access large .wav files from disk. However, if your hard disk has a slow access time, it may not be possible to play the .wav file in real-time. |

Audio Waveform area

The Waveform area shows a waveform of the audio file loaded in the Audio settings.



Audio Device Settings A. Audio Properties area B. Waveform area

If only one channel is displayed in the Waveform area, your audio file is playing in Mono. If you know that the file is not a Mono recording, verify your audio device settings.

NOTE When an audio file is loaded into the Audio settings, a waveform also appears on the Action timeline in the Transport Controls window.

- [Playing audio files](#) on page 185
- [Connecting to an audio device](#) on page 184

Audio display in the Action Timeline

In addition to displaying keyframes, the Action timeline can show *.wav* files. Audio files let you use an audio reference when creating your animation.

You can add audio files and select audio options using the Transport contextual menu. You can also drag audio files from the Asset browser onto the Action timeline.

For example, shows audio waveforms for left and right channels on the Action timeline.



Action timeline A. Waveforms for right and left audio channels display.

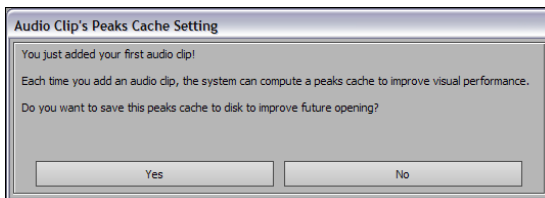
- [Loading audio files](#) on page 185
- [Navigating the Audio waveform area](#) on page 189

Peaks Cache dialog box

The first time you load an audio file, the Audio Clip's Peaks Cache Setting dialog box appears , letting you save the audio cache on the hard disk.

NOTE This option is only offered the first time you load an audio file.

The audio cache is used to display peaks in the audio view. Saving the audio cache to your hard disk saves memory by preventing the peaks from being recomputed.



Audio Clip's Peaks Cache Setting dialog box

If you choose to save your audio cache files, they are saved to the same location where your .wav audio files are stored.

- [Accessing audio from disk or memory](#) on page 192
- [Playing audio files](#) on page 185

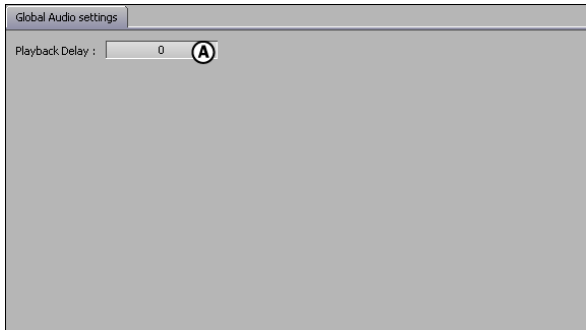
Global Audio settings

To view the Global Audio settings, click the Audio root folder in the Scene browser.

The Global Audio settings display the Playback Delay setting. See [Playback Delay setting](#) on page 197 for more information.

Playback Delay setting

Use the Playback Delay setting to delay the audio clip playback in your scene in order to sync the sound to your animation. Sometimes a delay is necessary if the processing speed of the animation creates sound synchronization problems.



Global Audio settings A. Playback Delay

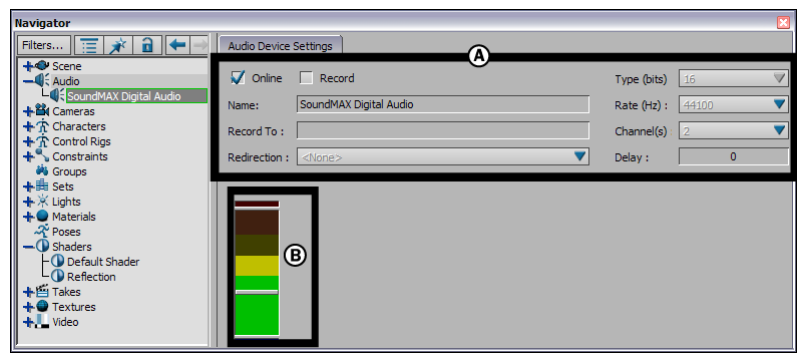
- [Connecting to an audio device](#) on page 184
- [Playing audio files](#) on page 185
- [Recording audio](#) on page 187

Audio Device settings

When you select an audio device in the Scene browser, the Audio Device Settings display in the Navigator window .

The Audio Device settings are divided into two areas:

- [Device Properties area](#) on page 198
- [Record area](#) on page 200



Audio Device Settings A.Device Properties area B. Record area

Device Properties area

When an audio device is selected from the Audio folder, the Device Properties area shows the selected device's settings.

NOTE You can only modify the Redirection, Rate, and Channel(s) fields in the Device Properties area; the other fields are read from the hardware and cannot be changed.

The following settings are found in the Device Properties area:

| Setting | Description |
|---------|---|
| Online | Starts communication with the Audio device when you are ready to start recording.Once Online is activated, the audio input displays in the Record area, and you can test the levels and settings before you |

| Setting | Description |
|-------------|--|
| | click Record.Activating Online does not start the recording process, it makes the Audio device open the connection to the selected audio hardware. |
| Record | Opens the Audio Clip Record Destination window, where you can name and select the destination of the file to be recorded. Activating Record does not start the recording process, it only allows the input audio to be controlled by the Transport Controls. |
| Name | Shows the name of the audio device currently selected in the Scene browser. |
| Record To | Shows the path of the .wav file to be recorded. You can specify this path in the Audio Clip Record Destination window when you activate the Record option. |
| Redirection | Lets you select the audio output device to which you want to output the recorded audio. Any audio output hardware connected to your computer, and which is automatically detected and added by Motion-Builder, can be selected. |
| Type | Shows the number of bits used by the selected audio device. |
| Rate | Lets you select the sampling rate (in Hertz) of the selected audio device. |
| Channel | Lets you select 1 or 2 channel recording. |
| Delay | Delays output from Redirection menu to an audio device. |

Record area

The Record area displays a threshold meter that indicates the input level of the audio device. When the device is online, the meter reacts by displaying threshold levels that the input device captures.

- [Recording audio](#) on page 187
- [Playing audio files](#) on page 185
- [Connecting to an audio device](#) on page 184

Video settings

15

The Video settings let you organize the video clips and images used by the Texture settings. You can use the Video settings as a storage and linking area for all live video and recorded clips. Whenever you add a video clip or image to MotionBuilder, the Video settings appear in the Navigator window.

NOTE MotionBuilder supports .avi, .qt, and .mov video files.

Applying video to objects

To apply video to your scene:

- 1 Drag a Texture asset from the Asset browser onto the object on which you want the video to appear.
- 2 In the Texture settings Media menu, select a video texture.

You can also apply video to a camera's Back Plate or to objects in your scene.

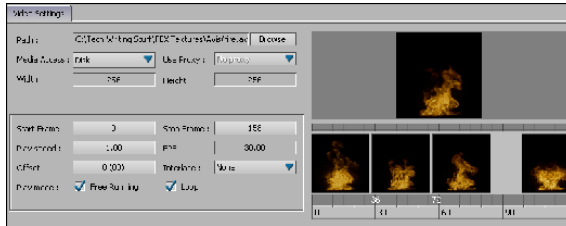
To apply a video or image to a camera:

- 1 Select a video or image file from the Video folder in the Scene browser, and drop it onto the camera.

The selected video or image file is applied to the current camera as the Back Plate. See [Back Plate pane](#) on page 315 for more information about the camera Back Plate.

Video settings

The Video settings let you select various file and playback options for the current video or image.



Video settings

Path

The Path field displays the path of the selected media.

Media access

The Media Access menu lets you specify whether a video plays from a disk or from memory.

- **Disk:** Plays the proxy video from the disk.
- **Memory:** Pre-loads and plays the proxy video from memory. This play method is faster than playing from disk. If the video file is too long, you cannot load it into memory.
- **Disk Async:** Pre-loads the video from memory seconds before being displayed.

Use proxy

The Use Proxy menu lets you assign an alternate version of your video file. This is useful if you want to use a low resolution file or placeholder video while you compose the scene.

When you select a proxy setting, a proxy must exist for the selected file. You must determine when to use the proxy file instead of the original high resolution file.

Create a proxy file in the same directory as the high resolution file, and use the file name format:<X>proxy.avi, (where <X> is the name of the high resolution file).

The Proxy Menu contains the following options:

- No Proxy: Specifies that a proxy file does not exist for the selected video file.
- On Play: Specifies that the proxy for the selected video file plays in place of the original high resolution file.
- Always: Specifies that the proxy for the selected video always plays.

Width/Height

The Width/Height fields display the frame size of the selected media.

Start/Stop frame

Enter a frame number in the Start or Stop Frame fields to specify at which frame to start or stop your video.

Play speed

Enter a value in the Play Speed field to specify how fast or slow the video file plays.

FPS

The FPS field shows the frames per second rate of the current video file.

Interlace

Use the Interlace menu to select the Interlace setting. Interlace settings are dependent on the type of VTR and TV used.

| Setting | Purpose |
|---------|---|
| Fields | Specifies that the video file is shown as a complete resolution picture with both even and odd fields. This changes the way the video is displayed. |

| Setting | Purpose |
|---------------------|--|
| None | Specifies that there is no interlacing during the playing or recording of the video file. |
| Half Frame Even | Specifies that the video file is interlaced at half of true resolution, and even lines are used. |
| Half Frame Odd | Specifies that the video file is interlaced at half of true resolution, and odd lines are used. |
| Full Frame Even | Specifies that the video file is interlaced at full resolution, and even lines are used. |
| Full Frame Odd | Specifies that the video file is interlaced at full resolution, and odd lines are used. |
| Full Frame Even/Odd | Specifies that the video file is interlaced at full resolution, and alternating even and odd lines are used. |
| Full Frame Odd/Even | Specifies that the video file is interlaced at full resolution, and alternating odd and even lines are used. |

Offset

Enter a value in the Offset field to offset the video's time code. If a video file is offset, it starts at the same time as the animation, but plays at the specified offset time code. The Offset is displayed in the same measurement as the Frame Rate field in the Transport Controls window.

Play mode

Use the Play Mode options to set a play type for the selected media.

| | |
|--------------|--|
| Free Running | Specifies the loaded video file as free running. Free Running plays the video file automatically, without the need to use the Transport Controls window. |
| Loop | Loops the selected video file. |

Video Media viewer

The Video Media viewer displays the selected image or video. When the video plays in your scene, it also plays in the viewer.

If a video is selected, the Video Media viewer shows the frames of the clip beneath the video preview. Ctrl-drag or Shift-drag the video frames to zoom in or out.

Version control

16

MotionBuilder has its own version control manager that uses simplified versions of the Microsoft Visual Sourcesafe and NxN Alienbrain version tracking software.

Version control is useful for development teams, letting them protect and track their work with Check In and Out options for all shared files.

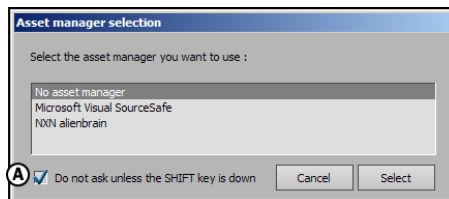
MotionBuilder's version control manager does not apply to external objects such as textures and video clips. To include these, use the Embed Media option when saving your files.

- [Activating Version Control](#) on page 207
- [Microsoft Visual Sourcesafe](#) on page 208
- [NxN Alienbrain](#) on page 211

Activating Version Control

To activate version control:

- 1 The first time you run MotionBuilder, a dialog box appears letting you choose which Asset manager to use in MotionBuilder.



Asset manager selection dialog box A. The Do not ask option

2 Select one of the following three choices:

- No asset manager
- Microsoft Visual Sourcesafe
- NxN Alienbrain

If you select No asset manager, MotionBuilder does not use a file management system. If you select Microsoft Visual Sourcesafe, a simplified version of Visual Sourcesafe is used, and if you select NxN Alienbrain, the NxN Alienbrain integrated features are used.

3 After you choose your Asset manager, activate the Do not ask unless the Shift key is down option to make the Asset Manager Selection dialog box appear only when you press and hold the Shift key as MotionBuilder loads. If this option is disabled, this dialog box is shown every time you run MotionBuilder.

4 Access the MotionBuilder Version Control menu by selecting Version Control from the menu bar. The Version Control menus for Microsoft Visual Sourcesafe and NxN Alienbrain are similar, but have a few different options that are discussed in the following topics:

- [Microsoft Visual Sourcesafe](#) on page 208
- [NxN Alienbrain](#) on page 211

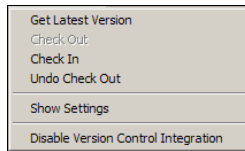
Microsoft Visual Sourcesafe

If you select Visual Sourcesafe to be your Asset manager, a connection to the database is established automatically when MotionBuilder loads

The Open, Save, and Save As commands are synchronized with the database projects, letting you work locally while still connected to the project's database.

Before you can use Visual Sourcesafe, you must manually select the file paths to be managed in the Visual Sourcesafe settings window. You can set managed paths in the Managed Paths pane. See [Adding Managed Paths in VSS](#) on page 210.

In addition, the VSS Version Control menu appears in the MotionBuilder menu bar .



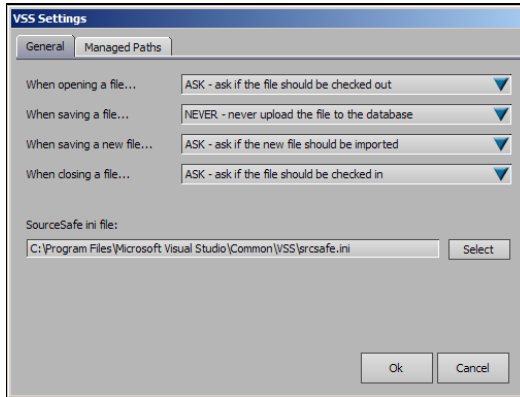
VSS Version Control menu

The Version Control menu contains the following options:

| Option | Description |
|-------------------------------------|---|
| Get Latest Version | Select Get Latest Version to copy the latest version of a file to a local drive. |
| Check Out | Select Check Out to open a file for editing. If the file is already checked out by another person, you cannot retrieve it. |
| Check In | Select Check In to copy a local version of a file to the project database. |
| Undo Check Out | Select Undo Check Out to cancel any changes made to the file while it was checked out. |
| Show Settings | Select Show Settings to display the VSS settings window for Microsoft Visual Sourcesafe. This window lets you set preferences for opening, saving, and closing files. See VSS settings configuration on page 210. |
| Disable Version Control Integration | If you select Disable Version Control Integration, MotionBuilder does not use a file management system. To reactivate version control, disable the No Asset Manager option in the Asset Manager Selection dialog box. |

VSS settings configuration

Configure Visual Sourcesafe's settings by choosing Version Control > Show Settings from the menu bar. The VSS Settings window appears .



VSS Settings window: General Pane

You can set managed paths in the Managed Paths pane. See [Adding Managed Paths in VSS](#) on page 210.

The Asset manager assumes that any files created or accessed within the specified directory are intended for versioning and storage on the central server. When you create a new project move it into the specified directory so it can be managed by the Asset manager.

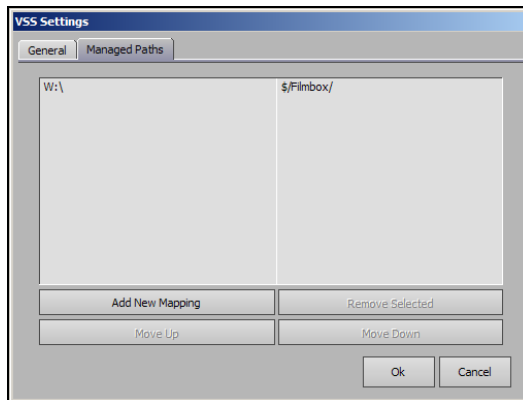
Configuring Drives with VSS

You must manually select the drives to be managed by the Visual Sourcesafe Asset manager in the Visual Sourcesafe settings window.

To set managed paths in the Visual Sourcesafe Asset manager, choose local directories and map them to remote directories in the database.

Adding Managed Paths in VSS

To add a managed path, click the Managed Paths tab in the VSS Settings window , click Add New Mapping and specify the new path.



VSS Settings window: Managed Paths pane

NxN Alienbrain

If you select NxN Alienbrain as your Asset manager, you have all of the features of the Visual Sourcesafe Asset manager with a few extra features.

You can access the NxN Alienbrain Version Control menu from the menu bar. It contains the following options:

| Option | Description |
|--------------------|--|
| Get Latest Version | Select Get Latest version to copy the latest version of a file to the local drive. |
| Check Out | Select Check Out to open a file for editing. If the file is already checked out by another person, you cannot retrieve it. |
| Check In | Select Check In to copy a local version of your file to the project database. |
| Undo Check Out | Select Undo Check Out to cancel any changes made to the file while it was checked out. |

| Option | Description |
|-------------------------------------|---|
| Show History | Select Show History to view an annotated list of all the versions of a file. |
| Show Settings | Select Show Settings to display the settings window for the Asset manager. This window lets you set Preferences for opening, saving, and closing files. |
| Disable Version Control Integration | If you select Disable Version Control Integration, MotionBuilder does not use a file management system. To reactivate version control, deselect the Disable Version Control option in the Asset Manager Selection dialog box. |

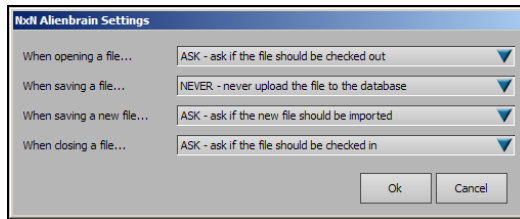
Opening, Saving, and Saving As with NxN Alienbrain

The Open, Save, and Save As commands are modified when you use the NxN Alienbrain Asset manager. These commands are mapped to drives and are synchronized with the database projects, letting you work locally while still connected to the project's database. See [Configuring drives with NxN Alienbrain](#) on page 214 for information on how the Asset manager manages drives.

The Asset manager assumes that any files created or accessed within the specified directory are intended for versioning and storage on the central server.

When you create a new project, move it into the specified directory so that you can manage it with the Asset manager.

You can configure Save settings by choosing Version Control > Show Settings from the menu bar. The NxN Alienbrain Settings window appears.



NxN Alienbrain Settings window

File Options with NxN Alienbrain

When you select NxN Alienbrain as your Asset manager, the following options appear in the File menu:

Open from Database option

The Open From Database option opens the Open File dialog box so you can select a file to open directly from the database.

Add to Database option

The Add to Database option lets you select a folder in which to store a file in the database. You can use Add to Database with scenes that have never been saved or scenes that already exist locally.

Upload to Database option

The Upload to Database option lets you save your changes directly to the database. Use this feature to create backup copies of your work.

When you select Upload to Database, the file is automatically saved to your local drive first.

Database connection

If you select NxN Alienbrain, a connection is established when an operation requests it. For example, when you open a file, or save a file under a managed path.

Configuring drives with NxN Alienbrain

The mapping of managed drives for NxN Alienbrain is automatic. The database is mapped to drive Z by default.

NxN Alienbrain FBX file preview

NxN Alienbrain supports *.fbx* file previewing.

If you select an *.fbx* file in Alienbrain, your scene appears in the Preview window . The scene can be rotated, played, viewed through different cameras, and so on.



NxN Preview window

For more information about the NxN Alienbrain preview window, consult the NxN Alienbrain documentation.

Setting up your Scene

MotionBuilder provides you with many tools that allow you to keep your scenes manageable and well-organized. This section includes topics that introduce the basic elements of a scene, as well as the various methods you can use to organize those elements.

The Scene browser, Navigator window, Asset browser, and Viewer window are all valuable tools that help you work with and keep track of all elements in your scene.

You can sort the objects in a scene into groups and sets in order to select and arrange them logically, and you can use the various views and windows that MotionBuilder provides to maintain a comprehensive inventory of every object you are working with.

Understanding the way scenes are built in MotionBuilder, and how you can effectively organize them can also help to familiarize you with the basics of MotionBuilder. For example, nodes and assets are the basic building blocks of a scene. You can create groups and sets of various assets in order to select and manipulate them as one.

Another good way to organize your work in MotionBuilder is to create custom icons for your *.fbx* files, so that when they display in the Asset browser they are easily identifiable.

The main topics in this section include:

- [Scenes](#) on page 221
- [Assets](#) on page 225
- [Nodes](#) on page 239
- [Groups](#) on page 255
- [Sets](#) on page 263

Namespace

A namespace is a group of objects collected under a name. Each item in a namespace is identified by its own name along with the namespace to which it belongs, for example, objects in the Namespace “Galaxy” could be “Galaxy:Moon”, “Galaxy:Rocket”, or “Galaxy:Alien”.

When you merge an object into a scene that contains another object with the same name, a namespace is added to the second object to resolve the naming conflict. This lets you keep multiple objects with the same name in one scene.

NOTE Use a colon (:) character to separate the names of namespaces and nodes.

When namespaces are used, you can have two objects with the same name in a scene, so long as they have different namespaces. For example, “Mars:Alien” and “Moon:Alien” could be in a scene together, even though the scene would have two objects that are both named “Alien”.

An asset can be in any namespace, regardless of how they are in a scene. You can give nodes from a Control rig hierarchy multiple or separate namespaces, or give a parent object one namespace and a child object another.

Namespaces within namespaces

A namespace acts like a directory in a file system. The assets assigned to a particular namespace are like files in a directory folder. You can store a namespace inside another namespace, just as you would store a directory inside another directory.

For example, the spine bone of an Alien character, shown as “Alien:Spine”, could be placed in the “Moon” namespace, which would then be Moon:Alien:Spine. The Moon namespace and all its associated asset could then be stored in a “Galaxy” namespace, creating Galaxy:Moon:Alien:Spine, and so on.

Just as you cannot have two subdirectories with the same name inside a directory, you cannot have two objects with the same name in a namespace. For example, in the namespace “Galaxy”, there cannot be two “Galaxy:Moon” objects.

You can assign a namespace with the Add/Remove Namespace window ([Creating new hierarchy namespaces](#) on page 217).

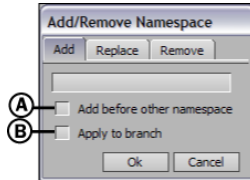
Creating new hierarchy namespaces

You can add prefixes to any hierarchy to change its namespace.

NOTE If you change an object's namespace, it might affect the merge-back of its animation, as the process is based on the object's name.

To create a new namespace for objects in a hierarchy:

- 1 Select the object(s) to which you want to add prefixes in the Scene browser or Viewer window.
- 2 Select Edit > Add/Remove Namespace from the MotionBuilder menu bar. The Add/Remove Namespace dialog box opens.
- 3 Select the Add tab, and enter a prefix in the text field.



Add/Remove Namespace dialog box A. Add before other namespace option B. Apply to branch option

- 4 Activate any of the following options, if they apply:
 - Activate the Add before other namespace option to add the new namespace to the beginning of the prefix.
 - Activate the Apply to branch option if you want to remove every instance of the prefix in the selected hierarchy.

NOTE To change only the first occurrence of the prefix, leave the Apply to branch option disabled.

- 5 Click Ok.
The namespace is applied throughout the selected object's hierarchy.

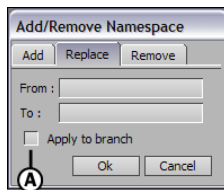
Replacing namespaces in a hierarchy

You can rename existing prefixes in any hierarchy to change its namespace.

NOTE if you change an object's namespace it might affect the merge-back of its animation, as the process is based on the name of the object.

To remove an object's namespace in a hierarchy:

- 1 Select the object(s) with prefixes you want to remove in the Scene browser or Viewer window.
- 2 Select Edit > Add/Remove Namespace from the MotionBuilder menu bar. The Add/Remove Namespace dialog box opens.
- 3 Select the Remove tab and enter the name you want to change in the From field.



Add Namespace dialog box A. Apply to branch option

NOTE You can enter multiple prefixes at the same time if you separate them with a colon (:) in the From field. For example, enter Leg:Arm to create a search for both Leg and Arm prefixes.

- 4 Enter the new prefix in the To field.
- 5 Activate the Apply to branch option to search for every instance of the prefix(es) occurring on the selected object(s).

NOTE If MotionBuilder encounters an with another namespace, for example A:, a prefix is still applied. This occurs even if the second prefix is the same as the first, for example, "A:A:".

- 6 Click Ok.

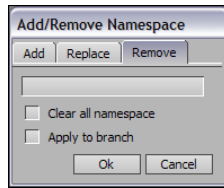
Deleting namespaces in a hierarchy

You can remove an existing prefix or prefixes in a hierarchy to change its namespace.

NOTE If you change an object's namespace, it might affect the merge-back of its animation, as the process is based on the object's name.

To delete a prefix:

- 1 Select the object(s) whose prefixes you want to delete in the Scene browser or Viewer window.
- 2 Select Edit > Add/Remove Namespace from the MotionBuilder menu bar. The Add/Remove Namespace dialog box opens.
- 3 Select the Remove tab in the Add/Remove Namespace dialog box.



Add/Remove Namespace dialog box

- 4 Do one of the following:
 - Activate the Clear all namespace option to remove every prefix.
 - Enter the name of the prefix you want to delete in the text field. Activate the Apply to branch option to clear all instances of the prefix in the selected hierarchy. Leave Apply to branch disabled if you want to delete only the first instance of the prefix.
- 5 Click Ok.

Scenes

17

The 3D scene is the environment where your 3D models exist. The Viewer window is where you interact with the 3D scene and set up your animations. You can set your scene on a grid with its own dimensions and limits. In the Viewer window, you can import, select, transform, copy, tweak, and animate your models.

All the action and animation is depicted in the Viewer window. You can change the Viewer window point-of-view through the use of different cameras. Cameras let you move in and around a scene without changing the orientation of any of the models.

These cameras are not only how you view your scene, but you can also use them to record the scene. You can have multiple cameras filming a scene, and cut back and forth between them by using the Camera Switcher.

Lights complete the 3D scene view, letting you simulate realistic or fantastic lighting effects for your scenes. The Asset list in the Scene browser alphabetically lists all the assets added to your scene in a hierarchy with your scene as the root.

There are various ways you can view and organize all of the elements of a scene, including the creation of groups and sets. You can also create different configurations in the Scene browser to organize the way you view assets in the scene.

You can view a graphical representation of all the objects in your scene by switching to the Schematic view.

- [Schematic view](#) on page 240
- [Cameras](#) on page 273
- [Lighting](#) on page 345
- Scene browser
- [Sets](#) on page 263
- [Groups](#) on page 255

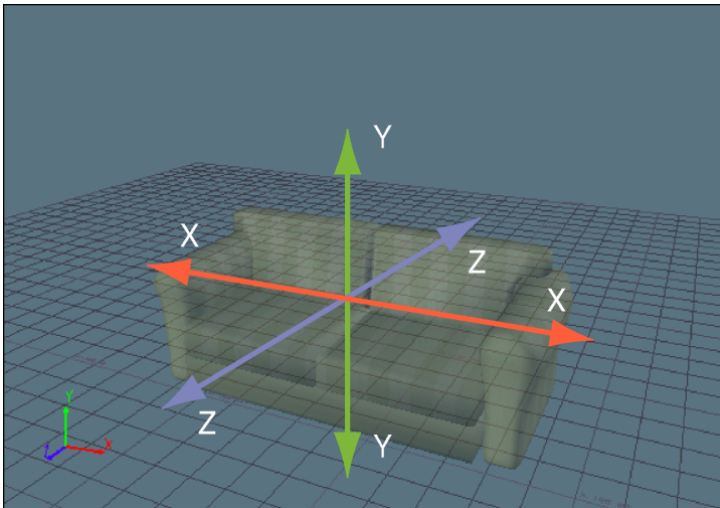
3D Space

In two-dimensional space, such as a drawing, every object has two coordinates (X and Y) that define the horizontal and vertical space the object occupies, and its location. When you move to three-dimensional (or 3D) space, another coordinate (Z) is needed to represent an object's depth.

Since 3D animation works within the two-dimensional interface of a computer, using the XYZ coordinate system provides the illusion of three dimensions.

All 3D objects consist of groups of values (X, Y, Z) in 3D space that define the object's orientation. These XYZ coordinates also let you situate an object in 3D space.

Most 3D software represents the X, Y, and Z axes using perpendicular arrows that intersect at the center (origin) of an object. The origin is the reference point for the object. These arrows are typically color-coded as red (X), green (Y), and blue (Z).



Y defines the up and down axis, X the left and right axis, and Z the forward and back axis.

In , the X coordinate defines the horizontal space in the scene, while Y defines the vertical space, and Z adds the third dimension by defining the depth to and away from the origin.

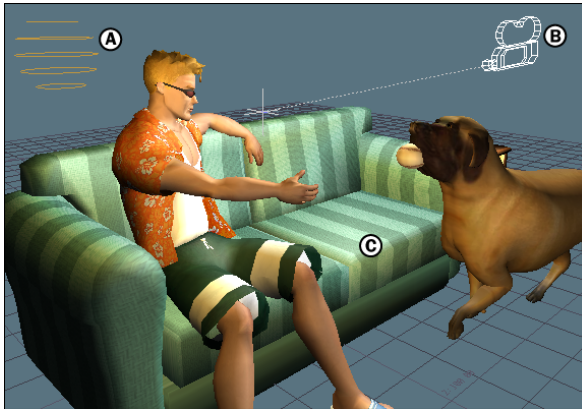
Every object in three-dimensional space can move horizontally (left and right), vertically (up and down), and forward and backward.

- [Transforming objects](#) on page 509

Setting up the scene

Similar to readying a film set, the scene contains all the needed elements, such as characters, props, lights, and cameras.

You view and add elements to your scene using the Asset browser and Viewer window. The Viewer window shows all the models and elements in your scene, lets you select different camera views, and create animation.



A scene A. Light B. Camera C. Models

You can also apply textures, materials, and shaders to the models in your scene to enhance their appearance, see [Surfaces](#) on page 381 and [Shaders](#) on page 415.

- Viewer window
- [Cameras](#) on page 273
- [Lighting](#) on page 345

Assets

18

Assets are objects that you can add to a scene, including characters, devices, elements, shaders, *.fbx* files, and so on.

Assets are listed in the Asset browser in a hierarchical tree structure. You can add them to the scene by dragging them from the Asset browser folders. You can also create favorite paths in the Asset browser to make shortcuts to your own *.fbx* files.

Some types of assets included with MotionBuilder in the Asset browser Templates folder include:

- [Character assets](#) on page 1081
- Constraints ([Animating with Constraints](#) on page 819)
- [Elements](#) on page 226
- [Device assets](#) on page 1019
- [Materials](#) on page 383
- [Adding assets to a scene](#) on page 83
- Adding a favorite path

Types of assets

There are many different types of assets available with MotionBuilder. This topic gives a short description of some of the assets you can find in the Asset browser window.

3D Curve asset

A curve that can be attached to a constraint to create an animation path. Dragging this asset into the Viewer window lets you create a set of points that make up a spline. See [Creating an animated path with a 3D Curve](#) on page 915.

Elements

In the Asset browser, the Elements folder contains a variety of 3D objects that you can add to the scene. For example, you can add a camera or light to adjust the way you view the scene, or you can add a 3D cube to test the effects of certain shaders. You can add video to a scene by first adding a Plane element, and you can build a skeleton using the Skeleton Root and Skeleton reference.

Cube asset

A 3D cube object. You can use cubes to test shaders, textures, materials or create environmental effects using the Particle shader.

Marker asset

A general purpose object you can use for everything from character rigging to creating floor constraints.

Note asset

A property that lets you create text comments for information sharing. You can add notes to individual objects in a scene, or groups of objects.

Refer to [Attaching and removing Notes](#) on page 231 and [Note properties](#) on page 232 for more information.

Null asset

An axis that you can parent to other objects for additional transformation. To learn how to hide nulls in your scene, see [Hiding nulls](#) on page 231.

Plane asset

A flat 3D object that you can use for walls, floors, to display video clips, and to create shadows and reflection maps. See [Applying shadows to objects](#) on page 485.

Script asset

A script text file containing Python commands for automating operations such as adding cameras, plotting, and other features. For more on scripting, see the *MotionBuilder Python Scripting Guide*.

- [Adding assets to a scene](#) on page 83

Browsing assets

In the Asset browser, all items are arranged hierarchically within folders that you can expand or collapse.

To expand a folder, click the plus sign (+) next to the folder name. To collapse a folder, click the minus sign (-) next to the folder name.

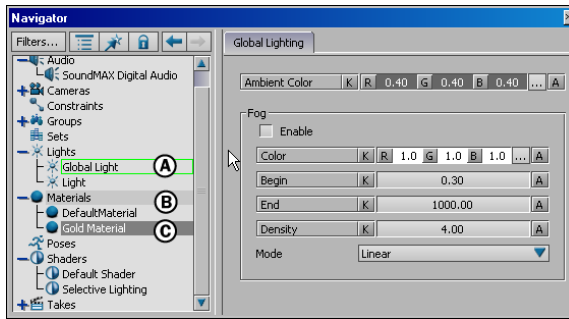
The Asset browser lets you display the contents of folders in various layouts. For example, you can split the window horizontally or vertically to display contents in a separate pane.

In the second pane, you can display assets and other files with additional details as thumbnails or in a list. You can also use custom icons for your own files.

- [Types of assets](#) on page 225
- [Adding assets to a scene](#) on page 83
- Asset browser

Selecting assets

To select assets in a scene, click or double-click them in the Asset list of the Scene browser. When you select assets in the Asset list, three different colors indicate the selection and what displays in the Asset Settings area .



Asset list selection colors A. Green outline indicates the asset settings are currently displaying in the Asset Settings area. B. Light gray indicates an asset is selected within a hierarchy. C. Dark gray indicates the currently selected asset.

The following table describes the selection colors:

| Color | Indicates |
|---------------|--|
| Dark Gray | The currently selected asset or folder. This is not necessarily the same asset appearing in the Navigator window. You can have more than one selected asset. |
| Light Gray | At least one asset is selected within its folder or hierarchy. |
| Green Outline | The asset displays in the Asset Settings area of the Navigator window. Only one asset can display in each Navigator window. |

To select an asset within the same folder, click once to select and view the asset's settings. For example, if the Producer Perspective camera is selected, click the Producer Top camera to select and display the Producer Top camera's settings.

You can allow append an asset onto an existing object in the scene, either in the Viewer window or in the Scene browser. For example, you can add a texture to a plane by dragging the texture asset over a plane. The Texture settings appear in the Navigator window, letting you set the texture's properties.

■ Scene browser

- [Types of assets](#) on page 225

Creating custom icons

You can create your own custom icons in the Asset browser so you can identify your *.fbx* files.

There are two ways to create custom icons. You can either render a thumbnail image from one of your scenes, or you can supply an image our your own.

The quickest way to create an icon for a particular *.fbx* file is to load the scene, then render a thumbnail image of an identifiable part of the scene.

To render a thumbnail image:

- 1 Select the Producer Perspective camera in the Viewer window.
- 2 Position the camera view so your scene is well-represented.
- 3 Choose File > Render Thumbnail from the menu bar.

The Thumbnail Preview window appears . The thumbnail is based on the current frame and the position of the current camera.



**Thumbnail
Preview window**

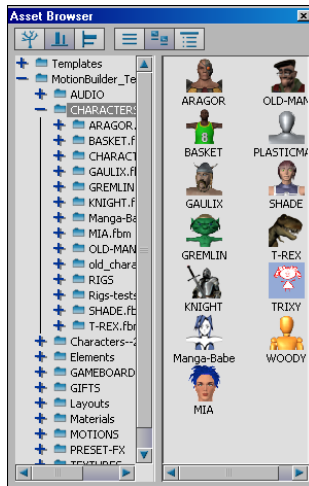
- 4 Click Ok to accept the thumbnail or Cancel to adjust your camera and retake the thumbnail.
- 5 Save the *.fbx* file for the thumbnail you created.
- 6 Right-click in the Asset browser and select Refresh Directory from the contextual menu.

Your custom icon displays to represent the *.fbx* file.

To draw a custom icon:

- 1 In your chosen image creation software, create an image measuring 36 x 36 pixels in .tif format.
- 2 Save the image file at the same directory level as the corresponding .fbx file.
- 3 Name the file using the main file name followed by .fbxicon.tif.
For example, if your .fbx file is "Mia.fbx", name your icon file "Mia.fbxicon.tif".

When your .fbx file displays in the Asset browser, the custom icon replaces the default MotionBuilder icon, as shown in the following image.



Asset browser showing custom icon

NOTE If your .fbx file has both a thumbnail and an image icon, the rendered thumbnail is shown.

■ Asset browser

Attaching and removing Notes

To attach a Note to an object:

- 1 Drag a Note asset from the Asset browser over the object to which you want to add a Note. You can drag Notes onto objects in the Viewer window or in the Scene browser.
The Note is attached to the object and listed in both the Scene and Notes folders in the Scene browser.
- 2 Select the Note and open the Properties window.
- 3 Enter text in the Static comment section.

NOTE To attach a note to multiple objects, drag the Note from the Scene browser Notes folder on top of other items in the Viewer window or Scene browser.

To detach a Note from an object:

- 1 Expand the Scene browser's Notes folder and locate the Note you want to detach.
- 2 Right-click the Note.
- 3 Select Delete. Select Detach Note from all objects to remove every instance of the Note in the scene.
- 4 You can remove a Note from an object by locating the object in the Scene folder and deleting it from an object. Doing this removes only this instance of the Note.
You can view a Note's settings in the Properties window by selecting the Note in the Scene browser.

■ [Note properties](#) on page 232

Hiding nulls

To hide nulls in your scene, select None from the Look menu in the Properties window Null group.

The Maya import process creates a null for every group in the scene and these nulls are visible when you export the file from Maya into MotionBuilder.

Note properties

Note properties display in the Properties and FCurves windows.

Name

Double-click the Name field (fig 4-27, A) to enter a new name for your Note.

Static Comment

Double click the Static Comment field to enter text for your Note.

Asset contextual menu

This topic describes some of the more commonly found items in the Asset contextual menu, which lets you perform actions on assets, change your selection, reorganize your assets into folders, and so on.

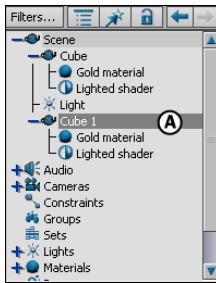
To open the Asset contextual menu, right-click in the Asset list in the Scene browser. Depending on your selection and where you right-click, the options in the contextual menu may change. For example, right-clicking on a folder shows different options from right-clicking on an asset.

The contextual menu applies to the asset on which you right-click, and applies to the selection when you right-click a selected asset.

Duplicate

Duplicates the asset on which you right-click. The duplicated asset inherits all the associated properties and assets of the original asset.

For example, duplicating a cube creates a second cube with the same attached assets.



Scene browser A.
Duplicated cube (Cube 1) inherits all dependencies of original cube (Cube).

Create Group/Set From Selected Item(s)

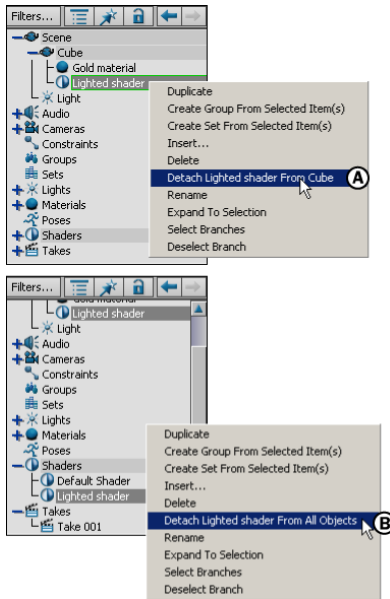
Lets you create a new Group or Set consisting of the selected assets in the Scene browser.

Detach/Detach All Assets

Lets you detach all assets from a model or other asset with materials, textures, and shaders. This menu item changes depending on the selected assets and where you right-click.

Right-click a material, texture, or shader in the Scene folder to detach the asset from its parent. For example, if you right-click a shader attached to a cube, the contextual menu item asks if you want to detach the shader from the cube.

Right-click a material, texture, or shader in its dedicated folder to detach the asset from all attached objects. For example, right-clicking a shader in the Shaders folder displays a menu option that lets you detach the shader from all attached objects.



A. Detach From Asset B. Detach From all Objects

Zero

Provides an additional submenu that lets you set all transformations to zero. This item only appears when you right-click a model or other asset with transformation values (translation, rotation, scaling).

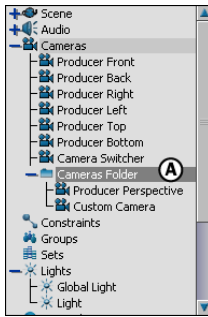
Make Camera Current

Makes the camera on which you right-click the current camera. This item displays in the contextual menu when you right-click a camera in the Cameras folder.

Insert Folder

Lets you add additional folders to the Asset list when you right-click a folder. You can reorganize your list of assets by dragging them into folders.

For example, you can separate your custom cameras in their own folder by right-clicking the Cameras folder and selecting Insert Folder from the contextual menu. The new folder inherits its Asset folder name. Rename folders by right-clicking the folder, and selecting Rename from the contextual menu.



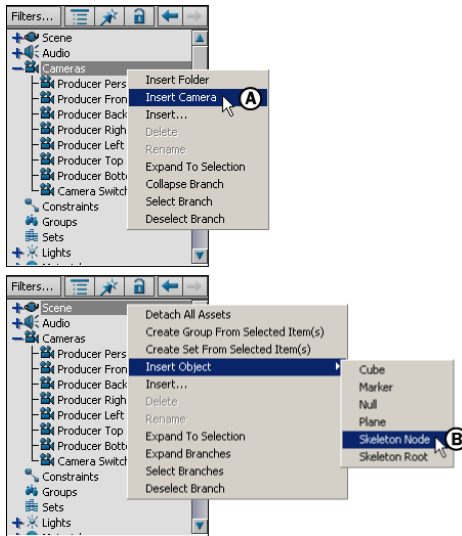
A. Added folder in the Cameras group inherits its parent folder name (Cameras Folder).

You can add folders to any Asset folder, but you cannot add folders under the Scene folder since it displays a hierarchical view of your entire scene.

Insert <Asset>

Lets you add an asset to your scene where <asset> matches the folder that you right-click.

For example, right-clicking the Cameras folder lets you add a custom camera, while right-clicking the Scene folder provides an additional submenu, letting you add any object.



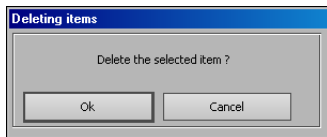
Insert <asset> **A.** Insert Camera **B.** Insert Object

Insert

Opens the Asset browser to let you add assets to your scene. If the Asset browser is already open, this command makes the Asset browser the active window.

Delete

Deletes either the asset that you right-click, or all the selected assets when you right-click a selected asset. Click Ok in the dialog box that appears to confirm deletion of the selected asset .



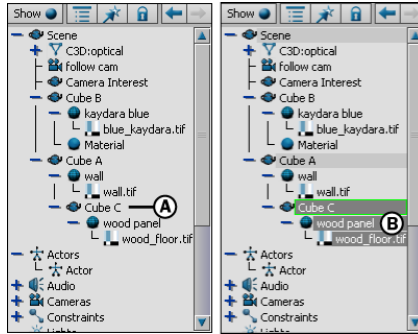
Deleting items dialog box

Rename

Lets you rename the asset that you right-click. To rename the asset, type a new name in the field that appears and press Enter.

Select/Unselect Branch

Selects or deselects all the assets connected to the branch that you right-click. For example, right-clicking on a cube and choosing Select Branch selects the cube and its child assets .



Select Branch A. Right-click on Cube C and choose Select Branch. B. Cube C and all its child assets are selected.

You can also use Select Branch and Unselect Branch with Asset folders. For example, you can right-click the Textures folder and choose Select Branch to select all the textures in your scene.

Expand To Selection

Expands the hierarchy that you right-click to show the selected asset(s). Assets that display in light grey indicate that one of its children are selected.

Expand/Collapse Selected Branches

Expands or collapses all selected branches. Collapse Selected Branches only appears in the contextual menu after a branch is selected. For Collapse Selected Branches to work, make sure you right-click an asset within a selected branch.

- [Groups](#) on page 255
- [Sets](#) on page 263

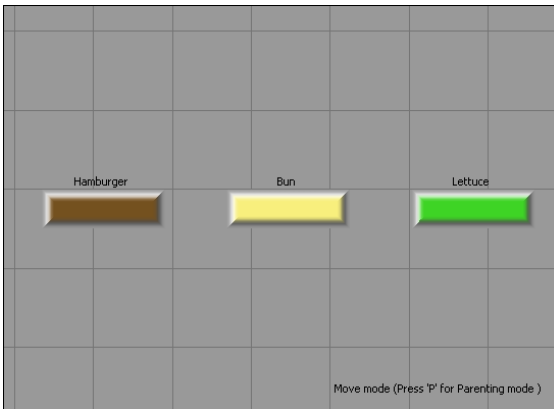
Nodes

19

In the Schematic view, behind the scenes in MotionBuilder, every 3D object is represented by a rectangular node. For example, each bone in a character model's skeleton is represented by a node. You can switch to the Schematic view in the Viewer window to see the nodes that make up your scene.

Nodes are always arranged in a hierarchy that reflects how they are constructed. Each node has a label that indicates what it represents, and if you zoom out far enough, only the labels of the root nodes display. Since nodes graphically represent every object in your scene as a simple rectangle, they make it easy to focus on the relationships between objects.

Nodes that represent models are light gray by default or they are the color of their material, as in . Nodes that represent markers, nulls, camera interests, and skeleton roots are red by default.



Three models represented by nodes in the Schematic view.

Nodes that represent hidden assets display in dark gray. To make hidden assets visible, select them and press Shift-S. Nodes that represent visible assets are light gray or the color of their designated material.

You can use the Schematic view to arrange nodes into new parent-child relationships, and create hierarchies to represent more complex objects.

- [Schematic view](#) on page 240
- [Parenting and hierarchies](#) on page 249
- [Setting up your Scene](#) on page 215

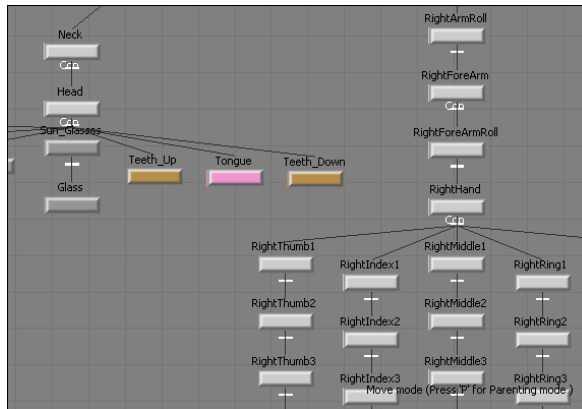
Schematic view

The Schematic view is like a “backstage area” to your scenes, where the object hierarchies in your scene are graphically displayed using nodes. You can switch to the Schematic view in the Viewer window by pressing Ctrl-W, or by selecting Schematic from the View menu. To switch back to the camera view, press Ctrl-W.

In the Schematic view, each hierarchy of nodes in your scene shows either a set of sensors from a device, the parent-child relationships of a loaded model, or the parent-child relationships you have created between objects.

TIP You can customize the color of the nodes that represent lights, skeleton nodes, and imported skeleton limbs using the color setting in the Properties window.

Depending on the position of the object in the hierarchy, you can hide entire parent hierarchies or individual child nodes. In , a model’s hierarchy displays in the Schematic view. The word “Con” in the Schematic view indicates a model or other object that is used in a constraint.



A model's hierarchy displays in the Schematic view. A. Constraint is used with this element.

- [Nodes](#) on page 239
- Viewer window
- [Parenting and hierarchies](#) on page 249
- [Creating parent-child relationships](#) on page 251
- [Organizing hierarchies](#) on page 250

Accessing the Schematic view

To switch to the Schematic view and view a hierarchy of the nodes in your scene, do one of the following:

- Select Schematic from the Viewer window View menu.
- Click in the Viewer window, then press Ctrl-W.

To switch out of the Schematic view, back to the previous camera view, press Ctrl-W again, or select another View from the View menu.

- [Schematic view](#) on page 240
- Viewer window

Selecting nodes in the Schematic view

To select nodes in the Schematic view:

- 1 Double-click or Spacebar-drag around them.

To select the parent of a hierarchy and all of its children:

- 1 Spacebar-right-click the parent. Ctrl-click on nodes to add them to the selection.

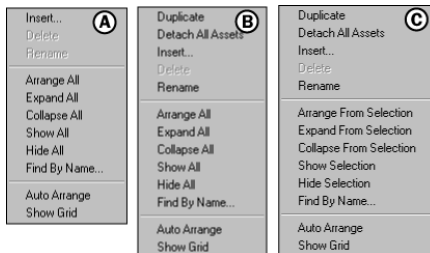
NOTE When you select models, cameras, or other objects in the Schematic view, they are also selected in the camera view(s).

- [Nodes](#) on page 239
- [Schematic view](#) on page 240

Schematic view contextual menu

Right-clicking in the Schematic view displays a contextual menu that contains options that are specific to the Schematic view.

Like the camera view contextual menu, the options in the Schematic view contextual menu change depending on what you click and on whether anything is selected .



Schematic view contextual menus A. Nothing is selected and you right-clicked an empty space B. Nothing is selected and you right-clicked an asset. C. One or more assets are selected.

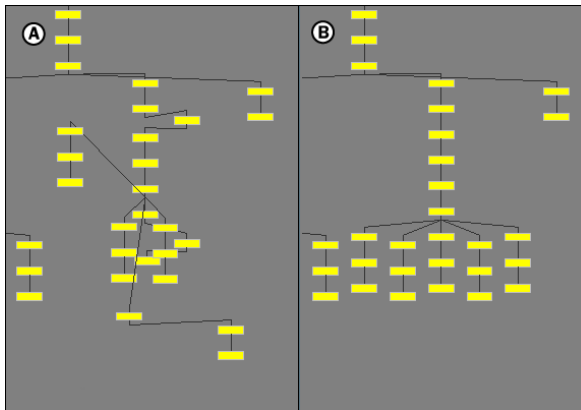
The Duplicate, Detach All Assets, Insert, Delete, and Rename options are common to both the Schematic and Camera views. See Viewer contextual menu for more information on these options.

The following are the options specific to the Schematic view contextual menu.

Arrange All

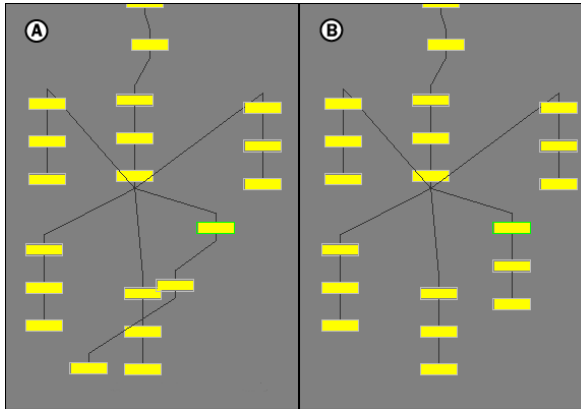
Rearranges the hierarchy display so that it is organized, keeping nodes from overlapping or from being too far apart.

When no assets are selected, Arrange All repositions the hierarchy displays of the entire Schematic view .



A. The hierarchy displayed is disorganized. B. Arrange All is activated.

When one or more assets are selected, use Arrange From Selection option to reposition only the children of the selected node or nodes .

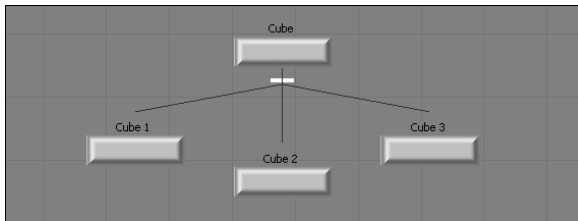


A. The hierarchy displayed is disorganized. One asset is selected. B. Arrange From Selection reorganizes only the selected asset and its children.

When you merge an *.fbx* file to another file, the saved arrangement of appended assets appears below all assets already showing in the Schematic view.

Expand All

Expands every hierarchy display that is collapsed .

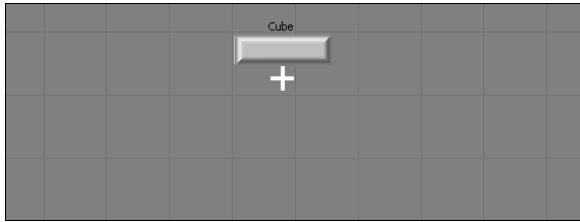


This hierarchy display is expanded. A minus sign displays under the root node "Cube."

When one or more assets are selected, use Expand From Selection expands only the children of the selected node or nodes.

Collapse All

Collapses every hierarchy display so that only the root nodes remain visible .



This hierarchy display is collapsed. A plus sign displays under the root node "Cube."

When one or more assets are selected, use Collapse From Selection to collapse only the children of the selected node or nodes.

Show All

Shows all assets in your scene. Use Show Selection to show only all selected assets.

For more information about parenting in the Schematic view, see [Parenting and hierarchies](#) on page 249 and [Schematic view](#) on page 240.

Hide All

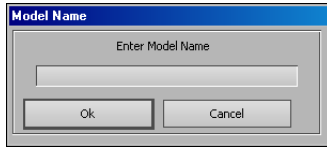
Hides all assets. Use Hide Selection to hide only selected assets. In the Schematic view, nodes that represent hidden assets display in dark gray.



A. All assets are shown, displaying in various colors. B. All assets are hidden, displaying in dark gray.

Find by Name

Lets you find an asset by searching for its name . Enter the name of the asset and click Ok. The asset is selected and framed. This feature is not case sensitive. You can also access this feature by pressing Shift-N.

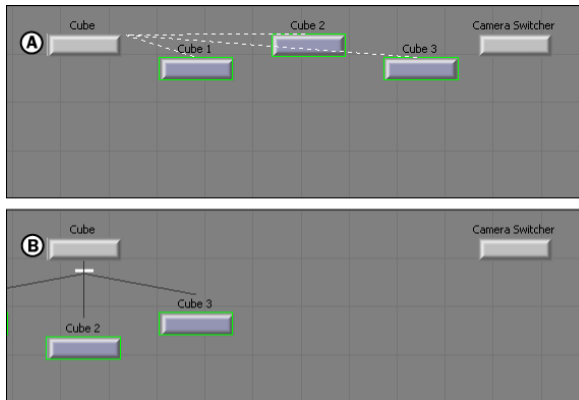


The Model Name dialog box lets you find assets by name in the Schematic view.

Auto Arrange

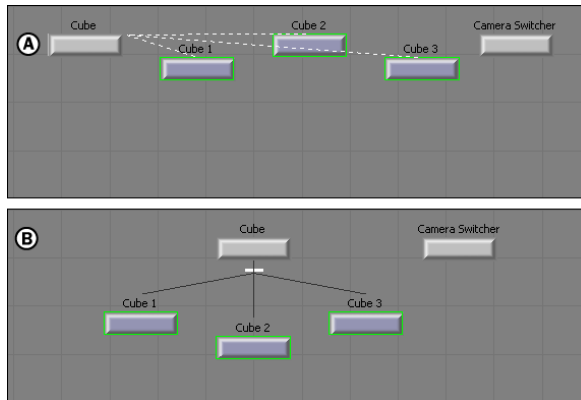
When the Auto Arrange option is enabled, it automatically repositions nodes in so that they are optimized and accessible. It is disabled by default.

For example, Auto Arrange can be useful when you are creating parent-child relationships .



Auto Arrange is disabled. A. Cube 1, Cube 2, and Cube 3 are constrained to Cube. B. The child nodes move underneath the parent node, and do not display fully in the Viewer window.

When Auto Arrange is enabled, child and parent nodes are repositioned so that they do not overlap or move too far away when you are parenting .



Auto Arrange is enabled. *A.* Cube 1, Cube 2, and Cube 3 are constrained to Cube. *B.* The child nodes move under the parent node, and the parent node is also repositioned.

NOTE When opening or appending *.fbx* files that are from FiLMBOX 3.5 or older, the Schematic view is arranged automatically even when Auto Arrange is not active.

Show Grid

Shows and hides the grid. You can also press Ctrl-G to show and hide the grid.

Schematic View shortcuts

The following list keyboard shortcuts available when working with Schematic view.

NOTE To use a keyboard shortcut, your cursor must be over the camera view you want to affect.

To toggle between the Schematic view and the camera view

- 1 Press Ctrl-W.

To create multiple panes

- 1 Press Ctrl-1, Ctrl-2, Ctrl-3, or Ctrl-4 to create one, two, three, or four separate panes in the Viewer window.

- 2 Click in one of the panes, then press Ctrl-W to switch that pane to the Schematic view.

To toggle between the regular Viewer window and full screen

- 1 Move the cursor over the Viewer window and press Ctrl-S. All other windows are hidden.

To zoom in on a specific region

- 1 Z-drag.

To zoom in or out

- 1 Ctrl-drag up to zoom in and Ctrl-drag down to zoom out.

To translate the view

- 1 Shift-drag in any direction to move the entire 3D view.

To show the Display Rate

- 1 Press Shift-F. The Display Rate appears in the upper left side of the Viewer window.

To display the Memory Status

- 1 Press Shift-M. The Memory Status appears in the upper right side of the Viewer window. The memory status shows the amount of memory available on the computer.

To frame everything

- 1 Press A.

To frame selected objects

- 1 Press F.

Related

Manipulating in the Schematic view

Parenting and hierarchies

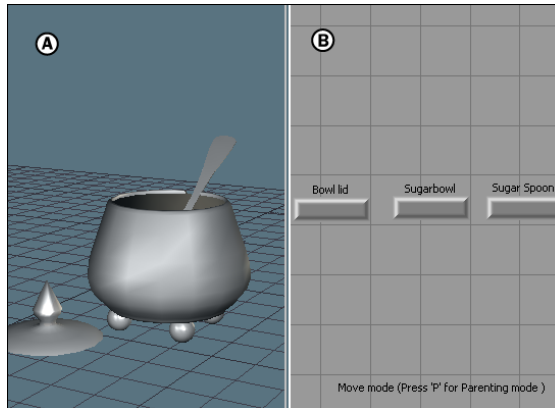
Parenting is a way of linking objects together so that they are connected by reference. When you move one connected object, it affects the other object. Linking objects in this way is called Parenting, as the source object is considered a “Parent” and the target object a “Child”.

When you connect a parent and child, the child object goes wherever its parent object goes. The translation, scaling, and rotation of the parent object applies equally to the child object. A local offset is often added to the child object so that it does not occupy the same space as its parent.

By parenting many objects together and adding the appropriate offsets to each, you can create hierarchies of objects that compose more complex objects, such as human models and skeletons.

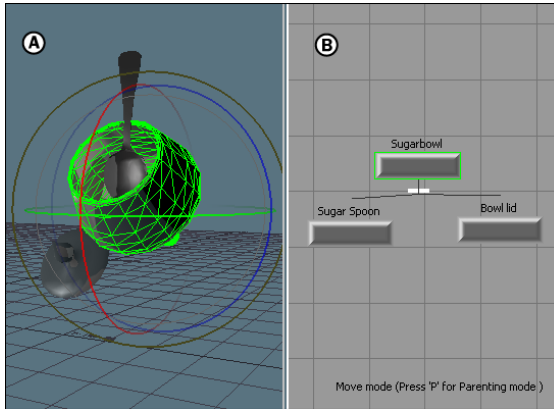
In the Viewer window, you can view the hierarchies in your scene using the Schematic view. The Schematic view uses rectangular nodes to represent the objects in your scene, making it easy to arrange and manipulate your hierarchies.

For example, in , sugar bowl, lid, and spoon models are shown as separate objects. In the hierarchy, they are shown as equals. Each model can be moved independently.



Unparented sugar bowl, lid, and spoon models A. Viewer window B. Schematic view of the same objects.

In , the sugar bowl is parented to the lid and the spoon. When you rotate the bowl, the spoon and the lid follow it. In a hierarchy, the spoon and lid are shown as children of the sugar bowl node.



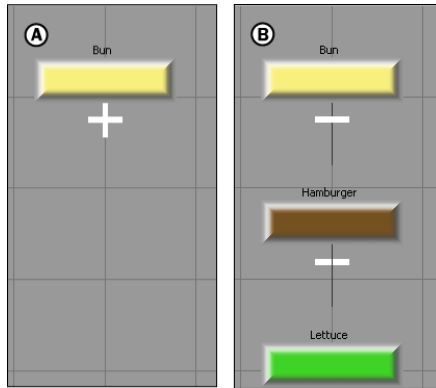
Parented sugar bowl, lid, and spoon models A. Viewer window B. Hierarchical Schematic view of the same objects.

- [Nodes](#) on page 239
- [Schematic view](#) on page 240
- [Creating parent-child relationships](#) on page 251
- [Creating a Control rig](#) on page 1245

Organizing hierarchies

There are different ways you can organize the hierarchies of nodes in the Schematic view when Auto-Arrange is not active. You can drag, arrange, expand, and collapse them. When the scene is saved, all hierarchies are saved in the position in which you place them.

Collapse and expand hierarchies by clicking the minus and plus signs below each reference node, or by right-clicking and selecting Collapse All and Expand All from the contextual menu.



**Schematic view A. Collapsed node B.
Expanded node**

Collapsing hierarchies in the Schematic view does not affect how your scene appears in any of the camera views. However, if you want to hide assets in the camera view when you are in the Schematic view, select them and press Shift-H.

- [Schematic view](#) on page 240
- [Parenting and hierarchies](#) on page 249
- [Creating parent-child relationships](#) on page 251

Creating parent-child relationships

To create parent-child relationships between objects in your scene, you can use either the Schematic view in the Viewer window, or you can use the Scene browser.

In the Scene browser:

- 1 Alt-drag the object to be parented and drop it on top of another object.
- 2 Select Parent from the contextual menu that appears.

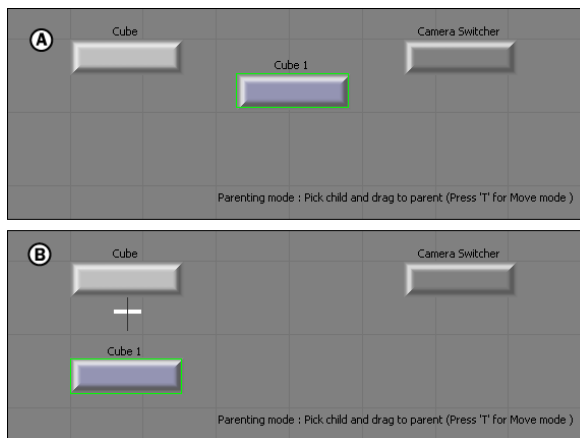
To add additional objects to the selection. Ctrl-click them, then drag the selection to the parent object.

In the Viewer window:

- 1 Switch to Schematic view (Ctrl-W).
- 2 Press P to activate Parent mode.
- 3 Double-click the node representing the object you want to select as a child. To add additional objects to the selection, Ctrl-click the corresponding nodes.
- 4 Drag the selection to the parent object's node.

A dotted line joins a parent and its selected child objects, and the parent object is highlighted. The parent is connected to the selected children, and the objects are rearranged in a hierarchy.

For example, illustrates two cubes before and after parenting in the Schematic view.



A. Before parenting B. After parenting, Cube 1 is the child of Cube.

NOTE You can create more complex parent-child relationships with constraints. See [Parent-child constraint](#) on page 909.

- [Parenting and hierarchies](#) on page 249
- [Disconnecting parent-child objects](#) on page 253
- [Parenting contextual menu](#) on page 253

Disconnecting parent-child objects

You can unparent child objects using the Viewer window, Scene browser, or Schematic view.

To disconnect parent-child objects in the Scene browser or Viewer window:

- 1 Right-click the child object of any parent.
- 2 Select Unparent > Confirm from the contextual menu.

To disconnect parent-child objects in the Schematic view:

- 1 In the Viewer window, switch to the Schematic view (Ctrl-W).
- 2 Click in the Schematic view, then press P to activate Parenting mode.
- 3 Select the node representing the child object you want to disconnect. Ctrl-click additional children to add them to the selection.
- 4 Drag the selection to the parent object's node and release the mouse button when the parent is highlighted.

Releasing the mouse button over an object other than the parent disconnects the selected children from their parent, and connects them to the selected object.

- [Parenting and hierarchies](#) on page 249
- [Nodes](#) on page 239
- [Creating parent-child relationships](#) on page 251
- [Parenting contextual menu](#) on page 253

Parenting contextual menu

If you Alt-drag an object onto another object in the Viewer window, a parenting contextual menu appears with different options depending on the objects involved.

The following are some of the common options available in the Parenting contextual menu.

Parent

Creates a parent-child relationship between the object dragged and the target object(s).

Align

Applies the translation/rotation, translation (X, Y, Z), rotation, and scaling values of the dragged object and the target object(s).

Attributes

Applies the properties of the dragged object to the target object(s).

- [Parenting and hierarchies](#) on page 249
- [Nodes](#) on page 239
- [Creating parent-child relationships](#) on page 251

Groups

20

One way to keep track of associated assets in MotionBuilder is to organize them into a group. Grouping assets together can keep large scenes well-organized, letting you easily select and view the related assets you need. Once stored in a group, you can manipulate the assets collectively, instead of manipulating each individual item.

For example, if you add all the nodes from a skeleton's arm to a group, you can then scale, rotate, or translate the entire arm at the same time. When you manipulate a group, the proportions and positions of its objects are constrained.

Groups are very similar to sets. However, groups are different in that you can have a single object appear in multiple groups. Sets are exclusive, meaning any object can occur in only one set.

The Groups window gives you a way to quickly transform and select a collection of objects, as well as toggle their visibility.

- [Creating a group](#) on page 255
- [Viewing the contents of a group](#) on page 257
- [Groups window](#) on page 258

Creating a group

You can create groups of objects and assets in your scene. You can store any type of object in a group. For example, you can create groups of lights, cameras, models, and so on. You can also create a group that contains the entire hierarchy of a Control rig. To change the timing of the animation, select the group, then make changes in the FCurves window.

To create a group:

- 1 Select an object in the Scene browser or the Viewer window. Ctrl-click to select multiple objects.
- 2 Click Create in the Groups window.
The new group is listed in the Groups list. If no objects are selected, an empty group is created.

When creating groups you can also select objects in the Scene browser or the Viewer window, right-click and select Create Group from Selected Item(s) in the contextual menu. The new group is automatically named “group”.

- [Adding and removing group objects](#) on page 257

Selecting groups

You can select grouped objects/assets in the Viewer window.

To select a group in the Viewer window:

- 1 In the Viewer window, G-click an object belonging to the group you want to select.

NOTE You can also click groups in the Scene browser groups folder.

To select multiple groups:

- 1 In the Viewer window, G-click an object belonging to the group you want to select.
- 2 Press Ctrl-G and select multiple groups.

If an object is part of more than one group, all groups to which the object is connected are selected.

NOTE This selection function is not available with sets.

- [Creating a group](#) on page 255
- [Adding and removing sub-groups](#) on page 258

Viewing the contents of a group

Expand the Groups root folder in the Scene browser, then expand the group you want to view.

- [Groups](#) on page 255
- [Creating a group](#) on page 255

Adding and removing group objects

You can add objects to existing groups, which will help you keep your scene organized.

To add an object to a group:

- 1 Select a group in the Groups list.
- 2 Select the objects you want to add to that set from the Viewer window.
- 3 Click Update to save the new objects to the group.

To remove a single object from a group:

- 1 Select the object to be disassociated from its group in the Groups folder of the Scene browser.
- 2 Right-click the object and select Detach x From y Group in the contextual menu, where *x* is the name of the object and *y* is the name of the group to which it belongs.
The object is no longer associated with the group.

To remove multiple objects from a group:

- 1 Select a group in the Groups list.
The objects in the group are selected in the Viewer window.
- 2 Deselect (Ctrl-click) the objects you want to remove in the Viewer window.
- 3 Click Update in the Groups window to save the changes to your group.

- [Creating a group](#) on page 255

- [Adding and removing sub-groups](#) on page 258

Adding and removing sub-groups

You can store groups within each other to create sub-groups. This can be useful when you want to organize less important scene elements or actions within another heading.

To create a group:

- 1 Select an existing group in the Scene browser.
- 2 Drag it on top of a second group.
- 3 Select Move to Group from the contextual menu.

The first group becomes a sub-group of the second.

You can also copy a group to another folder by selecting Duplicate to this Group from the contextual menu. This leaves the group where it is and adds it to another group at the same time.

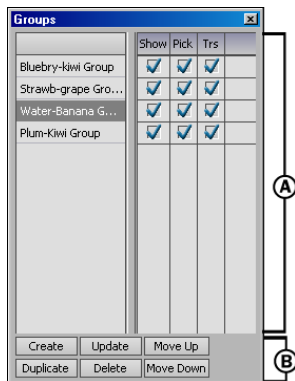
To remove a sub-group:

- 1 Select a sub-group in the Scene browser.
- 2 Drag the sub-group on top of the Groups root folder.
The sub-group then displays under the root folder as a regular group again.

- [Groups](#) on page 255
- [Creating a group](#) on page 255

Groups window

The Groups window lets you take any kind of asset or object and associate them. You can create Groups including models, elements, sensors, lights, materials, shaders, markers, nodes, textures, constraints, and even other groups.



Groups window A. Column area B. Options area

To display the Groups window, select it from the Window menu in the MotionBuilder menu bar.

Column Area

The column area is where you find commands for controlling the groups. The following table shows the available commands:

| Command | Function |
|-------------|--|
| Groups List | The Groups List shows all the groups created for use in the current take. |
| Show | The Show option lets you display or hide components of a group in the Viewer window. When the Show option is activated, all components of the group display in the Viewer window. When disabled, the components of the group are hidden. |
| Pick | When the Pick option is disabled next to a group, you cannot select objects in that group. |
| Transform | When the Transform (Trs) option is disabled next to a group, the contents of the |

| Command | Function |
|---------|---|
| | group are “locked” and you cannot transform them, although you can still select them. |

Options Area

The Groups option area, below the Groups column is where you find options for creating, copying, deleting, and reorganizing your groups. The following table shows which options are available from the Groups options area.

| Option | Function |
|-----------|---|
| Create | The Create button lets you add a new group to the Groups column. |
| Update | The Update button lets you add or remove the contents of the currently selected group. |
| Move Up | You can rearrange the order of groups in the Groups list. This is useful for quick access when you work with multiple groups. Use the Move Up button to advance a selected group higher in the Groups list. |
| Duplicate | The Duplicate button copies a selected group from the Groups column. To duplicate a group, select it in the Groups list, then click Duplicate. |
| Delete | The Delete button removes a selected group from the Groups list. Using the Delete button only disassociates objects from each other, it does not remove the objects contained within the group from the scene. To delete a group, select it in the Group list, then click Delete. |

| Option | Function |
|-----------|--|
| Move Down | You can rearrange the order of groups in the Groups list. This is useful for quick access when you work with multiple groups. Use the Move Down button to move your group lower down in the Groups list. |

- [Groups](#) on page 255
- [Creating a group](#) on page 255
- [Adding and removing group objects](#) on page 257

By organizing related assets into sets, you can effectively manage complex scenes that have a large number of assets involved.

Like groups, sets are used for the selection and organization of items in a scene. Unlike groups, the visibility of sets can be animated, and the animation stored in sets can be cached.

Using sets, you can select a pre-defined collection of several objects every time you want to work with them. Once stored in a set, you can manipulate the whole set instead of each individual object.

For example, if you add all the nodes from a skeleton's arm to a set, you can then scale, rotate, or translate the entire arm at the same time. When you manipulate a set, the proportions and positions of its objects are constrained.

Despite their similarities, the fundamental difference between groups and sets is that unlike groups, sets are exclusive. This means that while the same asset can appear in many groups, it can only occur once in one set. You cannot copy an asset or object from a set, you can only move it from one set to another.

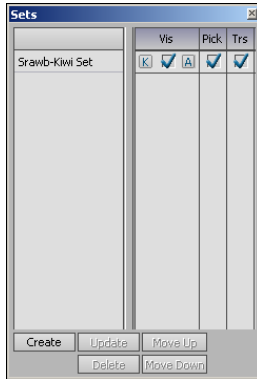
The Sets window gives you a way to quickly transform and select a collection of objects, as well as toggle their visibility.

- [Creating a set](#) on page 264
- [Viewing the contents of a set](#) on page 264
- [Adding and removing set objects](#) on page 265
- [Caching animation](#) on page 267
- [Sets window](#) on page 268

Creating a set

- 1 Select an object in the Scene browser or the Viewer window. Ctrl-click to select multiple objects.
- 2 Click Create in the Sets window.

The new set is listed in the Sets list. If no objects are selected, an empty set is created.



A set is added to the Sets list.

- [Sets](#) on page 263
- [Adding and removing set objects](#) on page 265
- [Creating and removing sub-sets](#) on page 265

Viewing the contents of a set

Expand the Sets root folder in the Scene browser, then expand the set you want to view.

- [Sets](#) on page 263

Adding and removing set objects

To add an object to a set:

- 1 In the Sets window, select a set in the Sets list.
- 2 Select the objects you want to add from the Viewer window.
- 3 Click Update to save the new objects to the set.

To remove a single object from a set:

- 1 Select the object to be disassociated from its set in the Sets folder of the Scene browser.
- 2 Right-click the object and select Detach x From y Set in the contextual menu, where x is the name of the object and y is the name of the set to which it belongs.

The object is no longer associated with the set.

To remove multiple objects from a set:

- 1 Select a set in the Sets list.
The objects in the set are selected in the Viewer window.
- 2 Deselect (Ctrl-click) the objects you want to remove in the Viewer window.
- 3 Click Update in the Sets window to save the changes to your set.

- [Sets](#) on page 263
- [Creating a set](#) on page 264
- [Sets window](#) on page 268

Creating and removing sub-sets

You can store sets within each other to create sub-sets. This can be useful when you want to organize less important scene elements or actions within another heading.

To create a sub-set:

- 1 Create a new set containing the objects you want in the subset.
- 2 Select the set in the Scene browser.
- 3 Drag it on top of a second set.
- 4 Select Move to Set from the contextual menu.

The new set becomes a sub-set of the second set.

NOTE You cannot copy a set to another set, you can only move a set from one set to another. There is no duplication of sets.

To remove a sub-set:

- 1 Select a sub-set in the Scene browser.
- 2 Drag the sub-set on top of the Sets root folder.

The sub-set displays under the root folder as a regular set again.

- [Creating a set](#) on page 264
- [Sets](#) on page 263
- [Creating and removing sub-sets](#) on page 265

Animation caching with sets

Animation caching lets you play the animation of one or more scenes from the hard disk. If animation is contained in any set, you can specify whether the animation is accessed from the hard disk or from memory.

NOTE This feature is available only in the Properties window and Scene browser when a set is selected.

Playing the animation from memory streams it directly from the hard drive. Doing this greatly improves the overall performance of the scene, letting you work with more models.

Because of this, you can load more elements in your scenes, such as secondary characters or backgrounds, while maintaining maximum performance for the

elements you are working on. See [Caching animation](#) on page 267 for more on how to cache animation in your sets.

NOTE You cannot cache animation within a group.

- [Creating a set](#) on page 264
- [Caching animation](#) on page 267

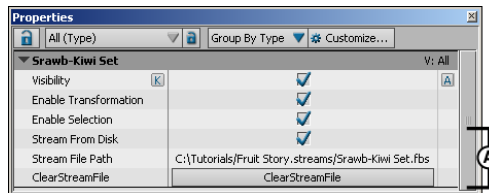
Caching animation

When you have a set containing animation in your scene, you can cache the animation in order to play it directly from your hard drive.

- 1 Save a scene containing a set with animation.
- 2 Select the set in the Scene browser, and open the Properties window.
- 3 Activate the Stream From Disk option.

The Stream File Path field automatically updates with the file path from which the animation is streaming. The *.fbs* animation cache file is named after the set, and is located in a folder named after the scene.

For example, the scene is named “Fruit Story” and the set with animation is called “Strawb-Kiwi set”. So, the cache file *Strawb-Kiwi set.fbs* is saved in the folder *Fruit Story.streams*.



Set properties A. Animation caching options

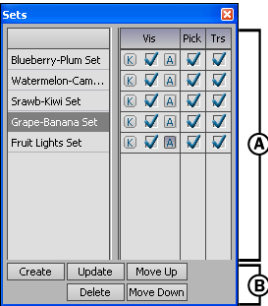
Now when you play animation in this scene, animation contained in the sets is accessed from the hard disk.

- [Sets](#) on page 263
- [Creating a set](#) on page 264

Sets window

The Sets window lets you take any kind of asset or object and associate them. You can create sets including models, elements, sensors, lights, materials, shaders, markers, nodes, textures, constraints, and even other sets.

To display the Sets window, select it from the Window menu in the MotionBuilder menu bar.



Sets window A. Column area B. Options area

Column Area

The Column Area of the Sets window lists all of the sets you have created and gives you options for controlling the sets.

The following table shows the options available in the Column area:

| Option | Function |
|------------|---|
| Sets List | The Sets List shows all the sets created for use in the current take. Any type of object can be stored in a set. For example, you can create sets of lights, cameras, models, and so on. You can also create a set that contains the entire hierarchy of a Control rig. To change the timing of the animation, select the set, then make changes in the FCurves window. |
| Visibility | The Visibility (Vis) option lets you display or hide components of a set in the Viewer |

| Option | Function |
|----------------------|--|
| | window. When the Visibility option is activated, all components of the set display in the Viewer window. When disabled, the components of the set are hidden. |
| Animating and Keying | With sets, you can set keyframes and animate the visibility of sets using the Key and Animate buttons next to the Visibility option. See Keyframe (K) and Animate (A) buttons. Note: The Animating and Keying visibility functions are not available within a group. |
| Pick | When the Pick option is disabled next to a set, you cannot select objects in that set. |
| Transform | When the Transform (Trs) option is disabled next to a set, the contents of the set are “locked” and you cannot transform them, although you can still select them. |

Options Area

The Sets option area, below the Sets column is where you find options for creating, copying, deleting, and reorganizing your sets.

The following table shows the options available in the Sets option area:

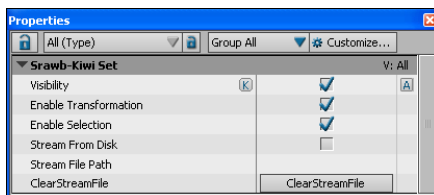
| Option | Function |
|---------|--|
| Create | The Create button lets you add a new set to the Set column. |
| Update | The Update button lets you add or remove the contents of the currently selected set. |
| Move Up | You can rearrange the order of sets in the Sets list. This is useful for quick access when you work with multiple sets. Use the Move |

| Option | Function |
|-----------|--|
| | Up button to advance a selected set higher in the Sets list. |
| Delete | The Delete button removes a selected set from the Sets list. Using the Delete button only disassociates objects from each other, it does not remove the objects contained within the set from the scene. To delete a set, select it in the Sets list, then click Delete. |
| Move Down | You can rearrange the order of sets in the Sets list. This is useful for quick access when you work with multiple sets. Use the Move Down button to move your set lower down in the Sets list. |

■ [Sets](#) on page 263

Additional Sets options

The Scene browser and the Properties window have some additional functions used with sets that do not appear in the Sets window. You can use the Scene browser or the Properties window to access the set's animation caching functions.



Sets options in the Properties window

NOTE You cannot cache animation within a groups.

Stream From Disk

Activate the Stream From Disk option to play the animation from memory, running it directly from the hard drive. Doing this limits the amount of RAM needed and greatly improves the overall performance of the scene.

Stream File Path

The Stream File Path field shows you from where on your hard drive the set's animation is streamed.

ClearStreamFile

The ClearStreamFile button removes the current Stream File Path.

- [Sets](#) on page 263
- Caching a set's animation

Cameras

When you look at your 3D scene through the MotionBuilder Viewer window, you are using a camera view. The camera represents your vantage point, framing your view of the objects inside the MotionBuilder 3D world.

In fact, when many people describe a scene in the Viewer window, they often are describing what they see happening in the Viewer window's camera view.

MotionBuilder lets you use many camera views, some of which you can alter and some that contain preset angles.

This section includes the following topics:

- [Producer cameras](#) on page 277
- [Custom cameras](#) on page 283
- [Camera settings](#) on page 291
- [Camera switcher](#) on page 335

Adding Cameras to your scene

You can use the default Producer cameras to view your scene or you can create a custom camera. See [Selecting a Producer camera](#) on page 282, and [Creating a custom camera](#) on page 284.

To use a Producer camera in your scene:

- 1 In the Viewer window, click View.
- 2 From the View menu select either Perspective > Producer. If you want a fixed camera view, select View > Orthographic and choose a preset orthographic camera view, such as Producer Left.

TIP There are keyboard shortcuts for each Producer camera view so you can switch between views quickly.

The Producer camera view is automatically created as the current camera and the Viewer window switches to the new view as soon as a new Producer camera is selected.

To add a custom camera in your scene:

- 1 Drag a Camera asset into the Viewer window from the Asset browser.
The new camera is added to the Scene browser's list of Custom cameras, beneath the Camera switcher.
- 2 Rename the custom camera by right-clicking it in the Scene browser's Cameras folder or the Viewer window, then selecting Rename from the contextual menu.

TIP You can add multiple custom cameras if you double-click the Camera asset in the Asset browser and then click anywhere within the Viewer window to place a camera at that point. Press Escape to cancel the operation or Enter to accept it.

- 3 To view through the new custom camera, make it the current camera. See [Making a camera current](#) on page 274.

Making a camera current

To make the Viewer window display a specific camera view:

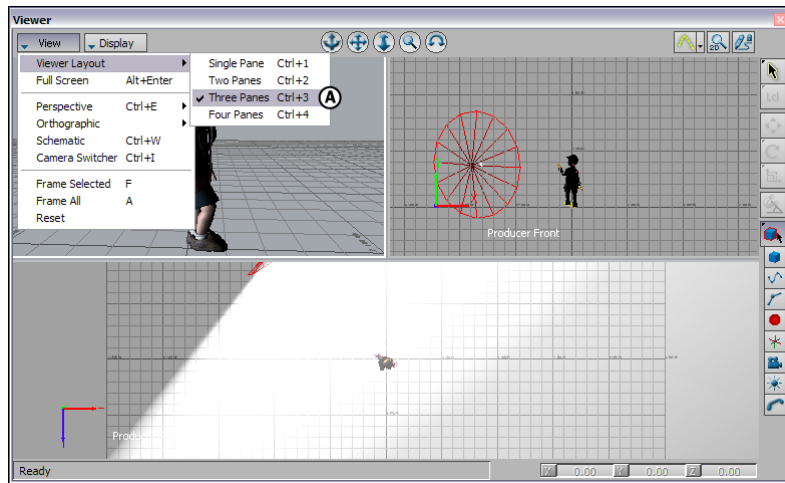
- 1 Select a camera in the scene.
- 2 Right-click it and select Make Camera Current from the contextual menu. You can also right-click any camera in the Camera folder, and select Make Current from the contextual menu.
- 3 When you select Make Current, the view in the Viewer window switches to show the view from the selected camera.

NOTE You can only select custom cameras in the Viewer window, or the Scene browser. Make Producer cameras current by selecting them from the Viewer window View menu, or right-clicking them in the Scene browser and selecting Make Current.

You can also right-click anywhere in a scene and choose **Select Current Camera** from the contextual menu, to select the current camera, its interest, and Up Vector (if applicable).

Creating multiple camera views

You can split the viewer window into multiple camera views. This provides you with up to four different angles on your scene and makes it easier to position cameras in your scene.

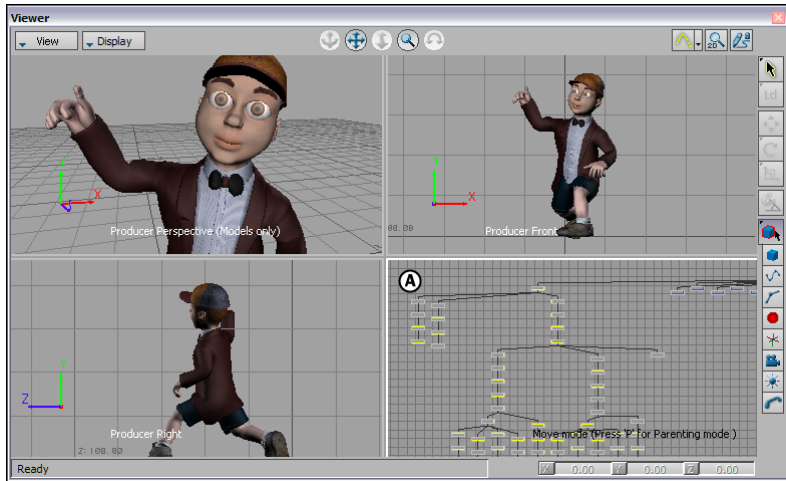


Viewer window A. Select **View > Viewer Layout > 3** to split the window into three camera views.

To split the Viewer window into multiple camera views, select **View > Viewer Layout** from the Viewer window View menu to split the view into one to four panes. You can also click in the Viewer window and press Ctrl-1, 2, 3, or 4.

See **Viewer Layout** for more information.

- 1 between splitting the Viewer window into one, two, three, or four panes . You can also press Ctrl and numbers 1, 2, 3, 4, from the keyboard.



Viewer window divided into four panes A. The active camera view

Each pane can use a different camera view, so you can see your scene from different perspectives at the same time. You can also show the Schematic view in any of the Viewer window panes.

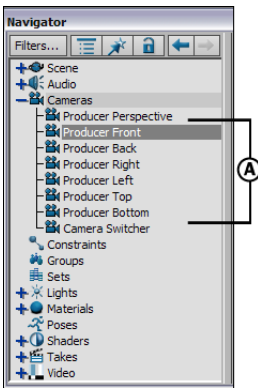
When the Viewer window has been split into more than one pane, click within the pane to activate it. You must make a Viewer window pane active before carrying out an action such as changing the camera view.

A white outline highlights the currently active Viewer window pane.

Producer cameras

22

The Producer cameras are the first seven cameras in the Scene browser's Cameras folder. Producer cameras are provided as default cameras with preset views that you can use to place models and elements in a scene.



Scene browser A. Producer cameras.

You cannot see a Producer camera in a scene, nor can you select its camera interest or rename it. As well, certain camera settings do not apply, for example showing the near and far clipping planes, and adjusting the horizontal and vertical aperture.

Each Producer camera provides a different view of the scene. The following are descriptions of each Producer camera:

- [Custom cameras](#) on page 283

Producer camera types

The first seven cameras in the Scene browser's Cameras folder are Producer cameras. Producer cameras are default cameras that you can use to place models and elements in a scene.

You cannot select the camera interest of a Producer camera, and certain camera settings do not apply, such as showing the near and far clipping planes, and adjusting the horizontal and vertical aperture.

Each Producer camera provides a different view of the scene. The following are descriptions of each Producer camera:

Producer Perspective

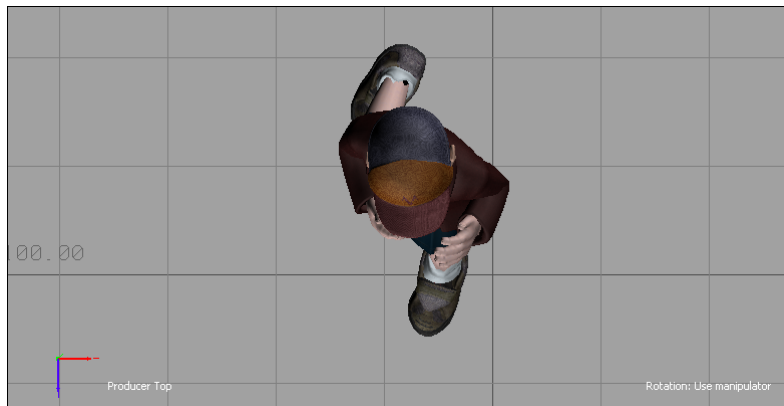
Shows the scene with the XZ plane defining the horizon . The Z-axis faces the camera, and continues towards the horizon, the X-axis is left to right, and the Y-axis is up and down. This camera view lets you translate an object on all three planes, and lets you zoom, pan, and orbit.



Producer Camera View: Producer Perspective

Producer Top

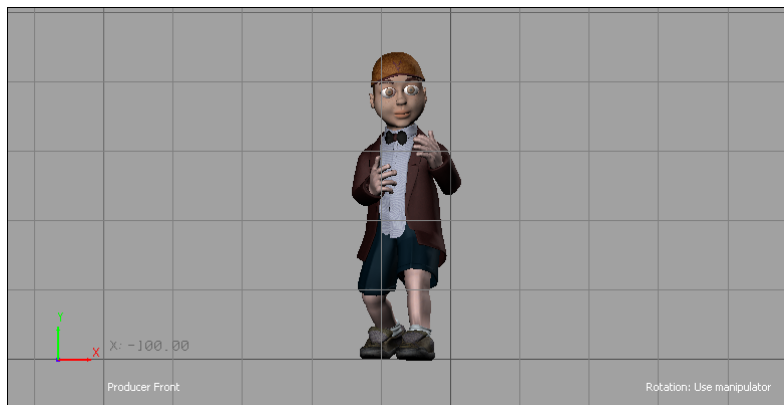
Shows the scene with the XZ plane defining the grid . The X-axis is left and right, and the Z-axis is up and down. The Y-axis points toward the camera. This camera view only lets you translate an object along the X and Z planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Top

Producer Front

Shows the scene with the XY plane defining the grid . The X-axis is left and right, and the Y-axis is up and down. The Z-axis points toward the camera. This camera view lets you translate an object along the X and Y planes only. You can zoom and pan, but you cannot orbit.

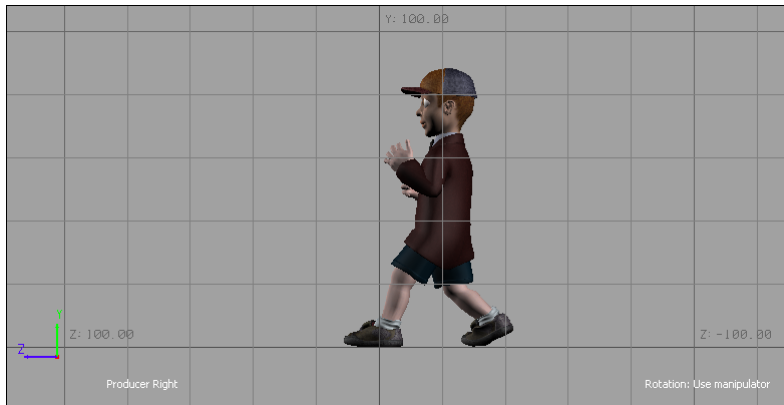


Producer Camera View: Producer Front

Producer Right

Shows the scene with the YZ plane defining the grid . The Z-axis is left and right, and the Y-axis is up and down. The X-axis points toward the camera.

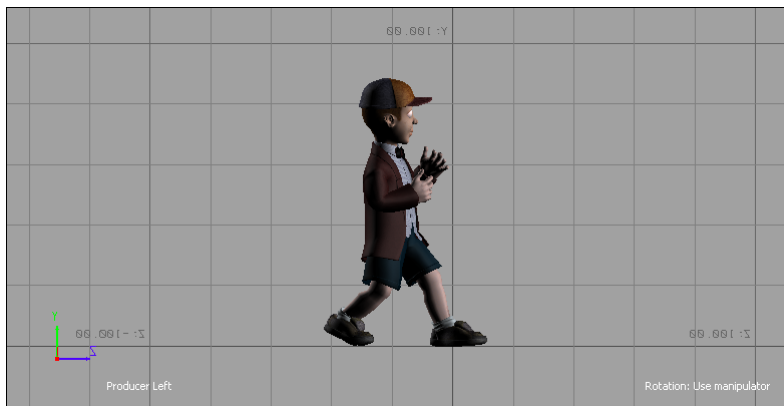
This camera view only lets you move an object along the Z and Y planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Right

Producer Left

Shows the scene with the YZ plane defining the grid. The Z-axis is left and right, and the Y-axis is up and down. The X-axis points toward the camera. This camera view only lets you move an object along the Z and Y planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Left

Producer Back

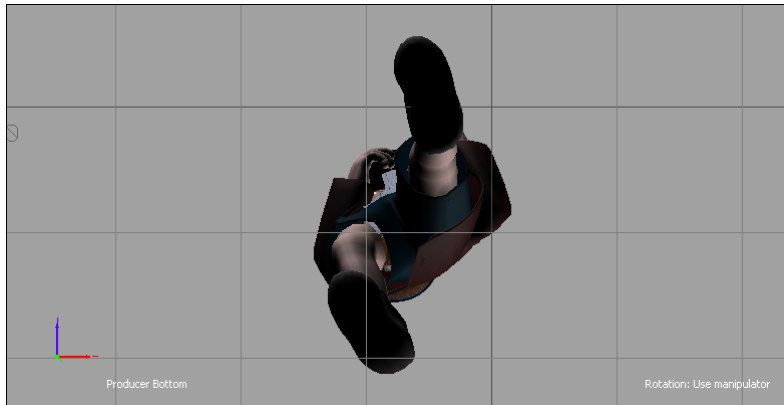
Shows the scene with the XY plane defining the grid . The X-axis is left and right, and the Y-axis is up and down. The Z-axis points away from the camera. This camera view only lets you move an object along the X and Y planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Back

Producer Bottom

Shows the scene with the XZ plane defining the grid . The X-axis is left and right, and the Z-axis is up and down. The Y-axis points away from the camera. This camera view only lets you move an object along the X and Z planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Bottom

- [Customizing the camera's view](#) on page 292

Selecting a Producer camera

As Producer camera do not appear in the Viewer window, you cannot click a wireframe model to select it, as you would with a Custom camera.

There are two ways you can select a Producer camera: in the Scene browser, or in the Viewer window View menu.

Scene browser

- 1 Expand the cameras folder in the Scene browser.
- Double-click any of the seven Producer cameras to display its camera settings in the Navigator and Properties windows.
 - Right-click any of the seven Producer cameras and select Make Camera Current from the contextual menu.

View menu

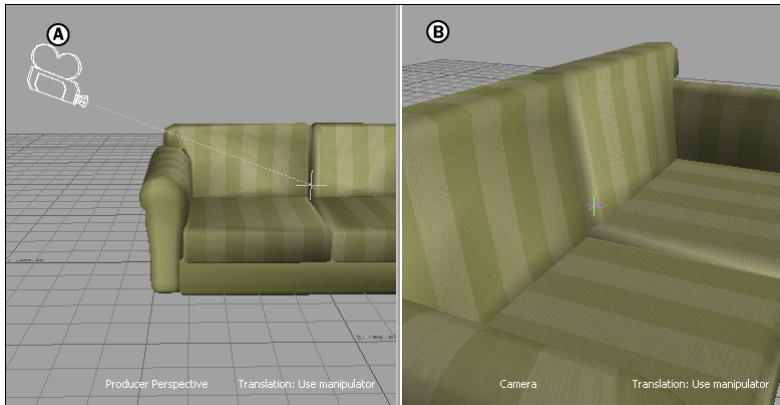
- 1 Expand the View menu in the upper corner of the Viewer window.
- 2 Expand the Orthographic menu and select the Producer camera you want to use.

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You can add an unlimited amount of cameras, by dragging a camera asset into the Viewer window. These Custom cameras can be manipulated, constrained and animated; they let you alter the settings to mimic real-world camera and film aspects. Custom cameras are listed below the Camera switcher in the Cameras folder.



Custom cameras are shown in the Viewer window as white wireframe movie cameras . You can view your scene through these cameras, which can be translated, rotated, scaled, and animated.



Camera views A. A custom camera viewed through the Producer Perspective B. The custom camera view.

In certain viewing modes, as in , you can see a dotted line that ends with a “+” (cross) symbol coming from the camera. The “+” (cross) symbol is the camera interest, or focal point, and the dotted line shows the camera view’s path.

You can also animate the camera interest or constrain it to an animated object to create a follow-cam. You can also use the Camera switcher to view a take through many custom cameras.

You can create scenes where the action is filmed through multiple cameras with the Camera switcher. For more on the Camera switcher, see [Camera switcher](#) on page 335.

- [Creating a custom camera](#) on page 284
- [Producer cameras](#) on page 277

Creating a custom camera

- 1 Drag a Camera asset into the Viewer window from the Asset browser. The new camera is added to the Scene browser’s list of Custom cameras, beneath the Camera switcher.
- 2 Rename a custom camera by right-clicking it in the Scene browser’s Cameras folder, or the Viewer window, then selecting Rename from the contextual menu.

To add multiple cameras:

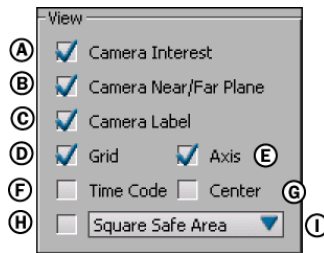
- 1 Double-click the Camera asset in the Asset browser. The cursor becomes a cross hair.
- 2 Click anywhere within the Viewer window to place a camera at that point.
- 3 Press Escape to cancel the operation or Enter to accept it.

Showing the camera Near/Far plane

Activate the Camera Near/Far Plane option in the Camera View area to show or hide both the Near and Far clipping planes for the selected camera.

NOTE You can see a dotted outline of the camera's Near/Far plane when looking at it through another camera view.

The position of the Near and Far clipping planes are set using the Camera Format options.



Camera view area A. Camera Interest option B. Camera Near/Far Plane option C. Camera Label option D. Grid option E. Axis option F. Time Code option G. Center option H. Safe Area option I. Safe area menu

Setting up a tracking camera

Use the Focal Length slider in the Camera settings' Advanced pane to recalculate the Field of View. The Focal Length is expressed in millimeters, which is the same as a traditional camera.

- 1 Shift the camera's X-axis orientation to its interest by adjusting the Optical Center X values. You can animate this setting when the Aperture Mode is set to Horizontal and Vertical.

The Optical Center X setting is disabled when the Aperture mode is set to Vertical.

- 2 Shift the camera's orientation to its interest with the Optical Center Y settings. You can animate this setting when the Aperture Mode is set to Horizontal and Vertical.


This setting is disabled when the Aperture mode is set to Horizontal.

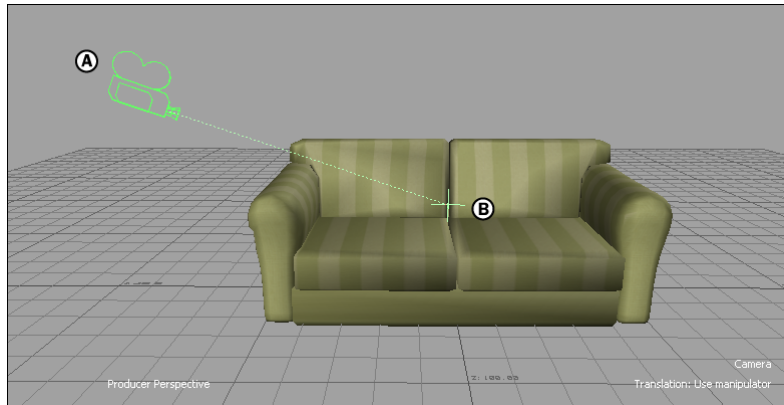
■ Advanced Settings pane

Camera interest

The camera interest is the null element created when a custom camera is added. This is also known as a “Look At” point. When you add a custom camera, you actually add two elements: a camera element for the camera itself, and a special Null element for the camera interest.

When a camera is added, it is placed off-center of the scene and the camera interest is always placed at the center. The focal point of a camera is always the camera interest. When you move the camera, the subject of the camera interest never changes.

In certain viewing modes, as in , you can see a dotted line that ends with a “+” symbol coming from the camera. The “+” symbol is the camera interest, or focal point, and the dotted line shows the camera view's path.



A. A custom camera B. camera interest

You can animate a custom camera's interest separately from the camera to create camera moves. The Properties window shows the attributes for the selected camera interest. You can only change where the camera points by moving the camera interest.

NOTE Changing the camera interest of the same camera can be disorienting; select a Producer camera to view the interest while changing the camera interest.

- [Showing the camera interest](#) on page 287
- [Selecting the camera interest](#) on page 289
- [Camera interest](#) on page 286

Showing the camera interest

- 1 Activate the Camera Interest option in Camera settings View area the to show or hide the camera interest that is represented by a separate object in the scene.
- 2 Switch the view mode to Normal or X-Ray mode by pressing Ctrl-A.
The camera interest is always placed at the center of the scene. The camera is shown with a dotted line that ends with a "+" (Cross) symbol.
The "+" (Cross) symbol is the camera interest, or focal point, and the dotted line shows the camera view's path.

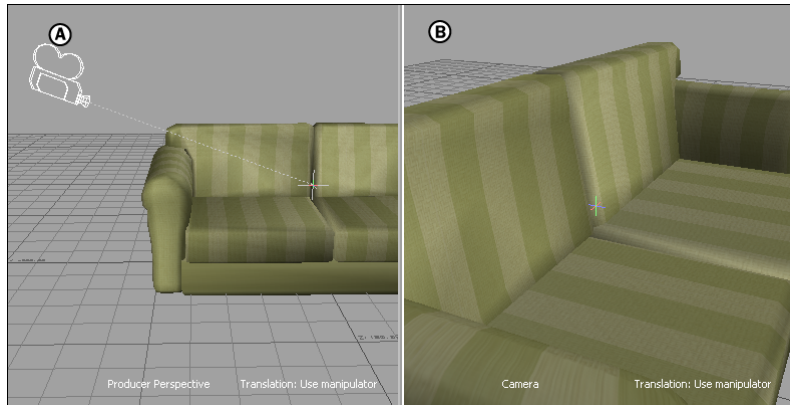
NOTE The Properties window shows the attributes for the selected camera interest.

- 3 You can select the Camera interest from the Schematic view or Viewer window.



A Camera with its interest

- 4 Switch the view mode to Normal or X-Ray mode by pressing Ctrl-A.
The camera interest is always placed at the center of the scene. The camera is shown with a dotted line that ends with a “+” (Cross) symbol.
The “+” (Cross) symbol is the camera interest, or focal point, and the dotted line shows the camera view’s path.

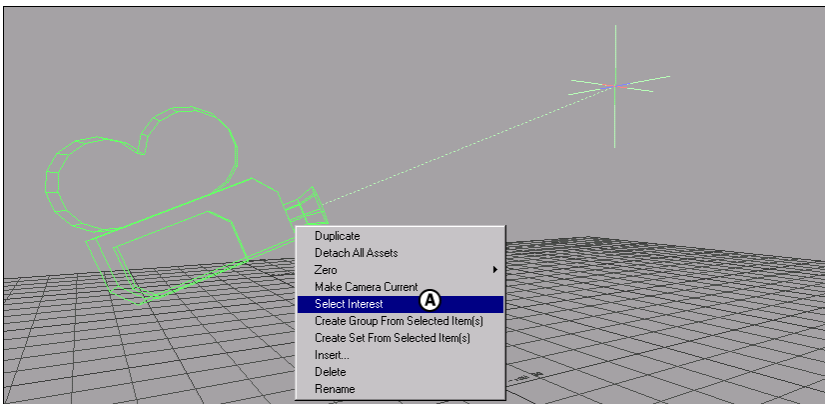


Camera views A. A custom camera viewed through the Producer Perspective B. The custom camera view.

- [Camera interest](#) on page 286
- [Selecting the camera interest](#) on page 289

Selecting the camera interest

Select the camera interest by right-clicking its camera in a scene and selecting Select Interest from the contextual menu .



Viewer window A. Camera contextual menu

You can also select the camera interest in the Schematic view in the Viewer window.

TIP Changing the camera interest of the same camera can be disorienting. Instead, select a Producer camera so you can see the camera interest while you adjust it.

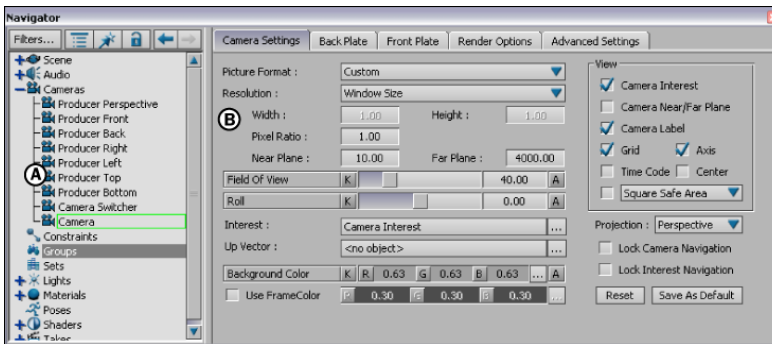
Camera settings

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The Camera settings pane is where you modify settings for Producer and Custom cameras to view your scene.

This sub-section covers the various properties contained within the Camera Settings and how you can use them to create specific camera views.

To access the Camera settings, open the Cameras folder in the Scene browser, and double-click a camera to display its settings. These settings also display if you select a camera in the Viewer window.



Camera settings A. Cameras folder B. Camera Settings

The Camera settings consist of four panes:

Camera Settings pane

The Camera Settings pane contains the settings for configuring the selected camera's view areas.

Back Plate pane

The Back Plate pane lets you select a background image, or video clip to be displayed in the selected camera's background plane.

Render Options pane

The Render Options pane lets you set the Anti-aliasing, depth of field, and other options related to rendering for the selected camera.

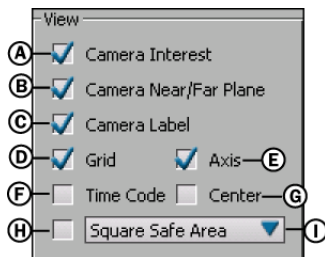
Advanced Settings pane

The Advanced Settings pane contains specialized camera settings and camera attributes that you can animate. These settings let you set the options for the aperture, lens, and film size of the selected camera.

- [Camera Settings pane](#) on page 301
- [Back Plate pane](#) on page 291
- [Render Options pane](#) on page 319
- [Advanced Settings pane](#) on page 325
- [Creating a custom camera](#) on page 284

Customizing the camera's view

You can show and hide elements that are displayed in a camera's view, such as the camera interest, Viewer window grid, time codes, and so on using the Camera settings View options in the Properties and Navigator windows.



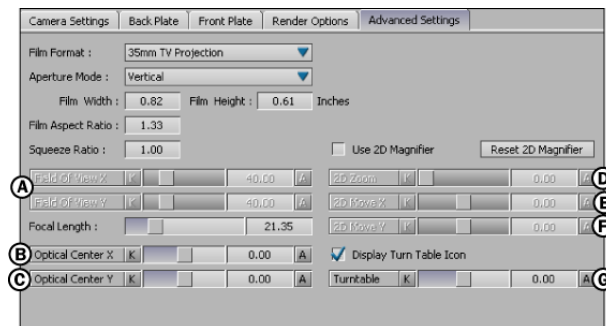
Camera view area A. Camera Interest option B. Camera Near/Far Plane option C. Camera Label option D. Grid option E. Axis option F. Time Code option G. Center option H. Safe Area option I. Safe area menu

NOTE The Camera Interest and Camera Near/Far Plane options are only for Custom cameras. See [Showing the camera interest](#) on page 287 and [Showing the camera Near/Far plane](#) on page 285 for more information on using these settings.

- [Showing the camera interest](#) on page 287
- [Showing the camera Near/Far plane](#) on page 285
- [Showing the camera label](#) on page 294
- [Showing the Viewer window grid](#) on page 295
- [Showing the camera axis](#) on page 296
- [Showing the camera time code](#) on page 296
- [Showing the camera center point](#) on page 297
- [Showing the camera Safe area](#) on page 297

Animating Camera settings

You can keyframe and animate any camera setting that has a Keyframe (K) and Animate (A) button beside it.



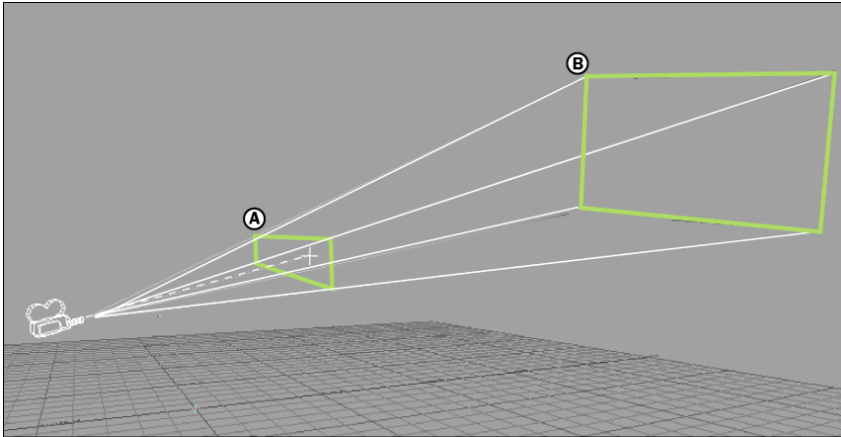
Camera Advanced Settings pane: you can animate settings A, B, C, D, E, F, and G.

For example, you can change the Field of View and Background Color of a camera in a scene so that over the length of the current take the look of the scene changes. See [Setting keyframes](#) on page 639.

NOTE The Focal Length or Field of View settings affect each other. If you animate the Focal Length, the Field of View settings are disabled and vice versa.

Showing the camera Near/Far plane

The Camera Near/Far plane option lets you view the viewing limit closest and furthest from the camera.



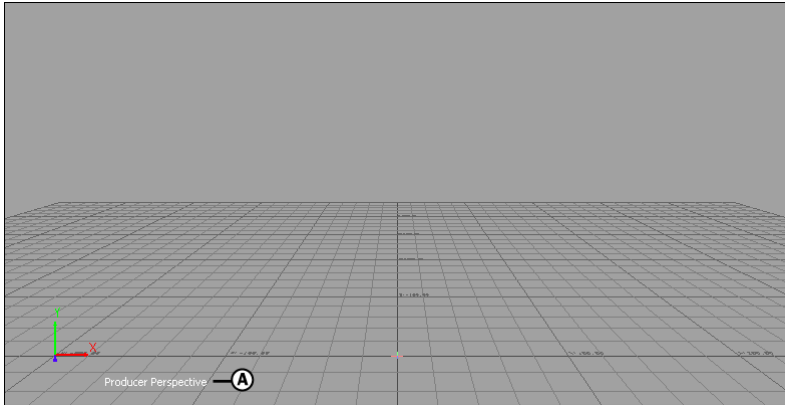
A. Near plane B. Far plane

To show the camera Near/Far pane:

- 1 Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.
- 2 In the Navigator window, activate the Camera Near/Far pane option in the Camera Settings View area.

Showing the camera label

The Camera Label option in the Camera settings View area lets you show or hide the text in the bottom left corner of the Viewer window, which indicates the name of the current camera.



Viewer window A. Camera label

To show the camera label:

- 1 Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.
- 2 In the Navigator window, activate the Camera Label option in the Camera Settings View area.

Showing the Viewer window grid

The Grid option in the Camera settings View area lets you show or hide the grid located at coordinate 0 of the Y plane.

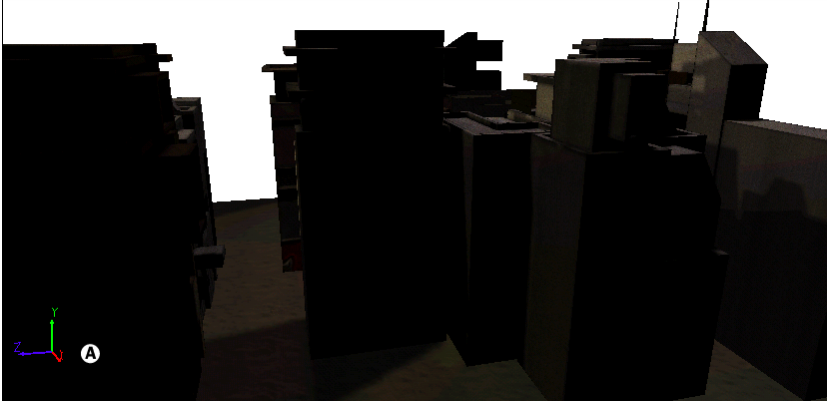
NOTE The grid shows in all camera views by default.

To show the Viewer window grid:

- 1 Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.
- 2 In the Navigator window, activate the Grid option in the Camera Settings View area.

Showing the camera axis

The Axis option in the Camera settings View area lets you show or hide the axis arrows that shows the scene's orientation.



Scene A. Axis

NOTE The axis shows in all camera views by default.

To show the camera's axis:

- 1 Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.
- 2 In the Navigator window, activate the Axis option in the Camera Settings View area.

Showing the camera time code

The Time Code option in the Camera settings View area lets you show or hide the local timecode in the Viewer window.

You may want to hide the time code when you are not playing animation.

To show the camera's local time code:

- 1 Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.

-
- 2 In the Navigator window, activate the Time Code option in the Camera Settings View area.

Showing the camera center point

The camera center point option lets you show or hide the center cross hair that marks the central point in the camera view.



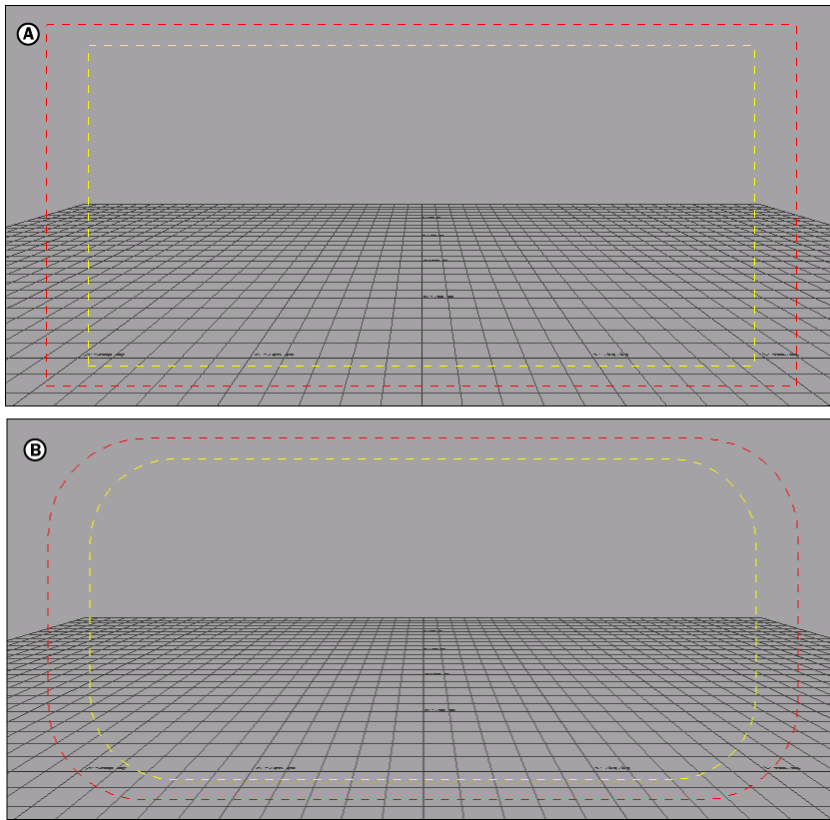
A. Camera center point

To show the camera's center point:

- 1 Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.
- 2 In the Navigator window, activate the Center option in the Camera Settings View area.

Showing the camera Safe area

The Safe Area option lets you show or hide a set of guides that mark the area in which titles or animation/motion should be placed. Anything that falls outside of these guides may be cropped when transferring to video.



A. Square Safe guides B. Rounded Safe guides

To show the camera safe area:

- 1 Activate the Safe Area option in the Camera settings View area.
- 2 Select Square or Round Safe Area from the Safe Area menu.
- 3 Activate the Safe Area option to show or hide the Safe area in the Viewer window.

NOTE If you do not observe Safe areas, titles and animation may be cropped when transferring to video.

Setting a camera Front or Back Plane

You can set media to be a foreground or backdrop for a selected Camera:

- From the Camera settings pane
- From a file already in the Scene or Asset browser.

To browse for media from the Camera settings pane:

- 1 Select a camera in the Viewer window or Scene browser.
- 2 Switch to the Front or Back Plane pane in the Camera settings.
- 3 Select New Media from the Media menu to open a file browser which lets you select the image to be used as the Front/Back Plane.

You can also use a video clip to project on the foreground/background plane. The new image or video clip is added to the Video folder in the Scene browser.

- 4 Select either the RGB or Alpha options to preview either the RGB or Alpha channels of a loaded image.

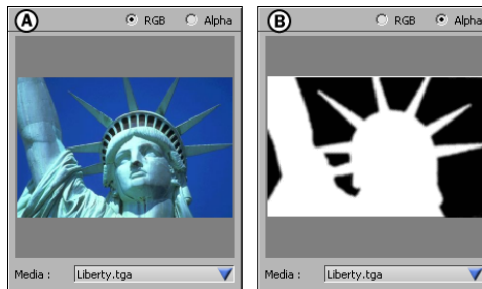


Image preview A. RGB view B. Alpha view

To apply a file already in the Scene or Asset browser:

- 1 Select a camera in the Viewer window or Scene browser.
- 2 Select a video or image file from the Video folder in the Scene browser.
- 3 Drag and drop it onto the camera.

NOTE For information on how to use camera back planes as Storyboard images, see [Creating a storyboard](#) on page 1506.

- 4 Select Foreground or Background from the contextual menu that appears.

Emulating real-world cameras

There are several settings for custom cameras that copy the attributes of real-world cameras so you can match MotionBuilder's output to that of actual camera footage.

NOTE The Film Format menu and Aperture mode settings apply to all custom cameras and the Producer Perspective camera.

- 1 Drag a custom camera into the Viewer window.
- 2 Right-click the camera in the Scene browser and select Make Camera Current.
- 3 Go to the Camera Setting's Advanced Settings pane and select the film format you are trying to emulate from the Film Format menu.
- 4 Adjust the Aperture mode based on the aperture setting of the camera lens you are trying to emulate.
- 5 Continue matching the settings in the Advanced settings pane until you are satisfied.

NOTE If you change the Film Format setting for a custom camera in the Camera Settings Advanced pane, the Viewer window view does not change. This is because the new Film Format settings (for example the Focal Length or Optical Center) adjust to match the display of the current camera view in the Viewer window. This lets you use the Viewer window to set up shots more accurately. To change the current camera view in the Viewer window so it reflects the Film Format settings change, change the settings in the Advanced pane manually.

- [Advanced Settings pane](#) on page 325
- [Camera Depth of Field settings](#) on page 322
- [Film Format menu](#) on page 325

Applying Real-Time effects

Activate Enable Real-Time Effects to apply the Rendering options while interacting with MotionBuilder.

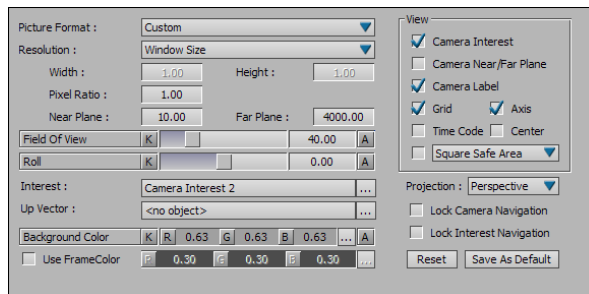
Disable Enable Real-Time Effects to apply the Rendering options only when rendering with the Render window.

For example, if Use Antialiasing is activated, and you disable Enable Real-Time Effects, Anti-aliasing is only applied when rendering to a file. Activating Enable Real-Time Effects can cause slower performance in some systems.

- [Render window](#) on page 161
- [Using Anti-aliasing with cameras](#) on page 323

Camera Settings pane

The Camera Settings pane contains the settings for configuring cameras and their view areas.



Camera Settings Pane

To configure cameras, right-click the camera that you want to change, and select Make Current from the contextual menu.

The Camera Settings pane consists of the following:

- [Picture format area](#) on page 302
- [View area](#) on page 310

Picture format area

The Picture Format area lets you select the camera's viewable area using a standard or custom frame size. You can also set the camera's near and far clipping planes in this area.

Depending on the way you configure the Aperture and Film settings, these two areas work together to determine the camera's viewable area.

Picture format menu

The following are the available Picture format options:

| Picture Format type | Function |
|---------------------|--|
| Custom | The format's width, height, or pixel ratio has been user-specified, and matches none of the other picture formats. |
| D1 NTSC | Standard format for D1 NTSC (720 by 486). |
| NTSC | NTSC standard for North American television broadcast (640 by 480). |
| PAL | PAL standard for European television broadcast (570 by 486). |
| D1 PAL | Standard format for D1 PAL (720 by 576). |
| 640x480 | Recommended computer screen format (640 by 480). |
| 320x200 | Recommended format for World Wide Web production. |
| 320x240 | Alternate World Wide Web format. |
| Full Screen | Full computer screen format (1280 by 1024 pixels). |

Resolution

Use the Resolution menu to specify the camera's viewable area. To see the viewable area, activate the Use Frame Color option (see [Use Frame Color](#) on page 307).

The selection in the Picture Format field works with the Width, Height, Custom, and Pixel Ratio fields.

The following are the available frame size options:

| Frame Size | Function |
|-------------------------|---|
| Window Size | Adjusts the viewable area to the size of the Viewer window used by the camera. |
| Fixed Ratio | Lets you select between several fixed ratios. The viewing area adjusts to fit the size of the viewer, but respects the selected ratio (Width ratio). |
| Fixed Resolution | Lets you select between several fixed resolutions. When the viewing area is changed, the camera is fixed to the selected video standard (D1 NTSC, NTSC, and so on), or custom resolution. |
| Fixed Width Resolution | Fixes the width of the viewing area to the selected video standard or custom resolution, and lets you select a ratio for the height. |
| Fixed Height Resolution | Fixes the height of the viewing area to the selected video standard or custom resolution, and lets you select a ratio for the width. |

Width and Height

The values in the Width and Height fields depend on the selection in the Picture Format field.

For example, when the Frame field is set to Fixed Width resolution, the Height field is shown as a ratio of the Width field, which is expressed in pixels.

Pixel Ratio

The Pixel Ratio field automatically sets the pixel ratio to the correct value for any selected Output format.

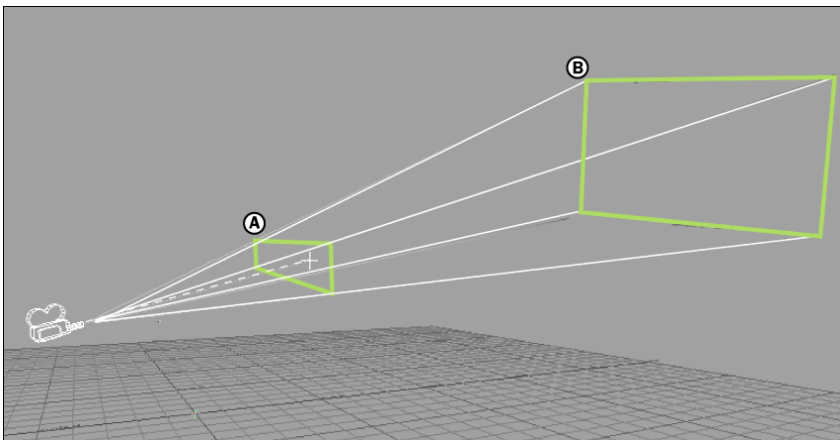
For example, on output to be viewed on television, the pixels are not square, so a small deformation is created in the Viewer window when rendering to compensate for output to that format.

When you choose from a standard picture format (NTSC, D1 NTSC,) the pixel ratio is recalculated to compensate.

If you change the pixel ratio when the Picture Format menu is set to a standard viewing area (D1 NTSC, NTSC, PAL, and so on), the Picture Format field is automatically set to Custom because the viewing area no longer matches the selected film standard.

Near Plane

The near plane is the viewing limit closest to the camera. Objects between this plane and the camera do not appear in the scene because they are out of the camera's viewing area.



A. Near plane B. Far plane

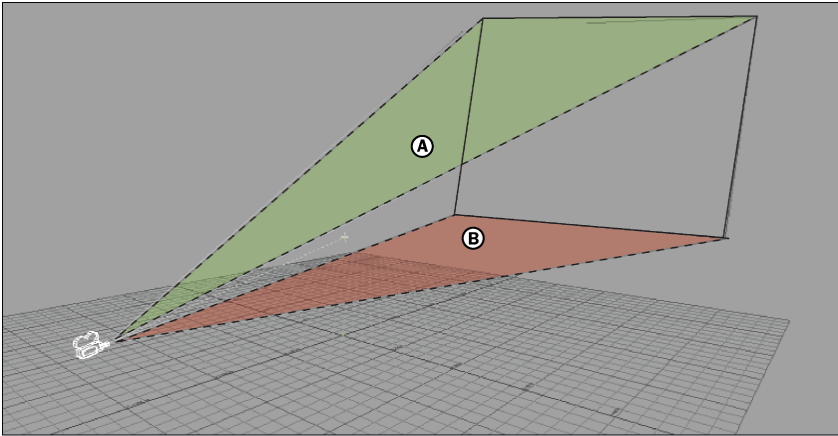
Far Plane

The far plane is the viewing limit furthest from the camera. Objects that move past this plane do not show in the scene because they are out of the camera's viewing range.

Use the Far plane field to set the distance in pixels of the far plane relative to the camera's position.

Field of View

The Field of View settings let you change the angle of the viewing area starting at the camera eye. When the Aperture mode is set to Vertical, the angle of view changes the angle between the top and bottom clipping plane, and so on.



A. Top plane B. Bottom plane

To view a camera's angle of view, activate the View Near/Far Plane option in the Camera View Options (see [Showing the camera Near/Far plane](#) on page 285). You can see the camera's top, left, right, and bottom clipping planes.

When the Aperture mode is set to Horizontal, the angle of view changes the angle between the left and right clipping planes.

The Field of View is expressed in degrees. You can animate this setting but the Focal Length setting is disabled.

Roll

The Roll setting lets you set a numerical value for the camera roll which rotates the camera's view. A negative value rotates the view clockwise, while a positive value rotates it counter clockwise.

The Roll setting is expressed in degrees.

Interest

The Interest setting lets you redefine the camera interest's Null element created when a custom camera is added.

Alt-drag any element from the Viewer window into the Interest field to define it as the interest of a given camera. Click the Interest field to select the camera's interest and press T on the keyboard to translate it.

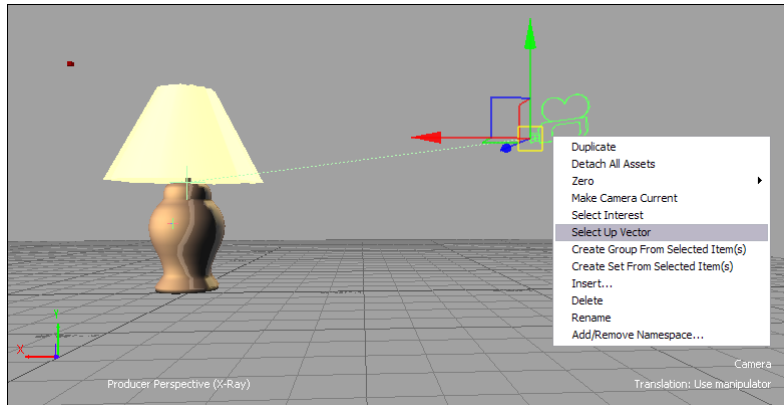
TIP Changing the camera interest of the current camera can be disorienting. Select a Producer camera to view the interest while translating it.

Up Vector

The Up Vector field lets you select an element to be used as the Up Vector of a selected camera. Alt-drag an object or marker from the Viewer window into the Up Vector field to assign an Up Vector to the current camera.

An Up Vector is an element that controls the Roll orientation of a given camera by constraining it to orient its Roll toward the Up Vector model's position. The top of the camera always pivots using the selected up vector element as a guide. This prevents the camera from flipping, and provides more realistic camera movement.

Click the Up Vector field to select the camera's Up Vector and then translate it. To select a camera's Up Vector, right-click the camera and choose Select Up Vector from the contextual menu.



Choose Select Up Vector in the contextual menu.

Background Color

The Background Color setting lets you change the background color for the selected camera. Click the Color button to open the Color window and select the background color.

Use Frame Color

Activate the Use Frame Color option to draw a border around the camera's viewable area. By default, Use Frame Color is disabled, which means no frame is used.

Use the three fields beside the Use Frame Color option to define the color of the border around the camera view.

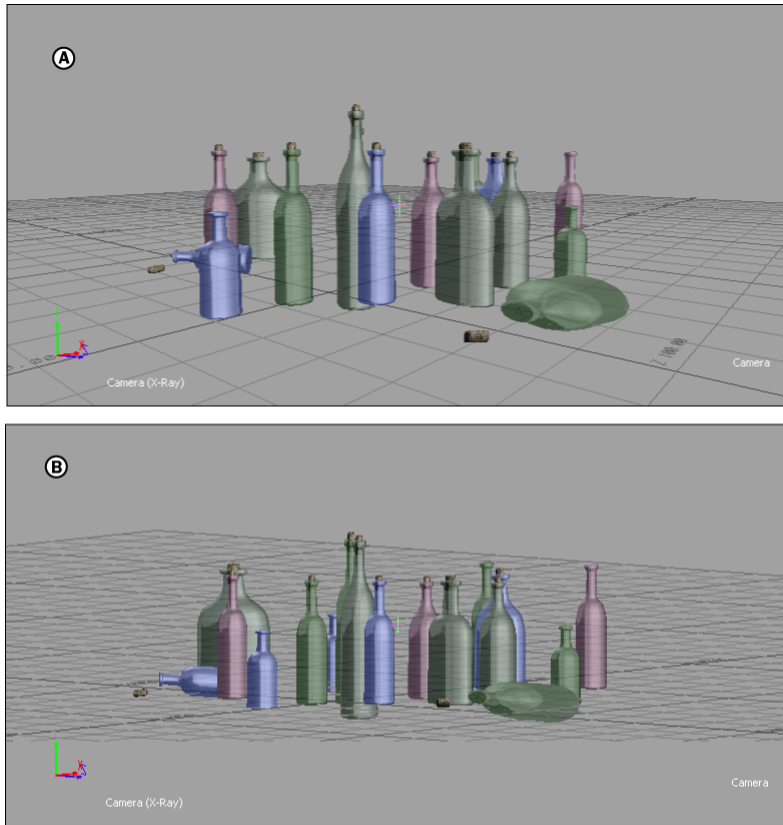
Click the Color button to open the Color window and select a specific frame color.

Key and Animate

You can keyframe and animate the Field of View, Roll, and Background Colors of cameras using the Keyframe (K) and the Animate (A) buttons beside the corresponding sliders.

Projection

Use the Projection menu to select the current camera's visualization options.



Camera Projection Types. A. Perspective B. Orthographic

Perspective

Select Perspective to set the current camera's view to show depth. This setting is the default.

Orthographic

Select Orthographic to set the current camera's view to show the environment without perspective.

Lock Camera Navigation

Activate the Lock Camera Navigation option to lock the current camera. When Lock Camera Navigation is active, you can no longer change the camera's

view using the mouse and keyboard commands when the custom camera is made current.

Use Lock Camera Navigation after you position a custom camera that you do not want move accidentally as you select and translate models.

Lock Interest Navigation

The Lock Interest Navigation option lets you lock the position of the camera interest.

Reset

The Reset button lets you remove changes to the camera settings and restore the camera settings to the default, whether it is the MotionBuilder default or new custom defaults created with the Save as Default setting.

It also resets the camera position to X: 0, Y: 145, and Z: 300.

NOTE The reset button does not restore MotionBuilder default settings once the Save as Default has been activated.

See [Setting a default camera](#) on page 333.

Save as Default

Click Save as Default to retain the current custom values of the camera as a new default setting so that any new cameras use these values by default. Once you set a camera as a Default, every new camera you create uses this custom setting.

This is useful if you need several cameras with very specific custom settings. For example, you can save the picture format, background color, and View options for a camera, and then load these settings for every camera in your scene.

NOTE The Save as Default option overrides MotionBuilder defaults to your own custom setting. You cannot restore the MotionBuilder default.

The Save as Default function overwrites any previously saved defaults as only one default exist a time. See [Setting a default camera](#) on page 333.

View area

The View area contains settings for how the camera view is supposed to appear. You can use the View area to hide the grid, display a timecode, or set a safe area.

NOTE These changes affect the selected camera only.

Camera Interest

Activate Camera Interest to show or hide the Camera Interest that is represented by a separate object in the scene. You can select the Camera interest from the Schematic view or Viewer window.

Camera Near/Far Plane

Activate the Camera Near/Far Plane option to show or hide both the Near and Far clipping planes for the selected camera. The position of the Near and Far clipping planes are set using the Camera Format options. [Showing the camera Near/Far plane](#) on page 285.

Camera Label

Activate the Camera Label option to show or hide the text in the bottom left corner of the Viewer window, which indicates the name of the current camera.

Grid

Activate the Grid option to show or hide the grid located at coordinate 0 of the Y plane. By default, the grid is shown in all camera views.

Axis

Activate the Axis option to show or hide the XYZ axis in the left corner of the Viewer window. You may want to hide the axis to avoid confusion when your scene contains many Nulls that look similar to it.

Time Code

Activate the Time Code option to show or hide the local timecode in the Viewer window. You may want to hide the time code when you are not playing animation.

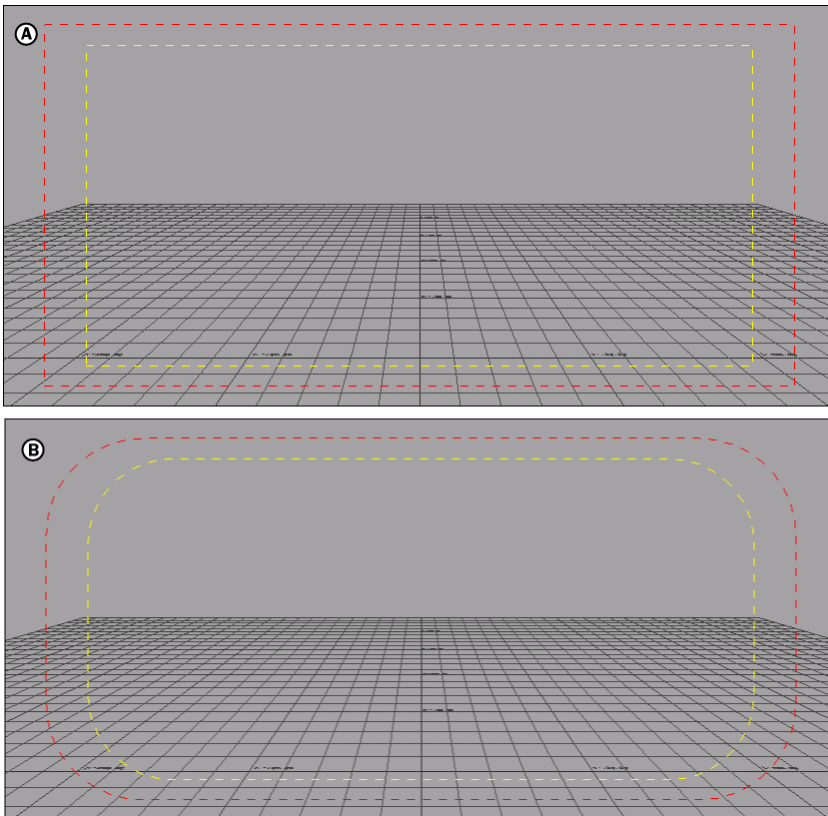
Center

Activate the Center option to show or hide the center cross hair that marks the central point in the camera view.

Safe Area

The Safe Area is a set of guides that mark the area in which titles or animation/motion should be placed. Anything that falls outside of these guides may be cropped when transferring to video.

Select Square or Round Safe Area from the Safe Area menu, then activate the Safe Area option to show or hide the Safe area in the Viewer window.



A. Square Safe area B. Rounded Safe area

NOTE If you do not observe Safe areas, titles and animation may be cropped when transferring to video.

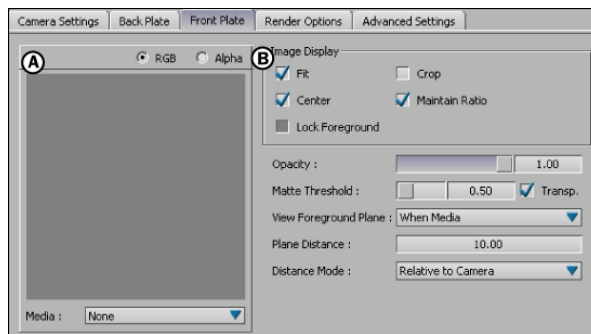
Front Plate pane

Similar to the Back Plate pane, the Front Plate pane lets you select an image or video clip to appear in the camera view, but this time in the camera's foreground plane.

The Front Plate plane is a separate plane used only for projecting images or video clips. The size of the plane matches the camera's viewing area and remains a part of the camera's view, even with the 2D magnifier, and the Turn Table options.

The Front Plate pane consists of two areas:

- [Image Preview area](#) on page 316
- [Image Display area](#) on page 317



Front Plate pane A. Image Preview area B. Image Display settings

Image Preview area

The Image Preview area of the Camera Settings Front Plate pane contains settings for loading a Front Plate picture, as well as lets you preview RGB or Alpha channels.

RGB - Alpha

Select either the RGB or Alpha options to preview either the RGB or Alpha channels of a loaded image.

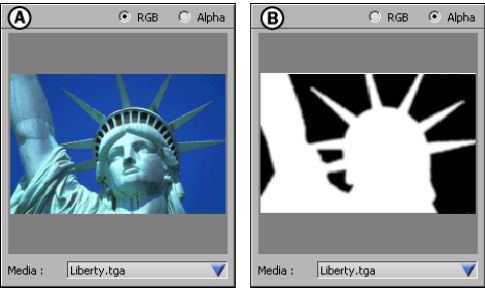


Image preview A. RGB view B. Alpha view

Media

The Media menu shows the name of the loaded image. For more information on loading an image on the camera back plate, see [Showing the camera Near/Far plane](#) on page 285.

Image Display area

The Image Display area lets you select how the specified media is applied to the Front Plate plane.

NOTE The default Image Display settings are Center and Maintain Ratio.

Choose the following options from the Image Display area:

| Option | Function |
|--------|---|
| Fit | Scales the foreground media to fit on the foreground plane. |
| Crop | Crops the foreground media to fit on the foreground plane. If the media is smaller than the plane, this option has no effect. |
| Center | Centers the foreground media on the background plane. |

| Option | Function |
|----------------|---|
| Maintain Ratio | Keeps the aspect ratio of the foreground media. Activate Maintain Ratio with the Fit option to scale the media proportionately. |

Matte Threshold slider

The Matte Threshold settings work with the Alpha channel of the selected background media. Use the Matte Threshold slider to change the white threshold of the matte's gradient. Double-click the Matte Threshold field to enter a precise value.

Transp. option

Activate Transp to make the Alpha channel blend with the foreground image. When disabled, the Alpha channel is only used to determine how the pixels are drawn. To take advantage of this feature, the Alpha channel of your clip or image must have a gradient.

View Foreground plane menu

The View Foreground Plane menu lets you select when to show the foreground plane. This field works with the View Near/Far plane option in the Camera View Options.

The View Background Plane menu contains the following options:

| Option | Function |
|------------|--|
| Disabled | Disables the Background plane whether media is being projected or not. |
| Always | Always shows the Background plane, even if no media has been added. |
| When Media | Shows the Background plane only if media has been added. |

Plane Distance field

The Plane Distance field lets you specify a distance where the foreground plane is to be placed.

- [Image Preview area](#) on page 316
- [Showing the camera Near/Far plane](#) on page 285

Distance Mode menu

The Distance Mode menu lets you select whether the foreground plane is placed in relation to the camera interest or the camera.

The Distance Mode menu contains the following options:

| Option | Function |
|----------------------|--|
| Relative to camera | Select to place the foreground plane relative to the camera. The foreground plane distance is measured in relation to the camera. This setting is the default. |
| Relative to Interest | Select to place the foreground plane relative to the camera interest. The foreground plane distance is measured in relation to the camera interest. |
| Absolute from Camera | Select to place the background plane relative to the camera. The foreground plane distance is measured in relation to the camera. |

- [Image Preview area](#) on page 316
- [Showing the camera Near/Far plane](#) on page 285

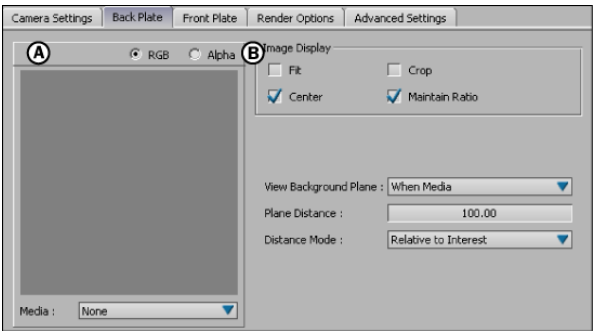
Back Plate pane

The Back Plate pane lets you select a background image or video clip to be displayed on a camera’s background plane.

The background plane is a separate plane used only for projecting images or video clips. The size of the background plane matches the camera’s viewing area and remains a part of the camera’s view, even with the 2D magnifier, and the Turn Table options.

The Back Plate pane consists of two areas:

- [Image Preview area](#) on page 316
- [Image Display area](#) on page 317



Back Plate pane A. Image Preview area B. Image Display settings

Image Preview area

The Image Preview area of the Camera Settings Back Plate pane contains settings for loading a Back Plate picture, as well as lets you preview its RGB or Alpha channels.

| Setting | Function |
|-------------|--|
| RGB - Alpha | Select either the RGB or Alpha options to preview either the RGB or Alpha channels of a loaded image. |
| Media | The Media menu shows the name of the loaded image. For more information on loading an image on the camera back plate, see Showing the camera Near/Far plane. |

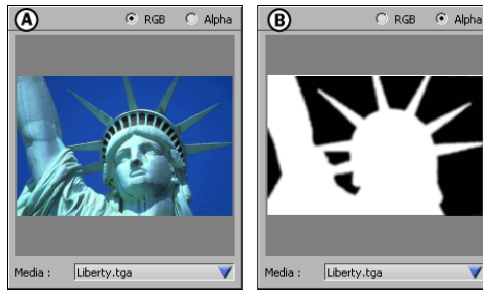


Image preview A. RGB view B. Alpha view

Image Display area

The Image Display area lets you select how the specified media is applied to the Back Plate plane.

NOTE The default Image Display settings are Center and Keep Ratio.

Choose the following options from the Image Display area:

| Option | Function |
|----------------|---|
| Fit | Scales the background media to fit on the background plane. |
| Crop | Crops the background media to fit on the background plane. If the media is smaller than the plane, this option has no effect. |
| Center | Centers the background media on the background plane. |
| Maintain Ratio | Keeps the aspect ratio of the background media. Activate Maintain Ratio with the Fit option to scale the media proportionately. |

View Background Plane

The View Background Plane menu lets you select when to show the background plane. This field works with the View Near/Far plane option in the Camera View Options.

The View Background Plane menu contains the following options:

| Option | Function |
|------------|--|
| Disabled | Disables the Background plane whether media is being projected or not. |
| Always | Always shows the Background plane, even if no media has been added. |
| When Media | Shows the Background plane only if media has been added. |

Plane Distance field

The Plane Distance field lets you specify a distance where the background plane is to be placed.

- [Image Preview area](#) on page 316
- [Showing the camera Near/Far plane](#) on page 285

Distance Mode menu

The Distance Mode menu lets you place the background plane in the camera's viewing area. The Distance Mode menu lets you select whether the background plane is placed in relation to the camera interest or the camera.

The Distance Mode menu contains the following options:

| Option | Function |
|----------------------|---|
| Relative to Interest | Select to place the background plane relative to the camera interest. The Background Plane distance field is measured in relation to the camera interest. |
| Absolute from Camera | Select to place the Background plane relative to the camera. The Background plane |

| Option | Function |
|--------|---|
| | distance field is measured in relation to the camera. |

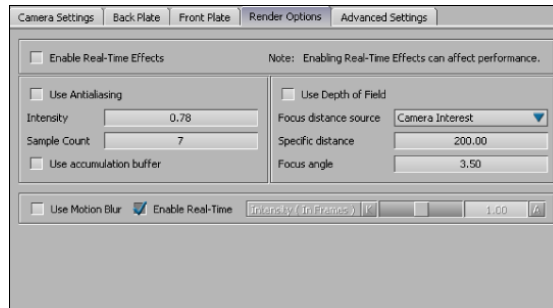
- [Image Preview area](#) on page 316
- [Showing the camera Near/Far plane](#) on page 285

Render Options pane

The Render Options pane lets you set the Anti-aliasing, depth of field, and other rendering related options for the selected camera.

The Render Options pane consists of the following:

- [Enable Real-Time Effects option](#) on page 319
- [Anti-aliasing settings](#) on page 320
- [Camera Depth of Field settings](#) on page 322



Render Options pane

Enable Real-Time Effects option

Activate Enable Real-Time Effects to apply the Rendering options. Disable Enable Real-Time Effects to apply the Rendering options only when rendering with the Render window.

For example, if Use Antialiasing is activated, and you disable Enable Real-Time Effects, Anti-aliasing is only applied when rendering to a file.

Anti-aliasing refers to a method of softening hard edges in a display that occurs as a result of sampling and over-sampling.

NOTE Activating Enable Real-Time Effects can cause slower performance in some systems.

Anti-aliasing settings

Use the Anti-aliasing settings in the Render Options pane to use and configure anti-aliasing when rendering the camera image.

You should remove the grid from your current camera when using anti-aliasing because anti-aliasing is applied to the grid as well as to models.

You should also hide objects such as Nulls, lights, cameras, and skeletons. These objects are also anti-aliased when anti-aliasing is activated, and slow the frame rate and rendering time of your scene.

Use Anti-aliasing option

Activate Use Anti-aliasing to blur the hard edges of your models in the display so they do not appear pixelated.

When this setting is activated, there is a brief pause as the scene is re-rendered. When this setting is disabled, anti-aliasing is not applied. See [Anti-aliasing and oversampling](#) on page 333.

Intensity field

Double-click in the Intensity field to enter an Anti-aliasing value to increase or decrease the intensity of the anti-alias blur.

For best results, use a low intensity. The default setting is 0.7778.

Because anti-aliasing blurs the entire image, a high intensity may blur important details.

Method field

If you are using dedicated hardware anti-aliasing, use the Method field to view the anti-alias applied to the selected camera.

Note: If you do not have dedicated hardware anti-aliasing, the default Use Software Oversampling option cannot be changed.

Use Software Over Sampling

Over-sampling refers to the process of sampling data at a higher rate than normal to obtain more accurate results or to make it easier to sample. Over-sampling is used to determine the color of each pixel viewed by the current camera.

Sample Count

This Anti-aliasing option concerns oversampling, which is a method used to determine the color of each pixel viewed by the current camera.

The resolution of the scene is not dependent on the number of pixels or scan lines. The unit of measurement is much smaller but must be adapted to pixels to be viewed by the current camera, and shown on the computer screen.

Use this field to enter the number of times each pixel is sampled to determine the pixel's color. The higher the number of samples the more accurate the pixel color, but the longer it takes to render.

Sampling Type

Along with Sample Count, this anti-aliasing option also affects oversampling, which is a method used to determine the color of each pixel viewed by the current camera.

There are two methods of sampling:

- The Uniform method samples each pixel at the same location. The pixel is divided into equal parts, and each part is sampled. The number of samples determines the number of times the pixel is divided.
- The Stochastic method randomly samples each pixel. This produces an accurate color using a small number of samples.

Use Accumulation Buffer option

Activate the Use Accumulation Buffer option if you are using a computer with a hardware accumulation buffer. If your computer is not equipped with a hardware accumulation buffer, a software emulation of the buffer is activated.

NOTE The software emulation of the accumulation buffer may decrease computer performance.

For more information on buffer settings, see [Buffer menus](#) on page 36.

Camera Depth of Field settings

The Camera Depth of Field settings let you configure the camera interest for the chosen camera.

The camera depth of field is the amount of space within lens view that maintains focus at given settings, such as camera speed, film speed, lens aperture, and so on. In MotionBuilder, it refers to a method of blurring the view depending on either the camera's focal point or a specific distance from the camera.

Use Depth of Field option

Activate the Use Depth of Field option to enable the Depth of Field options for the current camera.

The Depth of Field settings are a method of blurring the current camera view based on either the camera's focal point or a specified distance from the camera.

When disabled, Depth of field is not applied.

Focus Distance Source menu

Use the Focus Distance Source menu to select the focal point for the depth of field.

Focus distance is the distance between the camera and the object on which the camera is focused.

There are two possible sources:

| Source | Function |
|-------------------|---|
| Camera interest | Bases the depth of field on the camera interest. Models at the camera interest are in focus. As you move toward or away from the camera interest, models become increasingly blurred. |
| Specific Distance | Bases the depth of field on a point defined by a specific distance from the camera interest. |

Specific Distance

Enter a value in the Specific Distance field to define an alternative point other than the camera interest.

NOTE This field is activated only when Specific Distance is selected as the Focus distance source.

Focus Angle field

Use the Focus Angle field to specify the angle of the focus or blur. Increasing the angle value decreases the depth of field, and increases the amount of blur.

Decreasing the focus angle increases the depth of field, and decreases the amount of blur.

Use Motion Blur option

Activate the Use Motion Blur option to create a motion blur effect for the selected camera.

Enable Real Time option

Activate the Enable Real Time option to view the Motion Blur effects in real time. If this option is disabled, the blur effect is visible only when rendered.

For better results, disable Enable Real Time, as the render time motion blur calculation is more precise.

Intensity (In Frames) slider

Use the Intensity slider to set a value for the duration, in frames, that the Motion blur effect lasts. Set a frame number for a stronger blur effect and a low frame value for a subtle blur.

- [Customizing the camera's view](#) on page 292
- [Setting a default camera](#) on page 333

Using Anti-aliasing with cameras

Anti-aliasing is used to blur the hard edges of your models in the display so they do not appear pixelated.

Remove the grid from your current camera when using anti-aliasing because MotionBuilder applies anti-aliasing to the grid as well as to models. See [Showing the Viewer window grid](#) on page 295 for more on how to disable the grid in the Viewer window.

- 1 Hide objects such as Nulls, lights, cameras, and skeletons as these objects are also antialiased when antialiasing is activated, and slow the frame rate and rendering time of your scene.
- 2 Activate Use Antialiasing in the Camera settings Render options pane. When this setting is activated, there is a brief pause as the scene is re-rendered. When this setting is disabled, anti-aliasing is not applied.
- 3 Double-click in the Intensity field to enter an anti-aliasing value to increase or decrease the intensity of the antialias blur. For best results, use a low intensity. The default setting is 0.7778.

NOTE Because anti-aliasing blurs the entire image, a high intensity value may blur important details.

- 4 Use the Sample Count field to enter the number of times each pixel is sampled to determine the pixel's color. The higher the number of samples the more accurate the pixel color, but the longer it takes to render.
- 5 Activate the Use Accumulation Buffer option if you are using a computer with a hardware accumulation buffer.

NOTE If your computer is not equipped with a hardware accumulation buffer, a software emulation of the buffer is activated.

The software emulation of the accumulation buffer may decrease computer performance. See [Anti-aliasing settings](#) on page 320.

About camera Depth of Field

The Camera Depth of Field settings let you configure the camera interest for the chosen camera.

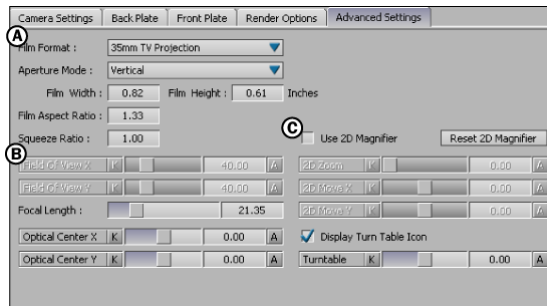
The camera depth of field is the amount of space within lens view that maintains focus at given settings, such as camera speed, film speed, lens aperture, and so on. In MotionBuilder, it refers to a method of blurring the

view depending on either the camera's focal point or a specific distance from the camera.

- [Showing the camera interest](#) on page 287

Advanced Settings pane

The Advanced Settings pane contains specialized camera settings, and camera attributes that you can animate. These settings let you set the options for the aperture of the camera, the lens, and the film size used by the camera.



Advanced Settings pane A. Film Settings area B. Camera Tracking settings C. 2D Magnifier settings

These settings are useful when making a MotionBuilder camera emulate a real-world camera.

If you modify the Aperture and Film settings, you may cause the Viewing Area settings to be updated. Changing settings in the Advanced Settings pane may affect other camera settings. See [Aperture Mode menu](#) on page 327.

Film Settings area

The Film Settings area lets you change MotionBuilder camera settings to mimic those of real-world cameras. Use these settings to set the camera's film size, aperture size, and squeeze and aspect ratios.

Film Format menu

Use the Film Format menu to set the width, height, and pixel ratio of the camera's settings to one of the available standard camera types.

NOTE If you change the Film Format setting for a custom camera in the Camera Settings Advanced pane, the Viewer window view does not change. This is because the new Film Format settings (for example the Focal Length or Optical Center) adjust to match the display of the current camera view in the Viewer window. This lets you use the Viewer window to set up shots more accurately. To change the current camera view in the Viewer window so it reflects the Film Format settings change, change the settings in the Advanced pane manually.

Standard Film Format settings

If you want to use a film format setting and also see the changes in the Viewer window, change the settings in the Advanced settings pane using this table:

| To simulate this film format: | Change the following settings: |
|-------------------------------|--|
| 16mm Theatrical | Film Size: 0.404, 0.295 inches. Film Aspect Ratio: 1.369.Field of View Y: 12.26. |
| Super 16mm | Film Size: 0.493, 0.292 inches. Film Aspect Ratio: 1.688.Field of View Y: 12.13. |
| 35mm Academy | Film Size: 0.864, 0.630 inches.Film Aspect Ratio: 1.371.Field of View Y is set to 25.83. |
| 35mm TV Projection | Film Size: 0.816, 0.612 inches. Film Aspect Ratio: 1.333.Field of View Y: 25.12. |
| 35mm Full Aperture | Film Size: 0.980, 0.735 inches. Film Aspect Ratio: 1.333.Field of View Y: 29.95. |
| 35mm 1.85 Projection | Film Size: 0.825, 0.446 inches. Film Aspect Ratio: 1.850.Field of View Y: 18.44. |
| 35mm Anamorphic | Film Size: 0.864, 0.732 inches. Film Aspect Ratio:1.180.Field of View Y: 29.84. |
| 70mm Projection | Film Size: 2.066, 0.906 inches. Film Aspect Ratio: 2.280.Field of View Y: 36.50. |

| To simulate this film format: | Change the following settings: |
|---|--|
| VistaVision | Film Size: 1.485, 0.991 inches. Film Aspect Ratio: 1.498.Field of View Y: 39.67. |
| DynaVision | Film Size: 2.080, 1.480 inches. Film Aspect Ratio: 1.405.Field of View Y: 56.62. |
| IMAX | Film Size: 2.772, 2.072 inches. Film Aspect Ratio: 1.338.Field of View: 74.04. |
| NOTE The Film Format field is automatically set to Custom if the Film Size, Film Aspect Ratio, or Squeeze Ratio fields are changed from the settings used for the Viewer window's display. | |

Aperture Mode menu

Use the Aperture Mode menu to select the aperture of the camera lens. You can use these settings can to match a MotionBuilder camera with a real-world camera.

There are three possible aperture modes:

| Aperture mode | Function |
|--------------------------------|--|
| Horizontal and Vertical fields | Select to set the angle values for both the horizontal and vertical settings. This setting activates Field of View X, Field of View Y, Focal Length, Optical Center X, and Optical Center Y. |
| Horizontal | Select to use the aperture and film settings to set only the horizontal angle. This setting activates Film Width, Film Aspect Ratio, Squeeze Ratio, and Focal Length. |
| Vertical | Select to use the aperture and film settings to set only the vertical angle. This setting activates Film Height and Focal Length. |

Film Width and Height fields

The values in the Width and Height fields depend on the selection in the Picture Format field. They automatically set the Field of View, Focal Length, and Film Size fields based on the selected film.

For example, when the Frame field is set to Fixed Width resolution, the Height field is shown as a ratio of the Width field, which is expressed in pixels.

NOTE Only the first field is active if you select Horizontal as your Aperture Mode setting.

Film Aspect Ratio field

The Film Aspect Ratio field gives the ratio between the horizontal and vertical Film Size. If you change either of the two Film Size fields, the Film Aspect Ratio is recalculated.

NOTE If you change the Film Aspect Ratio when the Film Format field is set to a supplied format (16mm Theatrical, Super 16mm, IMAX, and so on), the Film Format field is automatically set to Custom.

Squeeze Ratio field

The Squeeze Ratio represents the horizontal compression of the camera lens. The Squeeze Ratio only works when the Aperture mode is set to Horizontal.

NOTE Squeeze Ratio is active only if you select Horizontal as your Aperture Mode setting. Increasing the Squeeze Ratio affects the Field of View X settings.

See [Aperture Mode menu](#) on page 327.

Camera Tracking settings

The following settings are used with the Camera Tracker to help synchronize MotionBuilder cameras with a real-world cameras. You can change Focal Length value to choose a lens, or shift the camera's X or Y-axis orientation to its interest.

| Option | Description |
|-----------------|---|
| Field of View X | Use the Field of View X values to set the camera aperture's width. The Field of View X setting is disabled when the "Aperture |

| Option | Description |
|------------------|---|
| | mode” is set to Vertical. You can animate this setting when the Aperture mode is set to Horizontal or when it is set to Horizontal and Vertical. |
| Field of View Y | Use the Field of View Y values to set the camera aperture’s height. The Field of View Y setting is disabled when the Aperture mode is set to Horizontal. You can animate this setting when the Aperture mode is set to Vertical or when it is set to Horizontal and Vertical. |
| Focal Length | The Focal Length value changes the lens used to film the scene. When you change the Focal Length, the Field of View is recalculated to reflect the new focal length. You can animate this setting but it disables the Field of View settings. |
| Optical Center X | Use the Optical Center X values to shift the camera’s X-axis orientation to its interest. The Optical Center X setting is disabled when the Aperture mode is set to Vertical. |
| Optical Center Y | Use the Optical Center Y values to shift the camera’s orientation to its interest. The Optical Center Y setting is disabled when the Aperture mode is set to Horizontal. |

2D Magnifier settings

These settings lets you use and set up the 2D Magnifier. The 2D Magnifier lets you perform a 2D enlargement of the scene using the current camera without changing any camera settings.



A. Original scene with through Camera_floor B. Camera_Floor view enlarged with the 2D Magnifier.

Use 2D Magnifier

The Use 2D Magnifier option lets you perform a 2D enlargement of the scene using the current camera without changing any camera settings. Use this option when you want to enlarge the scene to view small details but do not want to alter the camera's primary position. The Use 2D Magnifier setting lets you edit from the same angle as the current camera, but without using a perspective zoom. You cannot orbit the camera when the 2D magnifier is activated. When the 2D Magnifier is activated,

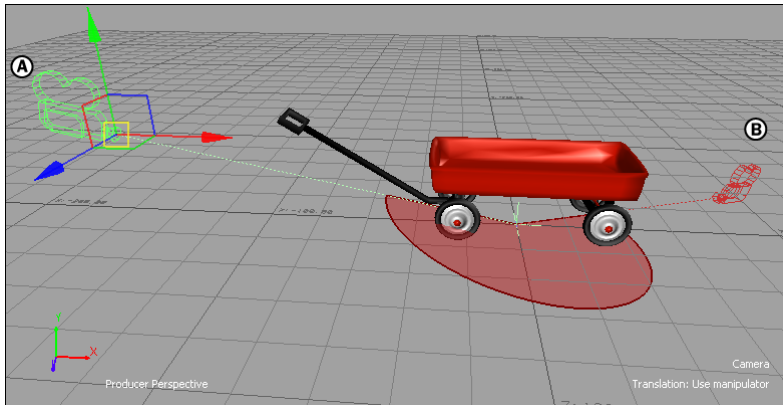
you can only move the camera laterally (left, right, up, or down) and enlarge or shrink the prescribed 2D magnifier view, which is designated by a yellow dotted line.

| | |
|--------------------|--|
| Reset 2D Magnifier | Click Reset 2D Magnifier to center and deselect the selected camera view. |
| 2D Zoom | Use the 2D Zoom slider to increase or decrease the enlargement of the 2D Magnifier. You can also enlarge or shrink the 2D Magnifier viewing area by Ctrl-clicking. |
| 2D Move X | Use the 2D Move X slider to move the 2D Magnifier view left or right. You can also move the 2D Magnifier viewing area horizontally by Shift-right-clicking. |
| 2D Move Y | Use the 2D Move Y slider to move the 2D Magnifier view up or down. You can also move the 2D Magnifier viewing area vertically by Shift-right-clicking. |

Turn Table options

Use the Turn Table options to rotate a camera around its interest without changing the camera position or settings.

The Turn Table is useful if you want to rotate around the camera’s interest but do not want to alter the camera’s primary position. The Turn Table values maintain any Back Plate settings specific to the camera.



Camera Turn Table set to 216. A. Camera in its original position B. Camera at 321 degrees

Display Turn Table icon

Activate this option to show or hide the Turn Table icon that appears in the upper right corner of Viewer window when the Turn Table option is active for the current camera.



Turn table icon

Turn Table slider

The Turn Table lets you move a full 360 degrees around the interest while maintaining the camera's original position at 0.

- [Customizing the camera's view](#) on page 292
- [Emulating real-world cameras](#) on page 300
- [Setting a default camera](#) on page 333

Setting a default camera

You can save and reuse any changes you have made to a camera in the Camera settings with the Save as Default option.

- 1 Once you have established a camera setup that you like, click Save as Default in the Camera settings Picture Format area.

Every camera you add to your scene now will use these default settings.

- 2 Experiment with the camera view.

- 3 If you want to recall your camera's custom default, click Reset.

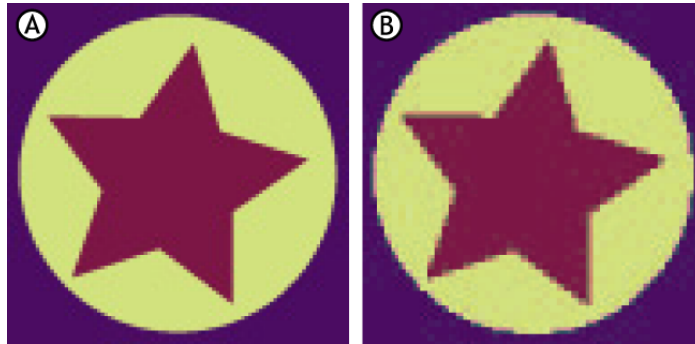
This lets you experiment with your default camera views without losing the settings you originally defined.

NOTE The Reset button does not restore MotionBuilder (or “factory”) default camera settings.

- [Customizing the camera's view](#) on page 292

Anti-aliasing and oversampling

In the figure below, A is an illustration of a model's edge without depending on pixels or scan lines is shown. Because the smallest unit of measurement is a pixel, the model is adapted by splitting its image into pixels. This results in an aliased, or jagged edge. To smooth this edge, each pixel is sampled at different locations to determine its color.



A. With antialiasing applied. *B.* Without antialiasing: the image is about to be over-sampled.

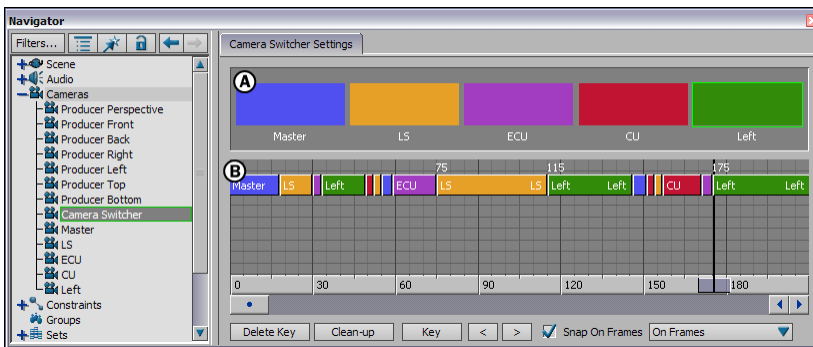
- [Anti-aliasing settings](#) on page 320

Camera switcher

25

The Camera switcher is a window that lets you switch between the custom cameras placed in your scene so you can create a take using multiple camera angles. It is found in the Scene browser's Cameras folder after the seven Producer cameras, and before any Custom cameras.

The Camera switcher contains the custom cameras you have created. If you have no custom cameras created in your scene, the Camera switcher is empty.



Camera switcher A. Camera Colors B. Switcher timeline

The Camera switcher is divided into two parts, the Camera Colors and the Switcher timeline.

- [Camera Colors](#) [area](#) on page 343
- [Switcher timeline](#) on page 341

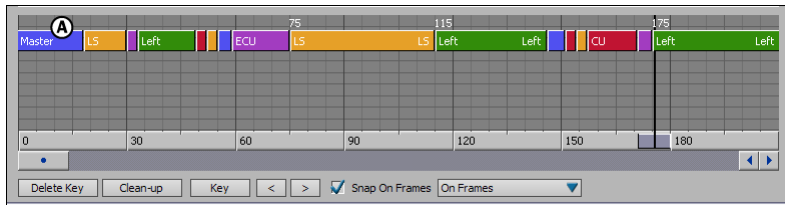
Creating camera switches

- 1 Add more than one camera to your scene. (See [Creating a custom camera](#) on page 284 for more on how to add a camera to your scene.)

- 2 Expand the Cameras folder in the Scene browser and double-click Camera switcher.
- 3 Right-click Camera switcher and select Make Current.
- 4 Select the camera color box that represents the camera you want to switch to in the Camera Colors area.
- 5 Move the Switcher timeline indicator to the point where you want a camera switch to occur, and click Key.

TIP You can also press K on the keyboard to set a camera switch.

This sets a keyframe, which creates a camera switch in the Camera switcher.



Camera Switches and Keyframes A. Camera switches in the Camera switcher

- 1 Advance the timeline indicator to the position of the next key, select the appropriate Camera Color, and click Key again.

The new key is set from that position forward.

- 1 To set the next switch, advance again, select a camera, and click Key, and so on.

Once you have added more than one camera switch to the Switcher timeline, you can refine the camera switching by playing the switches, changing the cameras, or removing the cameras altogether.

- [Selecting cameras in the Camera switcher](#) on page 337
- [Navigating the Switcher timeline](#) on page 343

Playing camera switches

After you have set a series of camera switches, you can play the camera switches like a current take.

- 1 Right-click the Camera switcher in the Scene browser and select Make Current from the contextual menu.

This lets you view your camera switches along with the current take when you play them back.

- 2 Click Play in the Transport Controls window

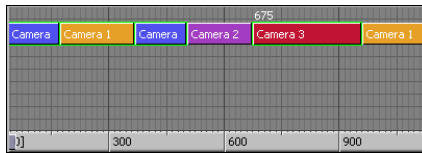
- Use the Play Backward button (<) to jump between camera switches in reverse of the order that they occur, that is, from right to left.
- Use the Play Forward button (>) to jump to the next camera switch in the order that they occur, that is, from left to right.
- [Creating camera switches](#) on page 335
- [Swapping cameras](#) on page 340
- [Navigating the Switcher timeline](#) on page 343

Selecting cameras in the Camera switcher

Select a camera by clicking its color box in the Camera Colors area. The selected box is highlighted with a green border. This makes the camera the current view in the Viewer window.

Selecting multiple camera switches

You can select multiple camera switches to change their assigned cameras. To do so, Ctrl-click the camera switches in the Switcher timeline, and then click the camera's color box in the Camera Colors area .



Multiple cut selection

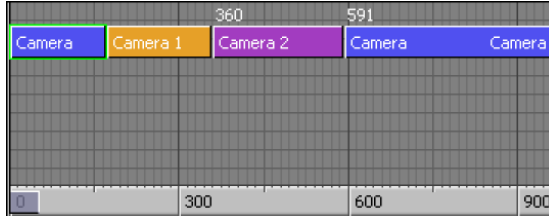
- [Selecting cameras in the Camera switcher](#) on page 337
- [Selecting cameras in the Camera switcher](#) on page 337

Editing camera switches

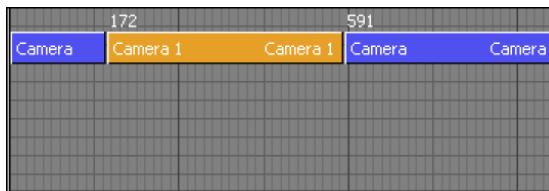
Once you have added your camera switches, you may want to delete, clean up, snap, resize, or have switches snap to exact frames.

Deleting switches

Click Delete Key to delete a camera switch. The Delete Key button removes a selected camera switch in the Switcher timeline and also removes the keyframe from the Transport Controls timeline.



Switcher timeline before the Camera 2 switch is deleted.

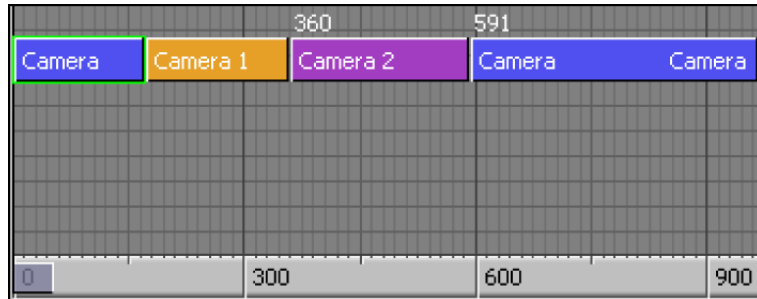


Switcher timeline after Camera 2 switch is deleted. Camera 1 fills the empty space.

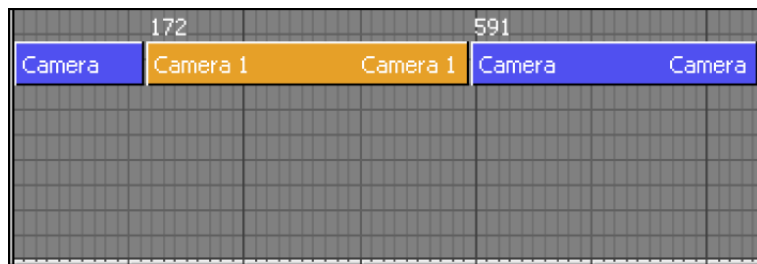
Removing redundant switches

Click Clean-up to remove any redundant camera switches that might reduce system performance.

For example, in , there are three Camera 3 switches. In , after the Clean up button is clicked, the three switches become one Camera 3 switch that lasts the duration of the previous three.



Three Camera 3 switches in a row



After clicking Clean up, the three Camera 3 switches become one.

Resizing switches

You can resize the camera switch length by click-dragging the left or right side of a selected camera color's green highlight in the Switcher timeline.

You can also move camera switch keys added to the Transport Controls by dragging them to another time. The keys on the Switcher timeline update automatically.

Swapping cameras

You can change the order in which the cameras are used by selecting a camera in the Switcher timeline, then clicking a different camera in the Camera Color row.

The selected camera in the Switcher timeline becomes the new camera for that camera switch. This does not alter the location of camera switches.

Snapping switches to frames

- 1 Activate the Snap On Frames option to snap camera switches to the nearest frame after the camera switch.

For example, if a switch occurs in the middle of two frames, the camera switch is bumped to the next frame.

When you select either of the two snapping methods, a dialog box appears asking if you want to apply snapping to all switches or new switches .



Snap Camera Switch dialog box

- 2 Click “Yes” to snap all current camera switches or click “No, snap only new switches” to ignore the existing camera switches, and snap only new camera switches.

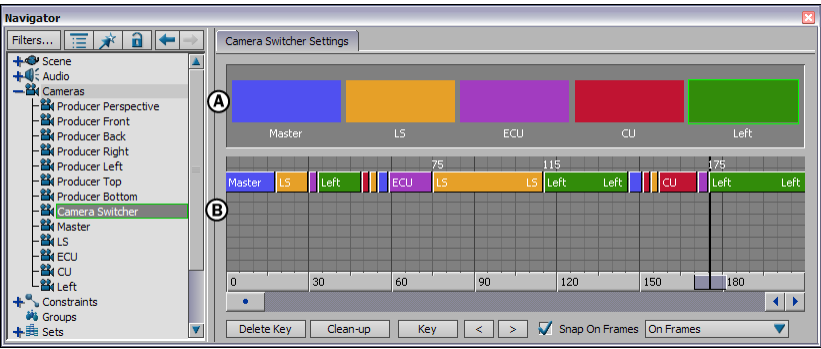
The menu to the right of the Snap On Frames button lets you choose two methods of snapping camera switches to frames:

| Option | Description |
|-----------|--|
| On Frames | Select On Frames to have the Camera Switch snap to the frame rate of the timeline. For example, if your take is set to thirty frames per second, the camera switches are snapped to this frame rate. If you do not have a video clip associated with the camera, a dialog box appears to |

| Option | Description |
|---------------------|---|
| | warn you that there is nothing on which to base the frame snapping. |
| On Back Plate Frame | Select On Back Plate Frame to have the Camera Switch snap on the frame rate you set as the Back Plate in your Camera view. This way, your camera switch is synchronized with any Back Plate video you might be using. |

Switcher timeline

The Switcher timeline lets you create and manage each camera switch.



Camera switcher A. Camera Colors B. Switcher timeline

The Switcher timeline is managed using the following options:

Delete key button

The Delete key lets you delete camera switches.

Clean-up button

The Clean-up button lets you remove any redundant camera switches.

Key button

The Key button lets you set a camera switch.

When the Camera switcher is the active camera, the Property field in the Key Controls window displays “Camera switcher” to signify the keyframes on the Action timeline represent existing camera switches.

Play Backward (<) button

The Play Backward button lets you play through your switches in reverse.

Play Forward (>) button

The Play Forward button lets you play through your switches.

Snap On Frames option

The Snap On Frames option snaps camera switches to the nearest frame after the camera switch. For example, if a switch occurs in the middle of two frames, the camera switch is bumped to the next frame.

The menu to the right of the Snap On Frames button lets you choose two methods of snapping camera switches to frames:

| Option | Description |
|---------------------|--|
| On Frames | Select On Frames to have the Camera Switch snap to the frame rate of the timeline. For example, if your take is set to thirty frames per second, the camera switches are snapped to this frame rate. If you do not have a video clip associated with the camera, a dialog box appears to warn you that there is nothing on which to base the frame snapping. |
| On Back Plate Frame | Select On Back Plate Frame to have the Camera Switch snap on the frame rate you set as the Back Plate in your Camera view. This way, your camera switch is synchron- |

| Option | Description |
|--------|--|
| | ized with any Back Plate video you might be using. |

- [Creating camera switches](#) on page 335
- [Navigating the Switcher timeline](#) on page 343

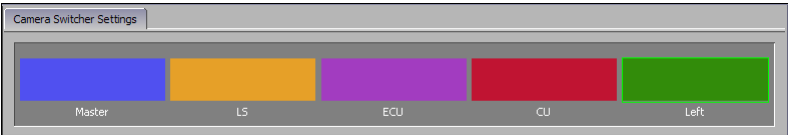
Navigating the Switcher timeline

Use the scroll bar located below the Switcher timeline to move it from left to right, or Shift-drag the timeline left and right. Ctrl-drag to zoom in and out of the Switcher timeline.

- [Selecting cameras in the Camera switcher](#) on page 337

Camera Colors area

The Camera Colors area show each custom camera represented by a colored rectangle. These rectangles are assigned different colors and are named for the camera they represent.



Camera Colors area.

If you rename the custom cameras in the Scene browser Cameras folder, the names in the Camera Colors rectangles are changed as well.

NOTE You cannot change the colors automatically assigned to each camera. They are assigned to the camera when it is created.

- [Creating camera switches](#) on page 335
- [Resizing switches](#) on page 339
- Removing redundant switches

Camera switches in the Story window

Switches created in the Camera switcher can be converted for usage in the Story window's Edit Track list. See [Edit track contextual menus](#) on page 1631.

Lighting

Lights are used to light your scene, and create special effects. They behave exactly like theatrical lights except that you can put them anywhere, even inside objects.

Aside from serving a practical purpose, MotionBuilder lights also can create a dramatic ambience that helps set your scene.



Lights can add drama to a scene.

This section covers MotionBuilder lights, their settings, properties and how to use them to create lighting in your scene.

This section covers the following topics:

- [Global lights](#) on page 373
- [Custom lights](#) on page 347

Lights are used to light your scene, and create special effects. They behave exactly like theatrical lights except that you can put them anywhere, even inside objects.

There are three Light types in the Light settings: Point lights, Infinite lights, and Spot lights. There is also a Global light, which provides default lighting, should your scene have no lights added. See [Global lights](#) on page 373.

These lights can be translated, rotated, scaled, colored, and animated.

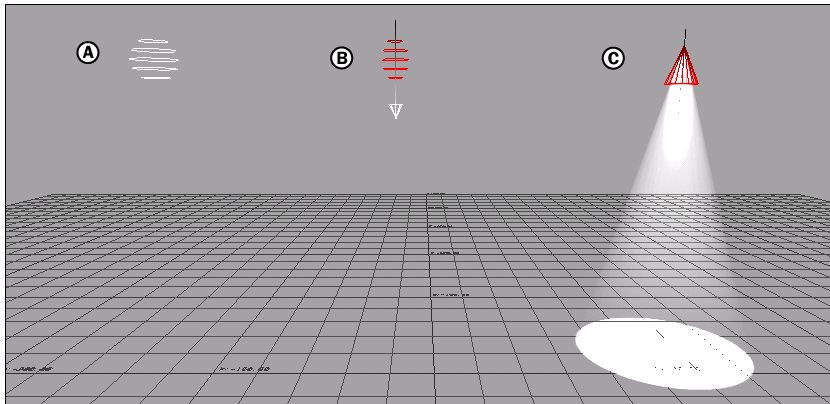
NOTE Settings are used for all light types unless otherwise noted. When properties cannot be used for the selected light type, their sliders are disabled.

- [Adding and removing lights](#) on page 350

Light types

In MotionBuilder, there are three Light types in the Light settings:

- [Point light](#) on page 348
- [Infinite light](#) on page 349
- [Spot light](#) on page 349

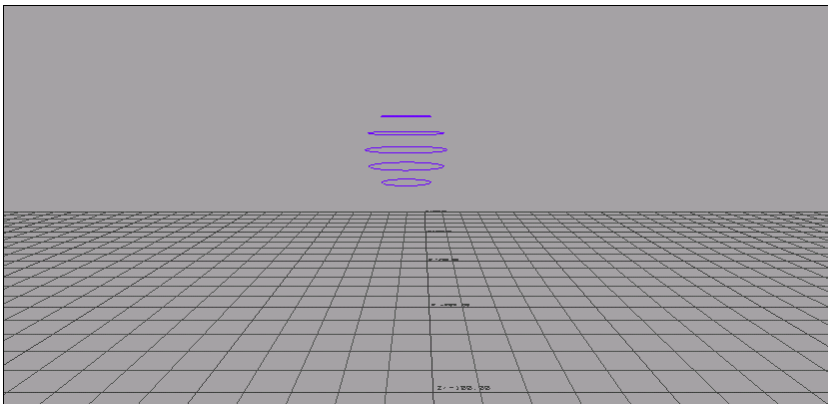


Light types A. Point light B. Infinite light C. Spot light

NOTE The Global light is present in every scene but cannot be selected from the Type menu. For more about the Global light, see [Global lights](#) on page 373.

Point light

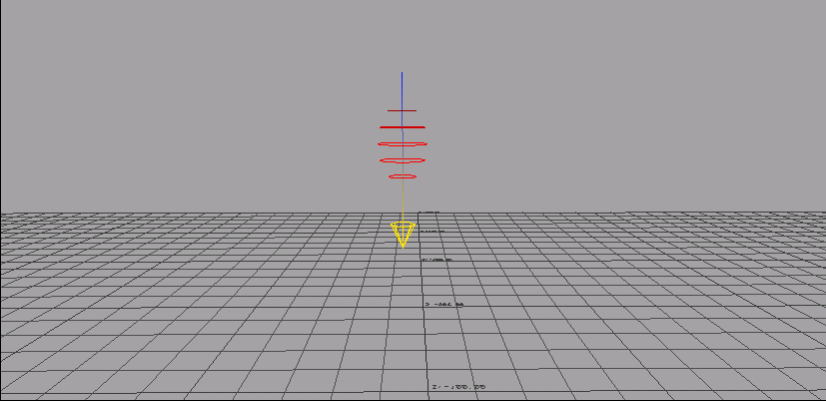
Radiates from the center of the light, illuminating all other models in the scene. The current color of the light is shown by the light. You cannot set the Cone Angle or Fog Intensity for Point lights.



Point light

Infinite light

Shines light in a specific direction. The position of the actual light is not important. The current color of the light is shown by a downward arrow. You cannot set the Cone Angle or Fog Intensity for Infinite lights.

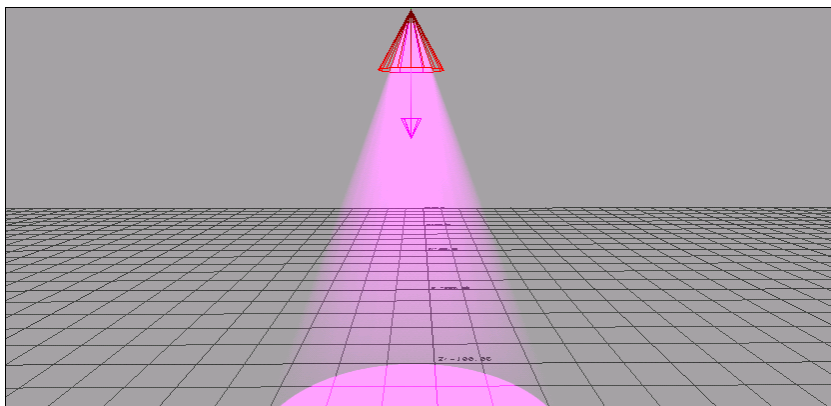


Infinite light

Spot light

Shines light in a specific direction from one position in your scene. The current color of the light is shown by the light ray, an arrow indicating the light's direction and the ground projection. The range of the light is defined using a Cone Angle.

Spot lights have the most settings available, and unlike other light types can show fog, project images and gobos, and have their cone angles animated. See [Defining Spot lights](#) on page 356 for more about the different Spot light options.



Spot light

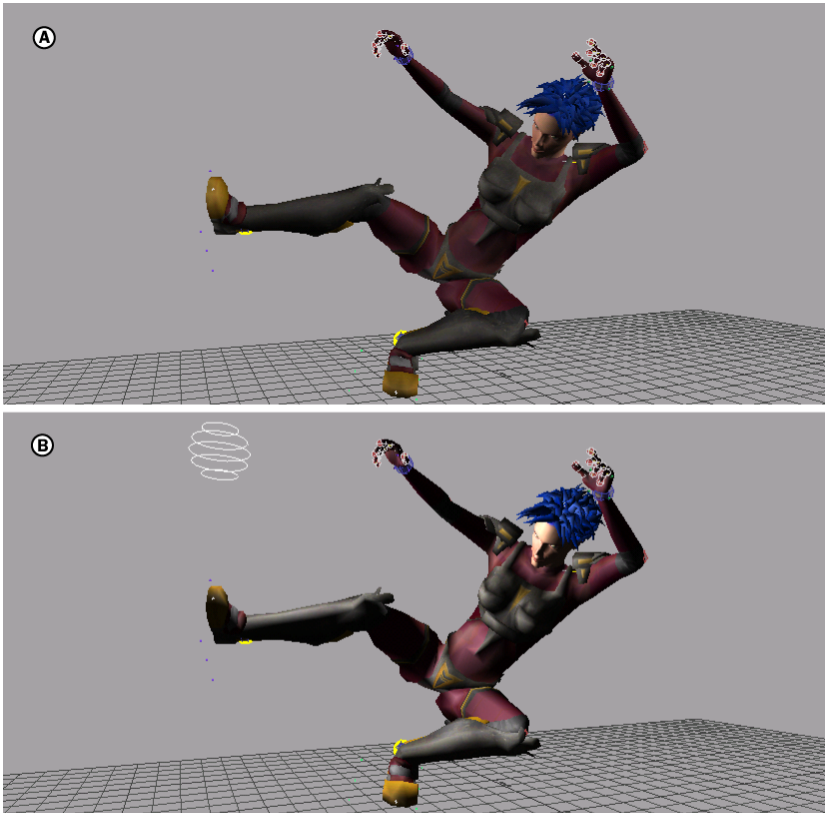
- [Adding and removing lights](#) on page 350

Adding and removing lights

Lights are used to light your scene, and create special effects. They behave exactly like theatrical lights except that you can put them anywhere, even inside objects.

To add a light to a scene, drag a Light asset from the Asset browser Elements folder into the Viewer window. The new light is added to the Lights folder.

When you add a light, it is a Point light by default and the Global (ambient) light is extinguished. For example, the following figure shows the scene illuminated using the default Global light (A) and an added Point light (B).



Default and added lights A. Global light B. Added Point light

TIP Rename a light by right-clicking it in the Lights folder and selecting Rename from the contextual menu.

To remove a light from your scene, right-click the light in the Scene browser's Lights folder and select Delete from the contextual menu. You can also select the light in the Viewer window and press the Delete key.

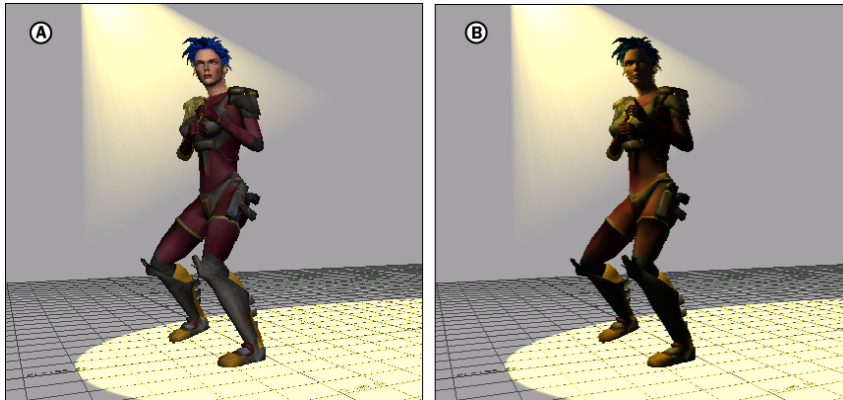
NOTE You can add an unlimited number of lights to a scene, however due to graphics card limitations, you can see only the effects of the first eight lights.

To add a light without lighting objects:

- 1 Select the light in the Viewer window or Scene browser.
- 2 In the Light Settings, disable Cast Light On Object.

This lets you use the light as an effect in the scene without illuminating objects.

For example, shows a model with Cast Light On Object disabled and activated.



Cast Light On Objects A. Disabled B. Activated

When the Cast Light On Object option is activated, objects are lit. When the setting is disabled, the light effect exists but does not affect the object. Disabling Cast Light On Object also speeds up the display time.

NOTE The Cast Light On Object option is activated by default.

This effect can also be provided by the Selective Lighting shader. For more information, see [Selective Lighting shader settings](#) on page 486.

- [Adjusting light color](#) on page 353
- [Projecting images with lights](#) on page 356

Intensifying a light

You can increase or decrease the brightness of any type of light using the Navigator or Property window's Light Intensity settings. The lower the intensity value, the softer the light.

- When set to 100, the Intensity mimics a hard light.
- At 0, the light is off.

Click the Animate (A) button beside the Intensity settings to activate this setting for animation.

Adjusting light color

You can adjust the color of any lights,

Use the Navigator or Property window's Color settings to adjust the color of the light. By default, the color of the light source is pure white.

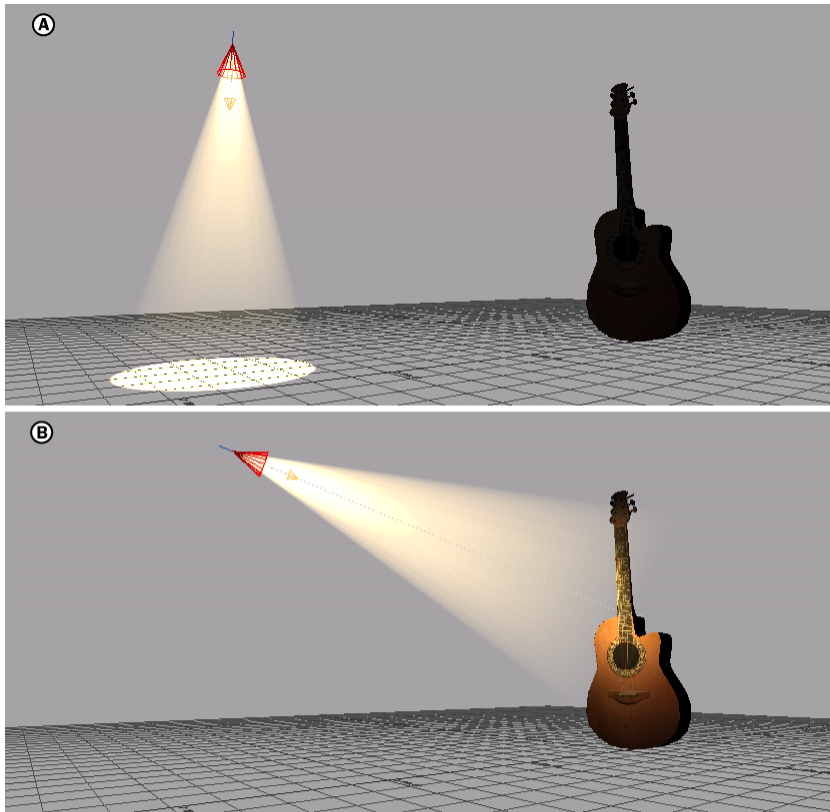
- 1 Select the light.
- 2 Enter a new value in the Color settings.
- 3 Click the Color button to open the Color window and change the selected light's color and mode. For more information on the Color window, see [Using the Color window](#) on page 9.
- 4 Click Animate (A) beside the Color settings to activate this setting for animation.

See [Intensifying a light](#) on page 352 for information on how to brighten or dim your lights.

Defining a light's Interest

You can assign an interest, or “look-at point” for any light.

- 1 Select the light in either the Scene browser or the Viewer window.
- 2 In the Light Settings, Alt-drag any element into the Interest field to define it as the interest of a given light.
- 3 If you translate the interest object, the light is constrained to it.



Spot light interest *A. Spot light with Interest not set. B. Spot light with Interest set on the guitar.*

Click the Interest field to select the element you selected to be the light's interest, and both the light and interest object are selected. When the light is translated, the light's interest follows it.

■ [Light types](#) on page 347

Defining a light's Up vector

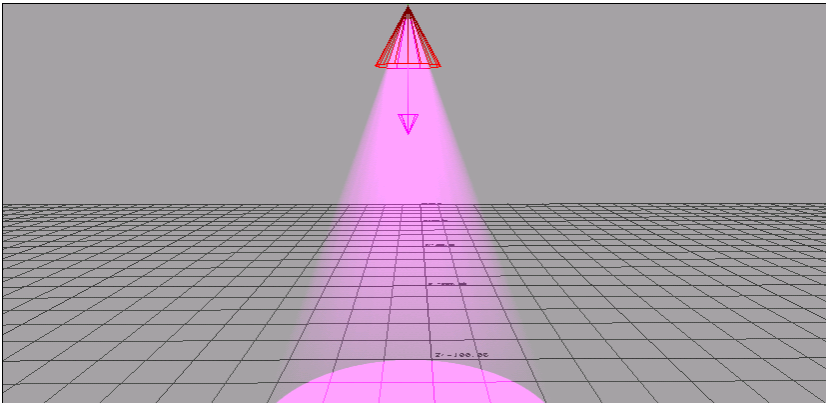
You can set an Up vector for any light.

To define a light's up vector:

- 1 Select the light in either the Scene browser or the Viewer window.
 - 2 Alt-drag an object or marker from the Viewer window into the Navigator or Property window's Light Settings Up Vector field to assign an Up Vector to the light.
 - 3 Click the Up Vector field to select the light's Up Vector, and then translate it.
- [Projecting images with lights](#) on page 356
 - [Draw Ground Projection option](#) on page 362

Spot Lights

Of all light types, Spot lights have the most settings available, and unlike other light types can show fog, project images and gobos, and have their cone angles animated. See [Defining Spot lights](#) on page 356 for more about the different Spot light options.



Spot light

- [Adding and removing lights](#) on page 350

Defining Spot lights

Spot lights have many different ways they can be customized. Use the following steps to customize the look and behavior of Spot lights in your scene.

- [Drawing lights that face front](#) on page 356
- [Projecting images with lights](#) on page 356
- [Projecting light on the ground](#) on page 357
- [Attaching a gobo to a light](#) on page 358
- [Removing a gobo from a light](#) on page 359
- [Showing the light beam](#) on page 359
- [Adjusting fog in lights](#) on page 360

Drawing lights that face front

- 1 Select the Spot light in either the Scene browser or the Viewer window.
- 2 Activate the Draw Front Facing Volumetric Light option in the Light settings to change the light stream of a Spot light to a realistic 3D cone shape.

Projecting images with lights

There are three methods you can use to project images with a selected Spot light:

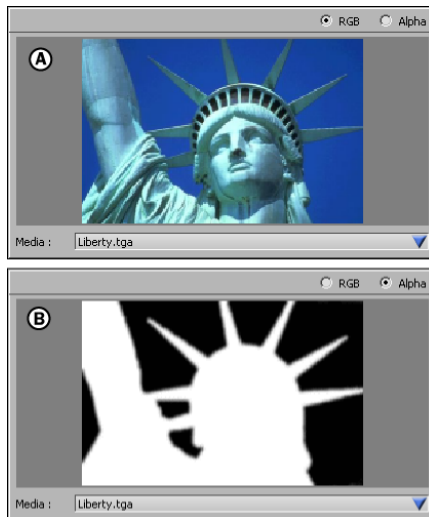
- Select New Media to open a file browser where you can select *.avi*, *.bmp*, *.tiff*, *.jpg*, *.memory*, *.pic* or *.qtmot* files, or select None to use a standard Spot Light.
- Drag images and textures from the Asset or Scene browsers onto Spot lights to be projected. If you drag video onto a Spot light, only the current frame is projected.

- You can also select files previously used on Spot lights. The Media menu lists all the image files used as textures on lights from the current session in the Media menu.

Previewing Alpha channels of projected images

Select the light in either the Scene browser or the Viewer window, and select either the RGB or Alpha options in the Light preview area to preview either the RGB or Alpha channels of a loaded image.

Select RGB to display a full-color version of the image in the Image Preview area, and select Alpha to display the Alpha image.



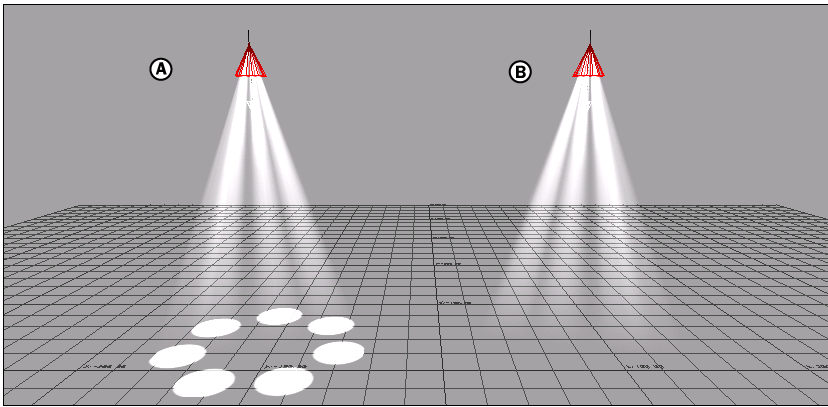
Light Texture preview A. RGB view B. Alpha view

The Alpha image displays the areas that are not projected in black, like a gobo, which is a filter placed over a light that projects light patterns.

Projecting light on the ground

- 1 Select the Spot light in either the Scene browser or the Viewer window.

- 2 Activate the Draw Ground Projection option in the Light settings to show the light projected on the ground.

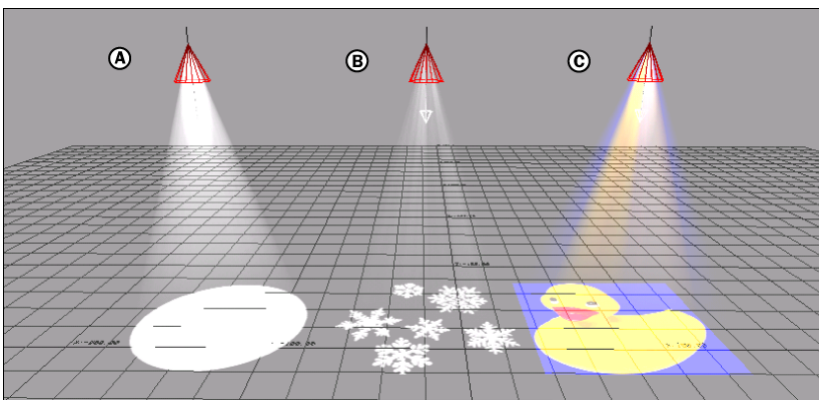


Draw Ground Projection A. Activated B. Disabled

Attaching a gobo to a light

You can use a gobo or an image to the projection of a Spot light.

- Drag a gobo or an image from the Asset browser on top of the light in the Viewer window.
- Drag a gobo or an image from the Asset browser on top of the Light settings Image preview. (The light must be selected in the Viewer window or Scene browser in order to do this.)
- Select Media > New Media from the Light Settings Media menu. A file browser opens for you to select a gobo or image to use as your projection. (The light must be selected in the Viewer window or the Scene browser in order to do this.)



Spotlight A. Without Gobo B. With Gobo C. With projected image

Removing a gobo from a light

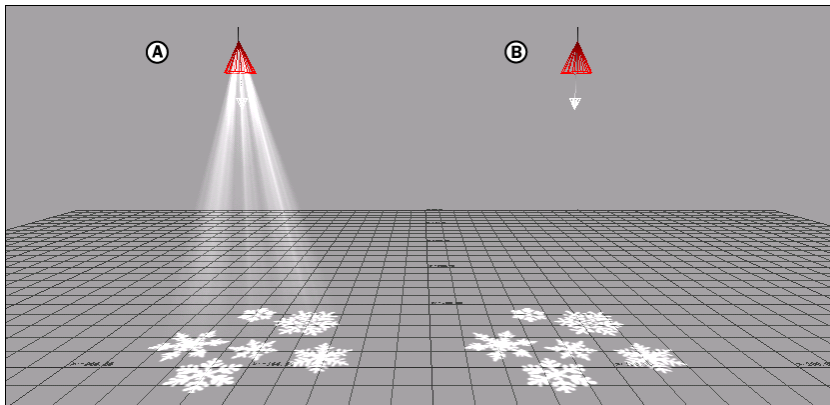
- 1 Select the Spot light, either in the Scene browser or the Viewer window.
- 2 In the Light Settings, select None in the Media menu.

- [Projecting images with lights](#) on page 356
- [Adjusting fog in lights](#) on page 360

Showing the light beam

- 1 Select the Spot light in either the Scene browser or the Viewer window.
- 2 In the Light Settings, disable the Draw Volumetric Light option if you want to project the image on the floor without drawing the light stream. When this option is disabled, the Fog Intensity field has no effect.

For example, shows two lights, one with Draw Volumetric Light activated and one with Draw Volumetric Light disabled. If you set Fog Intensity to 0, the Draw Volumetric Light settings have no effect.



Draw Volumetric Light A. Activated B. Disabled

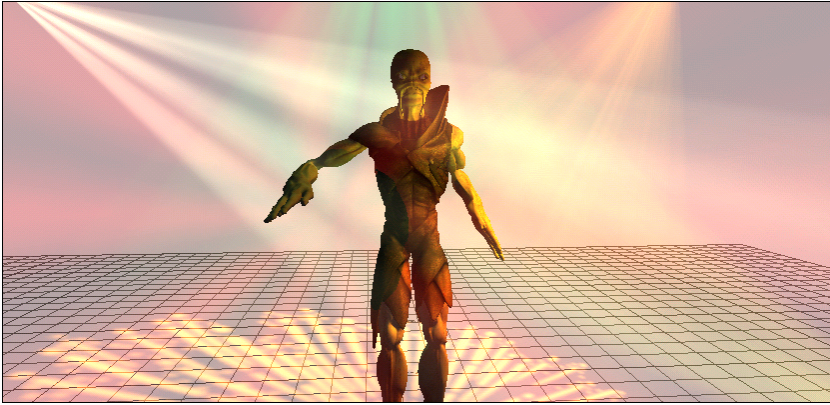
Adjusting fog in lights

Use the Navigator or Property window's Fog Intensity slider to increase or decrease the thickness of the fog shown in the selected Spot light's beam.

- 1 Select the light in the Scene browser of the Viewer window.
- 2 Use the Fog intensity slider in the Light Settings to increase or decrease the fog in a particular light's beam.

Spot light options

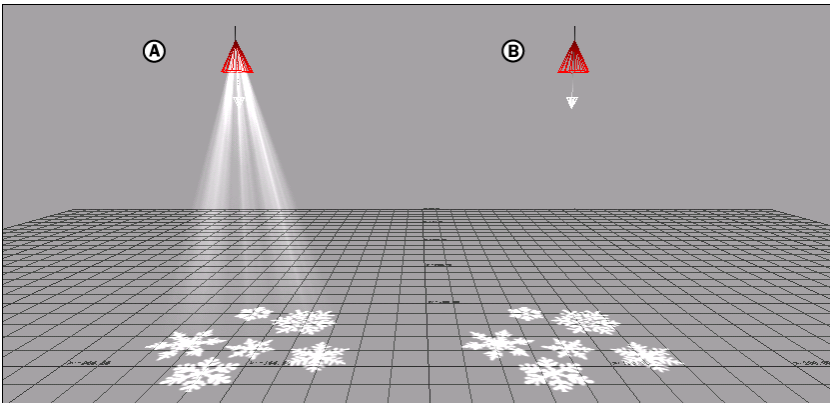
Spot lights are the most customizable of all the lights. You can use them to project images or gobos, widen their light beams, or have the light shine directly into the camera.



A model with various Spot light effects.

Draw Volumetric Light option

The Draw Volumetric Light option lets you create a volumetric lighting effect by making the light stream visible. The Fog Intensity field in the Light settings controls the strength of the volumetric lighting effect.



Volumetric light A. Active B. Disabled.

Cone Angle settings

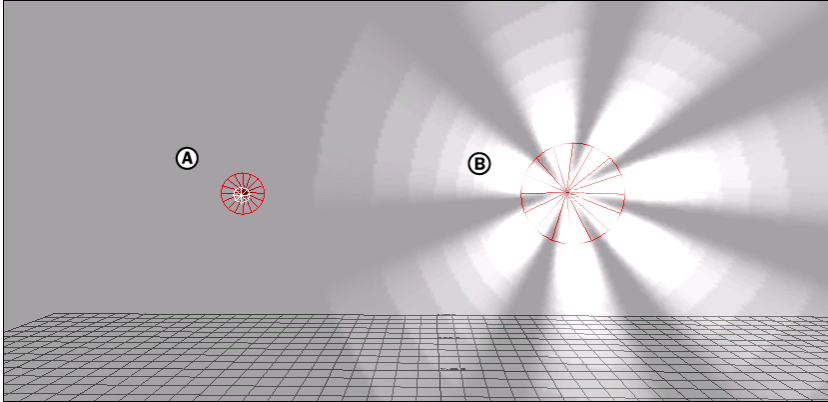
The Cone Angle setting in the Light Settings adjusts the spread or range of light. Use the Cone Angle slider or enter a new value in the Cone Angle field.

Click Animate (A) beside the Cone Angle settings to activate this setting for animation.

Draw Front Facing Volumetric Light option

Front facing light occurs when the camera view is looking down or up the light stream of a Spot light, which makes the light stream look three-dimensional.

For example, shows two lights, one with Draw Front Facing Volumetric Light activated and one with Draw Front Facing Volumetric Light disabled.

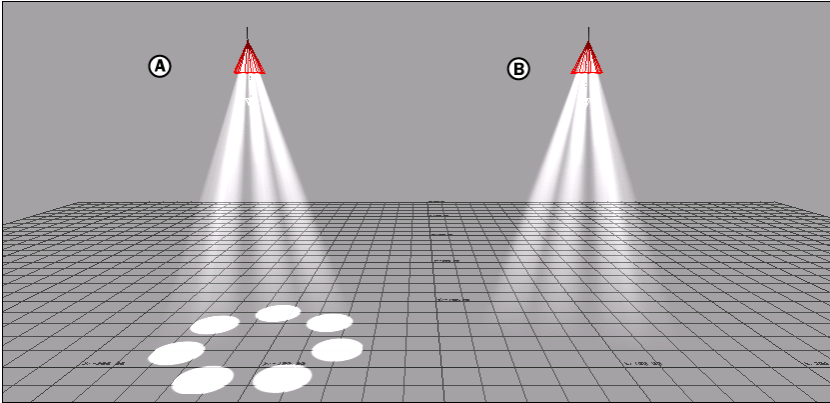


Draw Front Facing Volumetric Light A. Disabled: No light beams appear when facing the camera. B. Activated: Light beam appears realistic when facing the camera.

Draw Ground Projection option

The Draw Ground Projection option shows the light projected on the ground.

For example, shows two lights, one with Draw Ground Projection activated and one with Draw Ground Projection disabled.



Draw Ground Projection A. Activated B. Disabled

Light Preview area

The Light Preview shows the image applied to the selected Spot light. When no image is applied to the selected light, the Image Preview shows a white circle. For information on how to apply an image to a light, see [Attaching a gobo to a light](#) on page 358.

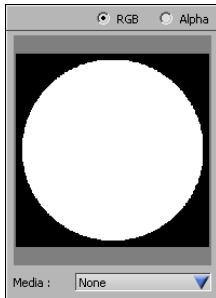


Image Preview default setting is None

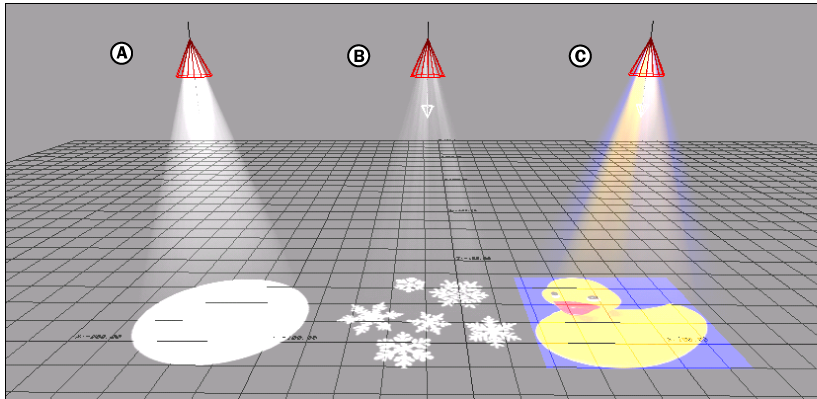
To view the Light Preview area, select a Spot light in the Lights folder, or select Spot Light from the Type menu.

NOTE The Light Preview area is only available with Spot lights. Point lights and Infinite lights cannot use projected light images.

■ [Adding and removing lights](#) on page 350

Gobos in Spot lights

A gobo is a filter placed over a Spot light to project light patterns through fog on a surface. The Gobo folder in the Asset browser has gobos that you can attach to lights in your scene.



Spotlight A. Without Gobo B. With Gobo C. With projected image

You can also use an image file as a gobo, which cause the light to project an image, much like a projector. You can use an *.avi*, *.bmp*, *.tiff*, *.jpg*, *.memory*, *.pic* or *.qtmot* file.

Not all the gobos are installed by default when you install MotionBuilder. Additional gobos are available on the MotionBuilder Clip Art DVD and can be installed separately.

- [Adding and removing lights](#) on page 350
- [Projecting light on the ground](#) on page 357

Saving light settings as defaults

You can create a default light type so that every time you add a light to a scene, it has the same values, such as cone angle or color, and so on.

To create the current light settings as a default:

- 1 Select the light in the Scene browser of the Viewer window.

Set up the light so that it has the settings you want all future lights to use as a default.

2 Click Save as Default in the Light Settings.

This retains your current custom light values as a new default setting so that any new light have these values as a preset.

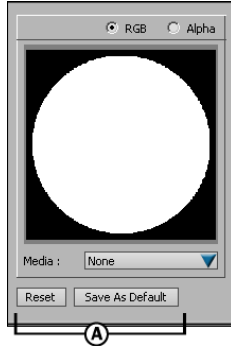


Image Preview area A.
Default light settings

See [Restoring the custom default light settings](#) on page 365 for information on how to undo changes made to these lights.

Restoring the custom default light settings

Click Reset to recall your light's custom default, and restore it to your default settings. This lets you experiment with your custom default lighting without losing the settings you originally defined.

NOTE The Reset button does not restore default light settings. To do this, see [Restoring original light settings](#) on page 366.

Changes to the default light settings are global and affect every light added to the scene after you created the default. The lights already in the scene do not change, but all subsequent lights use the default, regardless of which file you are working on.

Restoring original light settings

If you want to remove all changes made to the default light settings and restore MotionBuilder's factory default lighting, the configuration file must be modified.

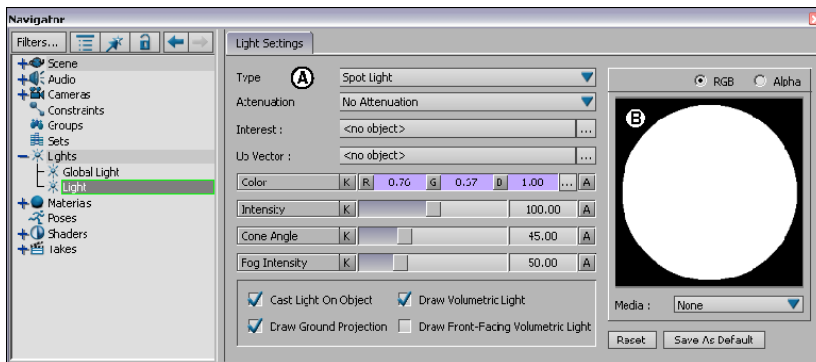
To restore original Light settings:

- 1 Close MotionBuilder.
 - 2 Locate the MotionBuilder Config folder on your hard drive.
 - 3 Delete the file *modeldefaultsetting.fbx*.
- [Adding and removing lights](#) on page 350
 - [Saving light settings as defaults](#) on page 364

Light settings

When a light is selected, its settings display in the Light settings. The Global light is always in the Light settings by default. See [Global lights](#) on page 373 for more on Global lighting. To access the Light settings for other lights in your scene, select the light in either the Scene browser or the Viewer window.

The Light settings let you add and set lights in your scene to illuminate models and other objects.



Light settings A. Light settings B. Light Preview area

Light settings area

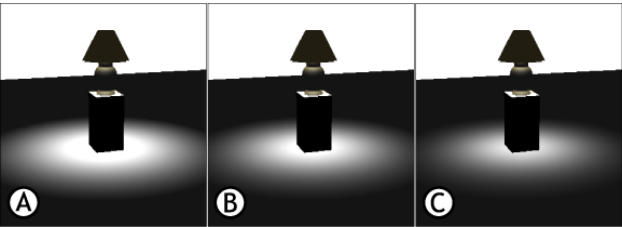
The light settings area contains options for customizing the look and behavior of your lights.

Light type menu

Lets you select one of three light types: Infinite, Point and Spot. For more information about these lights see [Light types](#) on page 347.

Attenuation

The Attenuation settings lets you specify how the intensity of a light drops off in relation to the distance from the source. Once you add a Dynamic lighting shader, use this setting to set how MotionBuilder calculates the light falloff. There are two options, Linear and Quadratic, that affect lighting falloff. No Attenuation disables the falloff effect.



Light attenuation setting: A. None B. Linear C. Quadratic. Compare the edges of the shadow.

Do not change the attenuation setting if you do not want to the lighting influenced by its distance from the source.

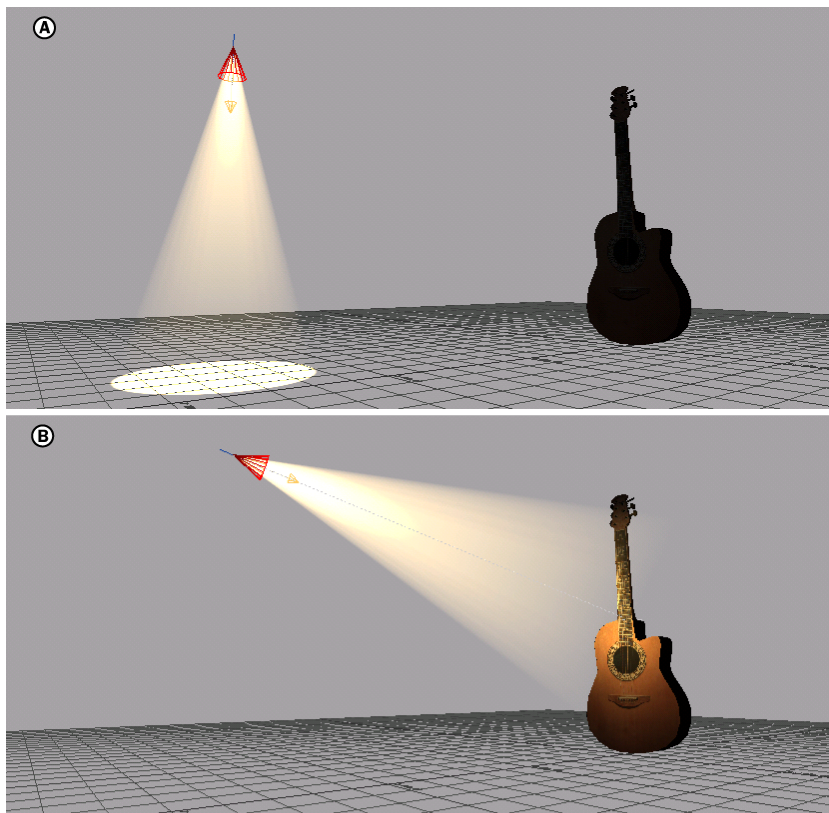
NOTE You must apply a Dynamic Lighting shader to the scene to see attenuation effects. See [Dynamic Lighting shader settings](#) on page 499for more information.

| Setting | Function |
|---------|--|
| Linear | This setting produces an even falloff. The equation is $(intensity/x)$. The light will drop off in an even fashion from the point it leaves the light until it illuminates an object. |

| Setting | Function |
|-----------|---|
| Quadratic | This setting produces an uneven falloff. The equation is $(\text{intensity} / x^2)$. The light will make a rapid drop off close to the object and the falloff will then slow the further it gets from an object. |

Interest field

Lets you define a “look-at point” or target for the selected light. When the light is translated, the light’s interest follows it.



Spot light interest A. Spot light with Interest not set. B. Spot light with Interest set on the guitar.

See [Defining a light's Interest](#) on page 353.

Up Vector field

Lets you add and use a model as the Up Vector of a selected light. An Up Vector is a model that controls the orientation of a given light.

This is done by constraining the light to orient its movement toward the Up Vector model's position and prevents the light from flipping, providing more realistic movement of an animated light's projections. See [Defining a light's Up vector](#) on page 354.

Color

Lets you specify the color of the selected light. By default, the color of the light source is pure white. You can animate this setting. See [Adjusting light color](#) on page 353.

Intensity

Lets you adjust the brightness of the selected light. You can animate this setting. See [Intensifying a light](#) on page 352.

Cone Angle

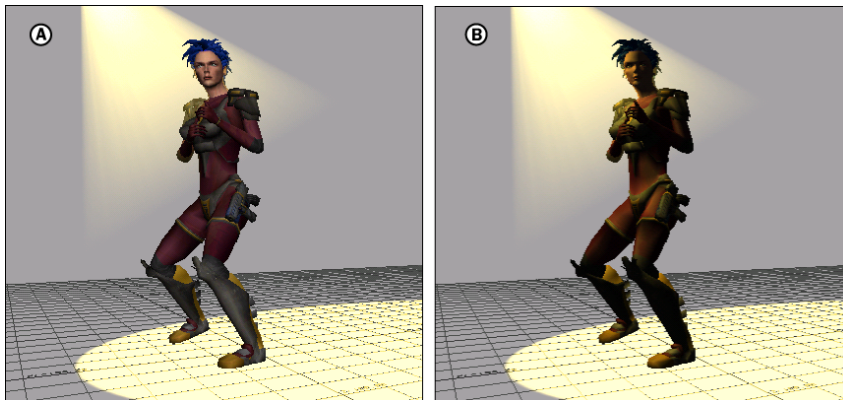
Active only for Spot lights, the Cone angle slider lets you adjust the spread or range of light from a Spot light. The smaller the cone angle, the smaller the area of the scene that is illuminated by the light. You can animate this setting. See [Defining Spot lights](#) on page 356.

Fog intensity

Active only for Spot lights, the Fog intensity slider lets you increase or decrease the amount of fog shown in the light's beam. You can animate this setting. See [Defining Spot lights](#) on page 356.

Cast Light on Object

Lets you use the light as an effect in the scene without illuminating objects. For example, shows a model with Cast Light On Object activated and disabled.



Cast Light On Objects A. Disabled B. Activated

When the Cast Light On Object option is activated, objects are lit. When the setting is disabled, the light effect exists but does not affect the object.

Disabling Cast Light On Object speeds up the display time. The Cast Light On Object option is activated by default. If you want only to have some objects affected by particular lights in your scene, see [Selective Lighting shader settings](#) on page 486.

Draw Ground Projection

Active only for Spot lights, this setting makes the beam of the Spot light shine on the ground. See [Defining Spot lights](#) on page 356.

Draw Volumetric Light

Active only for Spot lights, this setting lets you see the actual beam that the Spot light emits and is often used with Fog effects. See [Defining Spot lights](#) on page 356.

Draw Front-Facing Volumetric light

Active only for Spot lights, this setting lets you see the effect of the light when it is facing directly into the camera. See [Defining Spot lights](#) on page 356.

Light Preview area

Used only with Spot lights when they project images or gobos, the Light preview area shows you what the shape of the projection looks like.

| Setting | Description |
|-----------------------|--|
| RGB/Alpha options | Lets you view either the full image or the alpha channel of any image projected by the Spot light. |
| Light Preview | When no image is selected, the light pre-view shows a white circle. If an image is select in the media menu, it is shown here. |
| Media menu | Use the Media menu to select an image to be projected by the Spot light, depending on whether you have activated the Draw Ground Projection option, or the Draw Volumetric Light options. For example, if you have only selected Draw Ground Pro-jection, the selected image is shown on the ground. If you have selected Draw Volumetric Light only, the light beams are shown. See Projecting images with lights on page 356 for more on how to use lights to display images. |
| Reset/Save as default | The Reset and Save as Default buttons let you save modifications you have made to a light’s settings to create a new default light. Once a default is set, every new light added uses this custom setting.For ex-ample, you can save a Spot light’s intens-ity, cone angle, and fog options as a de-fault, and then all lights that you add to the scene use these settings.You cannot save Interest, Up Vector, or Media settings as defaults.Saving default settings is useful if you need several lights to use specific custom settings. See Saving light settings |

| Setting | Description |
|---------|--|
| | as defaults on page 364 for more about creating a new default light setting. |

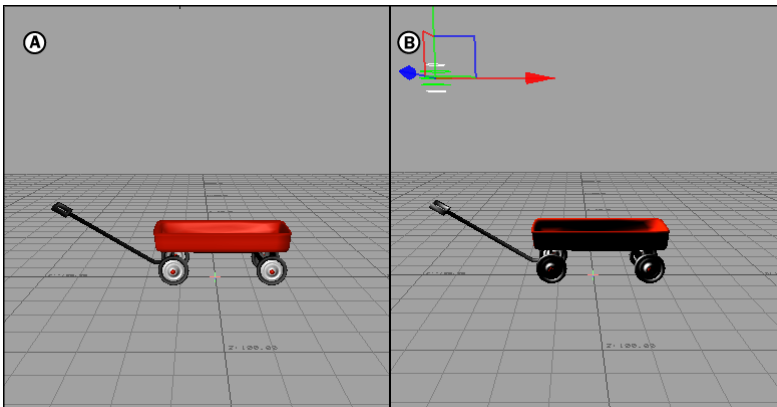
Global lights

27

When you first bring an object into MotionBuilder, no lights are in the scene, and yet you can see the object in the Viewer window. This is because of a generic lighting effect created by the *Global light*.

The Global light is the default light that illuminates your scene before you have added any lights. The Global Light is not considered a light because it is simply an ambient “work light” that illuminates your models in a steady, ambient light. You cannot select it, or make it brighter.

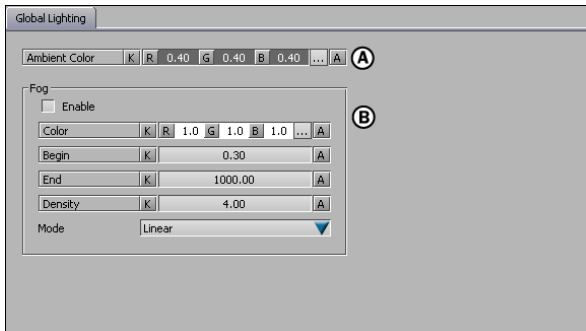
When a custom light is dragged into the scene, the Global Light is turned off.



The Global Light (A) is removed when a custom light (B) is added.

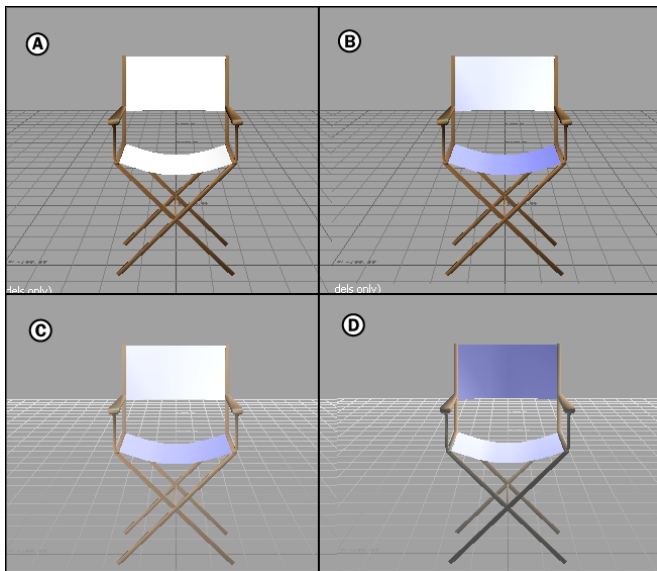
This light is fine for use while you are working, but provides a characterless ambience for your scenes. The Global light cannot display shaders or be animated, nor can you adjust the Global light’s position or intensity.

If the Global light is selected, the Global Lighting settings display, which let you change the general color and brightness of the scene .



**Light settings for the Global Light A. Ambient Color settings
B. Fog settings**

The Global Light settings are used to adjust the global lighting parameters, such as the overall ambient lighting effects and fog settings.



**Global lighting examples A. Global lighting B. Ambient color changed
C. Ambient color changed and Fog added D. Ambient color changed,
fog added, two custom lights added**

- [Adding and removing lights](#) on page 350
- [Changing a scene's ambient color](#) on page 375
- [Global lights](#) on page 373

Changing a scene's ambient color

- 1 Expand the Lights root folder in the Scene browser and double-click Global light.
- 2 Use the Ambient Color settings to adjust the color of the ambient light. By default, the color of the light source is pure white.
 - Enter a new value in the RGB fields, or click the Color button to open the Color window to change the selected light's color and mode.
 - Click Animate (A) beside the Ambient Color settings to activate this setting for animation.

NOTE There must be objects in the scene to see the effect of a change in ambient lighting.

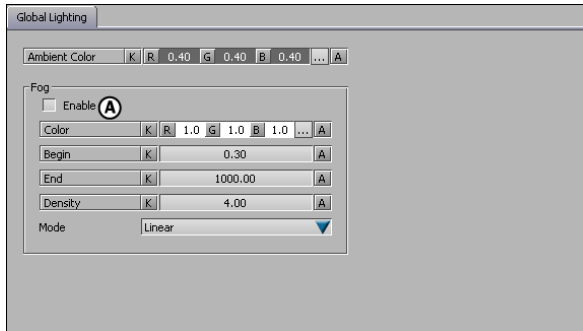
- [Adding fog to scenes](#) on page 375
- [Color window](#) on page 4

Adding fog to scenes

You can add fog to globally affect entire scenes.

To set the ambient fog for the entire scene:

- 1 In the Asset browser light settings, select Global Light.
- 2 Activate the Enable Fog option.



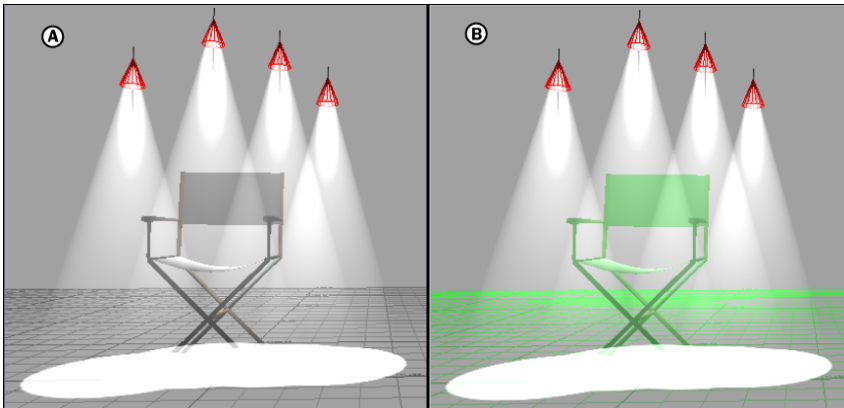
Light settings for the Global Light A. Enable Fog option

- 3 Enter a new value in the Color settings or click the Color button to open the Color window and change the fog's color.
- 4 Click the Animate (A) button beside the Color settings to activate this setting for animation.

- [Adding and removing lights](#) on page 350
- [Changing a scene's ambient color](#) on page 375

Setting fog color

- 1 Type a new color value in the Color settings in the Global lighting window to adjust the color of the fog.
By default, the color of the fog is pure white.



A. Fog settings disabled B. Fog settings activated and fog color set to green.

For more information on color, see [Color window](#) on page 4.

- 1 Use the Mode menu to select the type of fog generation. For more on the different Fog modes, see [Mode menu](#) on page 379.
- 2 Control the thickness of the Fog in your scene by adjusting the Begin and End fields in the Global Lighting window when Linear is the selected Fog Mode.
Begin and End are measured relative to the current camera. At Begin, objects are slightly obscured by fog. At End, objects are fully obscured by fog.
- 3 Adjust the Density value to control the thickness of the fog when Exponential or Square Exponential mode is selected.

Global Lighting settings

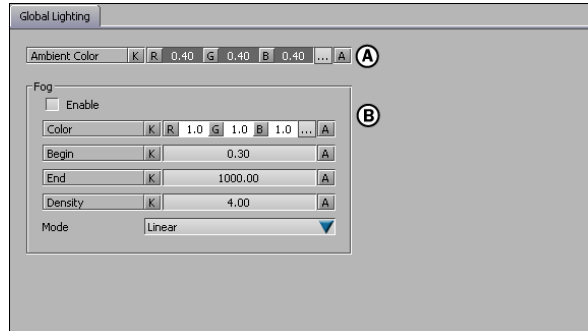
The Global Lighting settings are divided into two areas: The Ambient color and the Fog settings.

Ambient Color values

The Global lighting Ambient color values let you adjust the overall color in your scene. See [Changing a scene's ambient color](#) on page 375 for more on how to change the overall color of your scene.

Fog settings

The Global Lighting Fog settings let you create fog to add dramatic lighting effects to your scenes. See [Adding fog to scenes](#) on page 375 for more on how to add fog atmosphere to your scene.



Global Light settings A. Ambient Color settings B. Fog settings

Enable option

Activate the Enable option to use fog in your scene. Fog works best in a fully modelled scene with floors, walls, and props such as desks, stairs, and so on.

Color values

Use the Color settings to adjust the color of the fog. By default, the color of the fog is pure white.

Enter a new value in the Color settings or click the Color button to open the Color window and change the fog's color.

Click the Animate (A) button beside the Color settings to activate this setting for animation.

Fog Begin and End fields

Adjust the Begin and End fields to control the density of the fog when Linear is the selected Fog Mode.

Begin and End are measured relative to the current camera. At Begin, objects are slightly obscured by fog. At End, objects are fully obscured by fog.

Density option

This option controls the density of the fog when Exponential or Square Exponential mode is selected.

Mode menu

Use the Mode menu to select the type of fog generation.

There are three fog modes:

| Fog mode | Function |
|-----------------|--|
| Linear | Generates fog that gradually increases from the Begin value to the End value. |
| Exponential | Generates fog that increases exponentially according to Density. |
| Sqr Exponential | Similar to Exponential except the fog's density increases more rapidly, resulting in a clear fog close to the camera and a heavy fog the further you move from the camera. |

NOTE Settings are used for all light types unless otherwise noted. When properties cannot be used for the selected light type, their sliders are disabled.

- [Adding fog to scenes](#) on page 375
- [Color window](#) on page 4

Surfaces

Textures and Materials are attributes that give 3D models their defining characteristics, even though they are applied only to their surfaces. They provide identifiable properties like color, pattern, and shine are simulated in the 3D world by the application of materials and textures to an object.

Materials let you change the appearance of an object's surface by manipulating things like color properties and the way the surface of the model reacts to light. Materials let you control the emissive, ambient, and diffuse colors of objects, as well as assign specular highlights, opacities, reflectiveness, and shininess.

Textures are used to cover the surface of 3D models with color and pattern, which makes them more recognizable.

This section covers MotionBuilder Materials and Textures, their settings, properties, and how you can use them to add a dimension of realism to your scene.

This section covers the following topics:

- [Materials](#) on page 383
- [Textures](#) on page 393

Materials are the most basic way to create surface effects on models.

Material assets let you determine how the model's surface reacts to light. This gives the model an effect of color and an appearance of a surface "feel".

The way materials affect a model's surface can be approached into two ways:

- [Materials and object lighting](#) on page 383
- [Materials and surface consistency](#) on page 385

The object lighting settings of materials are portrayed as RGB fields. These fields let you use different colors to define aspects of the object's surface, such as the color of the light that reflects from it.

The surface consistency settings of Material assets are shown as sliders that can be increased or decreased. These sliders let you control the way light is shown on the object, such as reflectivity.

You can add a material to objects in a scene by dragging them from the Materials folder in the Asset browser. You can also attach a material to a model by dropping it on a model.

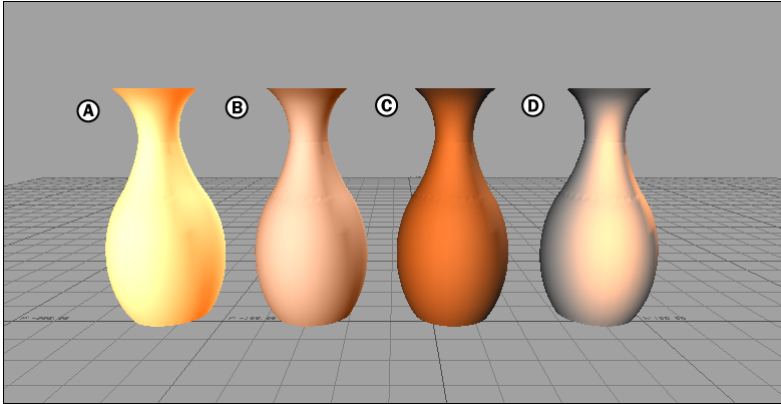
When you add a material, you can define its properties in the Material or Texture settings that appear in the Navigator window.

- [Applying a material to a model](#) on page 386
- [Adjusting the appearance of materials](#) on page 387

Materials and object lighting

Materials govern an object's own internal lighting attributes, such as Emissive, Ambient, and Diffuse Color. These attributes define how we determine the object's surface consistency.

These effects are created by changing the colors on the object, but they can create effects that go beyond simply coloring the object.



Materials Lighting settings. A. Emissive B. Ambient C. Diffuse D. Specular

In the image above, four vases illustrate the Materials light settings:

Emissive

Emissive refers to the color of the light that radiates from the object. Choosing a lighter color gives the effect of a radioactive glow.

Ambient

Ambient refers to the color that shadows are filled with on the object, as if the color is being bounced off of a nearby object.

Diffuse

Diffuse refers to the actual color of the object. In the figure above, C, the vase is orange.

Specular

Specular refers to the color of the highlight that appears on the object. A brighter, lighter color gives a sharp, shiny effect.

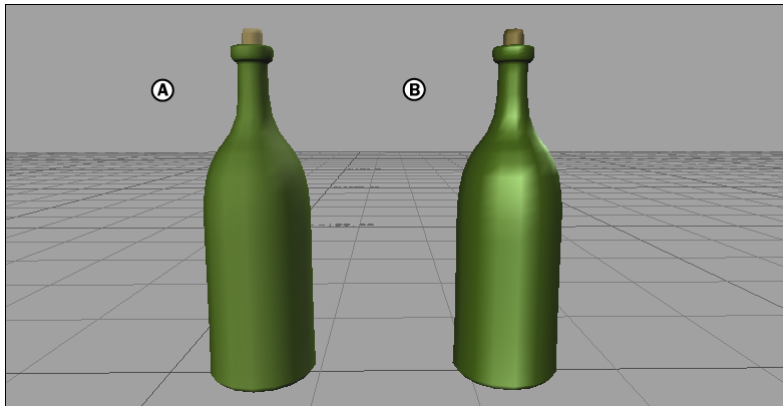
- Use Additive Specular Lighting option
- [Materials working with shaders and textures](#) on page 386

- [Adjusting the appearance of materials](#) on page 387
- [Applying a material to a model](#) on page 386

Materials and surface consistency

Materials change the model's surface “feel”, meaning that they provide the illusion of various external properties for models, such as transparency, reflectivity, and shine.

These external properties determine how we perceive an object, and of what it is composed.



A. Material only used for color. B. Material used for color and specularity.

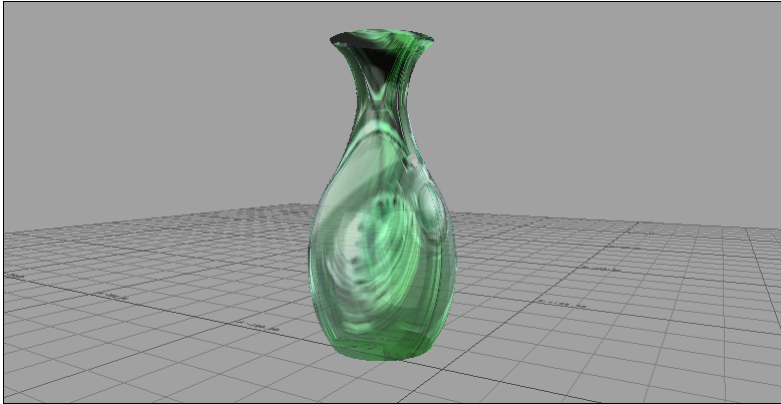
In the image above, two copies of the same bottle model are shown. The first bottle has a material applied simply to provide color, and the second bottle material has had the specularity settings changed to give it shininess, as well as color.

Note how changing the specularity settings changes the bottle so it appears to be smooth ceramic or plastic. Nothing has been changed on the model except that a Material has been added.

- Use Additive Specular Lighting option
- [Applying a material to a model](#) on page 386

Materials working with shaders and textures

Some of the effects of materials, such as color and reflectivity, can be also achieved with shaders or textures. Used together these can give simple grey models surfaces which resemble glass, metal, skin, and so on.



Vase with materials, textures, and shaders added.

A model's material properties may be used by the texture settings when applying textures, and by the shader settings when applying certain shaders.

For more on shaders, see [Shader basics](#) on page 417.

For more on textures, see [Textures](#) on page 393.

- [Adding a texture to a model](#) on page 394
- [Applying a material to a model](#) on page 386

Applying a material to a model

- 1 Open the Materials folder in the Asset browser.
- 2 Drag a Material asset onto an object in the Viewer window.
The new material appears in the Materials folder in the Scene browser and is named “Material” by default. The Material Settings display in the Navigator window.

NOTE A “Default Material” appears in the Materials folder of the Scene browser when there is no material applied to an object. You cannot modify the Default Material.

- 3 Adjust the color, opacity, and specularity of the material in the Material Settings window.

- [Materials working with shaders and textures](#) on page 386
- [Adjusting the appearance of materials](#) on page 387
- [Testing shaders, textures, and materials](#) on page 395

Adjusting the appearance of materials

Use the following sliders and values in the Material Settings to adjust the look of your material. See [Material Settings](#) on page 387 for specific information on what each slider does.

- [Applying a material to a model](#) on page 386
- Use Additive Specular Lighting option

Material Settings

The Material Settings let you do the following:

- Create material properties for models
- Define and modify material properties to create various effects such as transparency, reflectivity, shine, and multi-colors for objects in your scene.

A model’s material properties may be used with texture settings when applying textures, and by shader settings when applying certain shaders.

To open the Material Settings, add a new material to your scene, by expanding the Materials folder in the Asset browser, and dragging a Material asset into the Viewer window, dropping it on top of the desired object.

The new material appears in the Materials folder in the Scene browser and is named “Material” by default. The Material Settings display in the Navigator window.



Material Settings

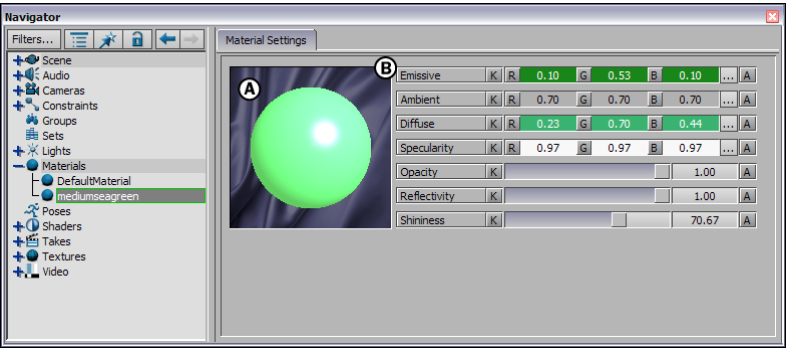
If there is no material applied to an object, a Default Material appears in the Materials folder of the Scene browser. See [Default Material](#) on page 392.

The Material Settings consist of two areas:

- [Material proxy](#) on page 388
- [Material Properties area](#) on page 389

Material proxy

The Material proxy depicts a sphere on which the material’s color, opacity, reflectivity, and specularity are represented as you change them.



A. Material proxy B. Material Properties

Use this proxy when composing or modifying the material for your model.

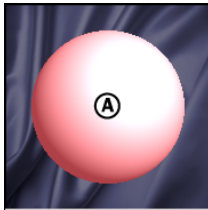
Material Properties area

The Material Properties area contains settings with which you can modify the attributes relating to the materials applied to an object.

When all the color and level adjustments are complete, drag your current material to the selected model. Any changes you make in the Material Properties update in real time.

Emissive slider

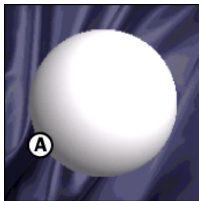
The Emissive slider lets you define the RGB color for the glow of a material. The Emissive color of an object is constant and uniform.



Material proxy A.
Emissive

Ambient slider

The Ambient slider lets you define the RGB color of the light reflected by a material. Ambient color is the general brightness of the material and comprises the dark range of color in a material's contrast.



Material proxy A.
Ambient color

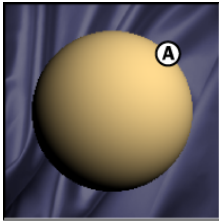
The Ambient color of an object depends on the lighting in your scene.

Diffuse slider

The Diffuse slider lets you define the base RGB color of a material. Diffuse color comprises the light range of color in a material's contrast.

The Diffuse color of an object is uniform and constant. It relies on the position and color of the lights in your scene and is not affected if you change the current camera view.

The Diffuse color field defines the color of the geometry. This field is ignored when using colored textures.

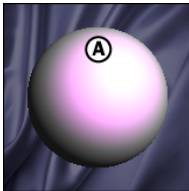


Material proxy A.
Diffuse color

Specularity slider

The Specularity slider lets you define the RGB color of a model's specular highlights, or “shiny” areas.

The Specular color of an object depends on the shine of an object, the position of your light sources, and the current camera view.



Material proxy A.
Specular highlight

Opacity slider

The Opacity slider lets you define the level of opacity for a material. Adjust this slider to increase or decrease the transparency of an object. A value of 100 creates an opaque effect, while a value of 0 means that the object is completely transparent.



Material proxy:
Opacity settings

This slider can only be used with the Flat or Lighted shaders.

Reflectivity slider

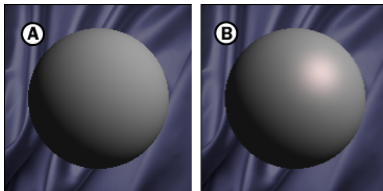
The Reflectivity slider lets you define the amount of light that bounces off a model.

NOTE This slider is active only when you apply a Reflection shader to the model. See [Making objects reflective](#) on page 465.

Shininess slider

The Shininess slider lets you define the level of light reflected on a material. Adjust this slider to control the distribution of an object's specular highlight.

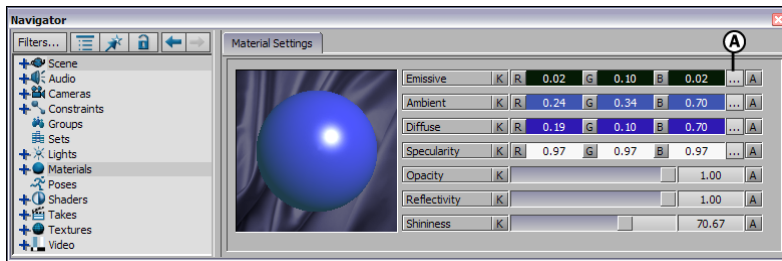
Low values result in a large, soft glow, and high values define a smaller, sharper highlight.



A. Before setting Shininess B. After setting Shininess

Color button

The Color button opens the Color window which lets you modify your material's color values. It is available for use with the Emissive, Ambient, Diffuse and Specular color options. See [Color window](#) on page 4 for more on the Color window.



Material Properties A. Color button

- [Making objects reflective](#) on page 465
- [Creating transparent objects](#) on page 469
- [Using the Color window](#) on page 9

Default Material

The Default Material is automatically applied to every model created in the scene. The Default Material appears in the Scene browser Materials folder.

NOTE You cannot delete the Default Material.

When you create or import objects into MotionBuilder, there are no textures or materials assigned to them. Without textures or materials applied to them, objects remain gray shapes. Textures add realistic surface detail to models without the need for complex geometric transformations.

A texture is based on an image or video clip. You can have many textures based on the same image with different texture settings.

The Texture settings let you do the following:

- Apply images, video clips, or live streaming video to selected models, planes, or cameras
- Add depth, color, and patterns to objects in your scene
- Modify texture settings such as Texture Type, Mapping Method, Translation, Scaling, and Rotation

The Texture settings contain three different areas:

Image Preview area

The Image Preview area contains controls for loading an image or movie, and previewing its RGB or Alpha channels. See [Image Preview area](#) on page 409.

Texture Appearance area

The Texture Appearance settings let you fine-tune settings related to the appearance of the selected texture. See [Texture Appearance settings](#) on page 411.

Texture Mapping area

The Texture Mapping area of the Texture Settings contains controls related to the mapping of the selected texture. See [Mapping area](#) on page 413.

- [Adding a texture to a model](#) on page 394

■ Texture Appearance settings

Adding a texture to a model

- 1 Open the Materials folder in the Asset browser.
- 2 Drag a Texture asset onto an object in the Viewer window.
A new texture is added in the Scene browser in the Textures folder. The Texture settings appear in the Navigator window.
- 3 Expand the Textures folder in the Scene browser.
- 4 Double-click the Texture.
- 5 Select New Media in the Texture setting's Media menu. A file browser opens.
- 6 Browse for a texture file and click Open.

If a texture is already added to the model, a contextual menu will appear. Select Replace if you want the new texture to replace the model's current texture, or select Append to add more than one texture to the model.

NOTE You cannot add the same instance of texture to an object twice. To have the same texture appear multiple times, drag a new texture onto the object and select the same image file.

Applying a video texture

- 1 Open the Materials folder in the Asset browser.
- 2 Drag a Texture asset onto an object in the Viewer window.
A new texture is added in the Scene browser in the Textures folder. The Texture settings appear in the Navigator window.
- 3 Expand the Textures folder in the Scene browser.
- 4 Double-click the Texture.

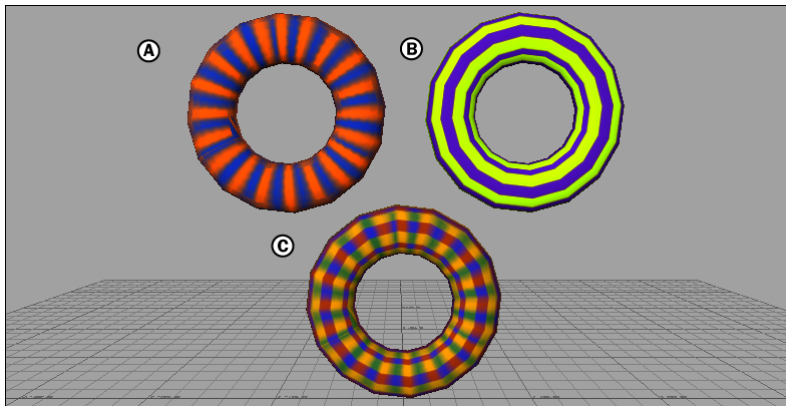
- 5 Select New Media in the Texture setting's Media menu. A file browser opens.
- 6 Browse for a video file and click Open.

NOTE MotionBuilder supports video clips such as .avi or .mov files.

The Video settings window appears in the Navigator window. For more information about configuring the Video settings, see [Video settings](#) on page 201.

Applying multiple textures to an object

To add more than one texture to a model in your scene, drag a new texture onto the object each time you want to use the texture, select Append and use the same image file.



Both the textures from A. and B. added to the torus C.

See [Changing a texture's mapping](#) on page 402 for information on how to position your texture.

Testing shaders, textures, and materials

Sometimes, before using a texture, you will want to test it out before applying it to your models.

To test a texture:

- 1 Drag a cube object into the scene from the Asset browser.
- 2 Apply the shader, texture, or material you want to test by dragging it from the Asset browser onto the cube.
- 3 Adjust the settings for the shader, texture, or material using the settings in the Navigator window.

Tiling your texture

Once you have applied a texture to your object, use the following steps to tile your textures. (To apply a texture to an object, see [Adding a texture to a model](#) on page 394.)

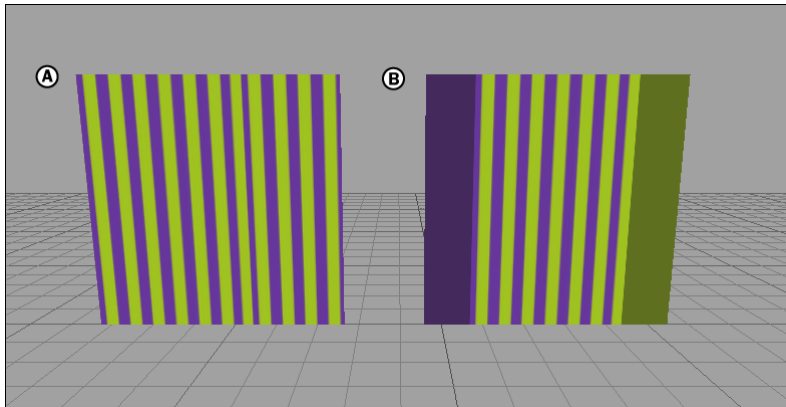
- 1 In the Scene browser, expand the Textures heading and double-click the texture you want to tile. The Texture settings appear in the Navigator and Properties windows.
- 2 Use the following settings to affect the way your texture covers the object:

U/V Tile

The U and V tile menus let you set the repetition of textures on a model's U or V coordinates.

Choose one of two options:

| Option | Description |
|--------|---|
| Repeat | Applies the texture over and over on the model's surface until the model is covered. This is the default setting. |
| Clamp | Applies the texture to a model only once, using the color at the ends of the texture as the "filler". |



The same striped texture on two planes A. Texture set to U repeat. B. Texture set to U Clamp.

Swap UV

Activate the Swap UV option to change the direction of the texture's UV map coordinates.

Translation values

Use Translation to position how your texture is displayed. Set a value to modify the UV starting position of your texture.

The data in these fields determines where your texture is applied on a selected model.

NOTE You can key and animate these settings.

Scaling values

Use Scaling to stretch, shrink, or tile your texture. Set a value to modify the UV scaling of your texture.

The data in these fields determines the size of your texture relative to a selected object.

NOTE You can key and animate these settings.

Rotation slider

Use the Rotation slider to adjust the rotation of your texture on the object to which it is applied. Your texture's rotation can range from 0 to 360 degrees. Rotation uses the texture's center as the pivot point.

NOTE You can key and animate these settings.

- [Texture coordinates](#) on page 398
- Texture settings

Texture coordinates

Texture coordinates, also called mapping coordinates, are the numbers that tell the engine where to position textures on mesh. The engine uses three texture coordinates, commonly called U, V, and W. U is the width of the texture, V is the height, and W is used for depth if you are using a 3D procedural texture.

The coordinates are measured in a scale of 0.0 to 1.0, with 0.0 and 1.0 at opposite sides of the texture. Numbers higher than 1.0 will make the texture tile, and negative numbers will mirror the texture.

With most 3D modelling software, these numbers are usually hidden from the artist, replaced by helpful visual representations of how the textures are projected. Planes, cylinders and spheres help the artist align the textures in a visual way, but it helps to know that engines see only the UVW numbers that these shapes create for the polygons.

Texture mapping

A Texture map is a way of controlling the diffuse color of a surface on a pixel-by-pixel basis, rather than by assigning a single overall value. This is most commonly achieved by applying a color bitmap image to the surface.

Color patterns can also be generated by the application itself to create what are called "procedural textures." The term texture map is confusing because it is actually a color map, and there are other surfacing mapping techniques that directly affect texture.

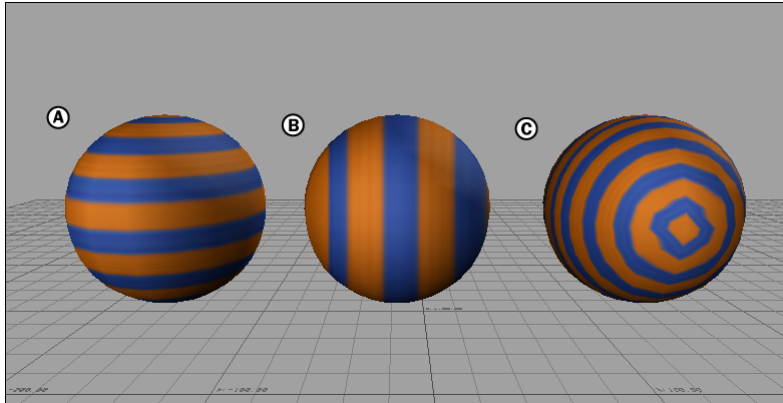
Image Map textures

Image Map textures use graphic files (*.tifs*, *.bmps*, *.jpgs*, and so on) applied to the 3D object. These can be drawn quickly, but use some of the computer's memory (RAM) to store the image.

Image Map textures are preferred by animators over Procedural Textures because procedural textures take too much memory to compute and slow the animation down.

Projective textures

Projective textures are image map textures that project an image onto an object's surface as if it was a slide. You can use projective textures to create shadows and Spot light effects, among other things.

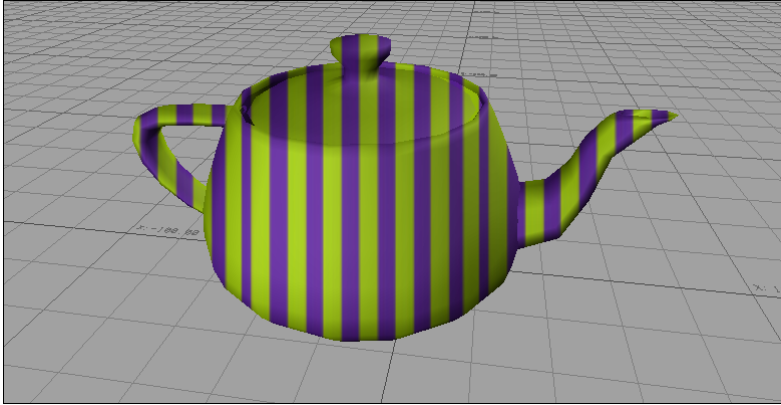


Texture mapping methods A. UV map B. Projective map C. Spherical map

Projective textures do not require specific texture mapping coordinates, unlike image map and procedural textures.

Projective textures cause strange effects when used on three-dimensional objects, as they do not recognize the object's shape so much as project directly onto the front of it.

In , note how the striped texture does not recognize the curve of the teapot's lid, bowl, spout, or handle.



Teapot model with Projective texture

- [Adding a texture to a model](#) on page 394
- [Testing shaders, textures, and materials](#) on page 395

Procedural textures

Procedural Textures are arithmetically-based, requiring no storage of graphics files. Unlike Image Map textures that are simply graphics files, the computations needed to portray the texture are performed by the computer's processor. This lets you create textures that do not use a lot of memory.

While this seems efficient because it uses less memory, there is a trade-off. Procedural textures can take more time for a computer to process because it needs to compute complex texture algorithms.

UV texture

A UV texture lets you use the U and V coordinates (width and height) to position the texture on the 3D mesh. U represents the width of the texture, V the height, and W for depth if you are using a 3D procedural texture.

UV Textures let you position the texture precisely, so for example, a face texture's eyes, nose, and mouth correspond correctly with the model.

- [Adding a texture to a model](#) on page 394

Texture types

The texture type you choose for the texture depends on which shaders are already applied to your selected object.

When you generate a map in the Reflection or Shadow Map shader, a texture is automatically created in the Texture settings, using the designated texture type.

The Spherical Reflection, Sphere, Shadow, Light and Bump Map options must be used with the appropriate shader and map type, as described in the following table.

| Type | Description |
|--------------------------|--|
| Color | Used with all textures; applies media straight onto the object. |
| Spherical Reflection Map | Used when the Reflection shader is set to Spherical Map type in the shader settings. See Reflection effects on page 463. |
| Sphere Map | Used when the Reflection shader is set to Sphere Map type in the shader settings. See Reflection effects on page 463. |
| Shadow Map | Used when the Shadow Map shader is set to Shadow Map type in the shader settings. See Shadows and lighting effects on page 485. |
| Light Map | Used when the Shadow Map shader is set to Light Map type in the shader settings. See Shadows and lighting effects on page 485. |
| Bump Map (Normal Map) | Used with the Bump Map shader. You can also use these options with imported models that use a Reflection or Shadow Map shader. For example, if you want to use a Sphere Map created in Maya, set the |

| Type | Description |
|------|---|
| | Texture Type to Sphere Map and load the Sphere Map as a texture on the model with a Reflection shader. See Surface effects on page 469. |

- [Adding a texture to a model](#) on page 394

Texture tiling

The method of repeating a texture more than once across a polygon. A tiled texture looks best if its edges seamlessly match up with each other, top to bottom and side to side.

Tiling is a common method of using the smallest texture possible to cover a large area, like a small texture of a couple bricks tiling across a large polygon, creating a big brick wall.

Changing a texture's mapping

To set mapping settings for your texture, use the Mapping Method menu in the Scene browser or Properties windows Texture settings.

- 1 Select the texture in the Scene browser.
- 2 Select UV to map your texture using texture space in the Scene browser or Properties window Texture settings. This option uses the UV coordinates that are assigned to the vertices of your model.
If your model does not have UV coordinates, the UV mapping option has the same effect as the XY mapping option.
- 3 Select the XY, YZ, or XZ options to map a selected texture to the bounding box of your object. The bounding box is then applied to your model.
 - Select XY to map the image on the XY plane of the bounding box.
 - Select YZ to map the image to the YZ plane
 - Select XZ to map the image to the XZ plane.

- 4 If you want to wrap your texture around the model as if it were either a sphere or a cylinder, select the Spherical or Cylindrical texture options.
- 5 Use the Environment mapping option to apply a texture to an object that is reflective.
For the best results, test the image by applying the image to a sphere before applying it to your model, and use it with a Reflection shader.
- 6 If you want to project the texture image straight onto the object, use the Projection option.
The image is always projected from the current camera's viewpoint.

- [Adding a texture to a model](#) on page 394
- Texture settings

Mapping method types

The Mapping Method menu lets you specify the mapping settings for your texture.

Use the Mapping Method options to map your texture to a selected object according to its coordinates (UV, XY, YZ, or XZ), to a designated wrap option (Spherical or Cylindrical), or use Environment mapping.

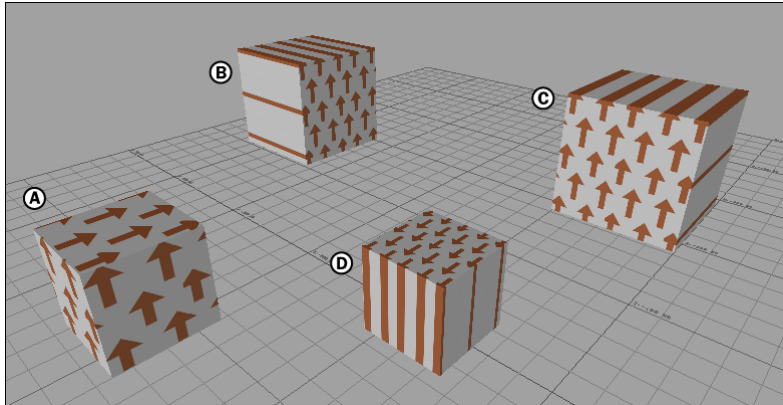
UV option

Use UV to map your texture using texture space. This option uses the UV coordinates that are assigned to the vertices of your model.

XY, YZ, and XZ options

Use the XY, YZ, or XZ options to map a selected texture to the bounding box of your object. The bounding box is then applied to your model.

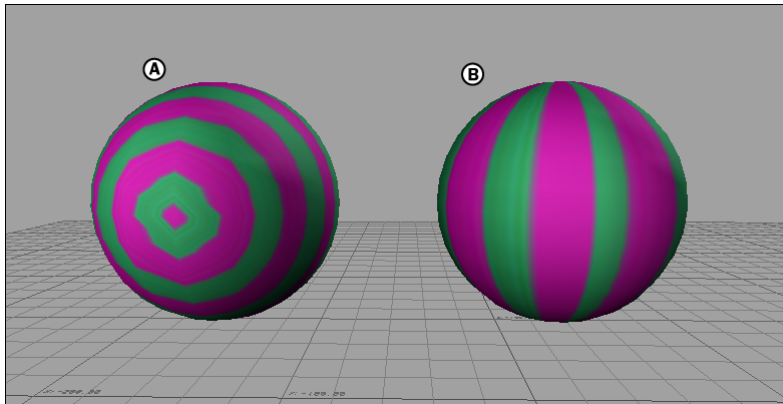
An example of each mapping style is shown below.



A. UV mapping B. YZ mapping C. XY mapping D. XZ mapping

Spherical and Cylindrical mapping options

Use the Spherical or Cylindrical mapping options to wrap your texture around the model as if it were either a sphere or a cylinder. Each method distorts the image in different ways and introduces a different seam. In the following image, a simple striped texture is mapped to two spheres, one using Spherical wrapping and one using Cylindrical mapping.



A. Spherical mapping B. Cylindrical mapping

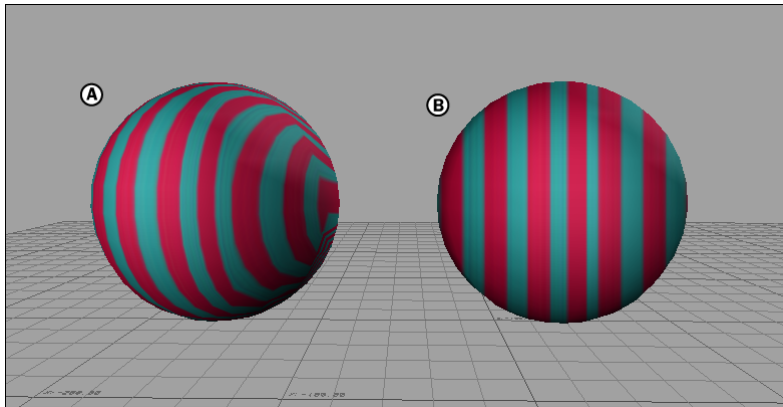
When you wrap a texture around a model, there is always an area where the sides of the image meet. This area is called the seam. The visibility of the seam depends not only on the selected mapping type (Spherical or Cylindrical), but also on the model and the image.

It is recommended that you use an image that can be tiled to reduce the size of the seam. A “tileable” image is an image where all sides match each other. You can easily create a tileable image with most common commercial paint programs.

Environment mapping

Use the Environment mapping option to apply a texture to an object that is reflective.

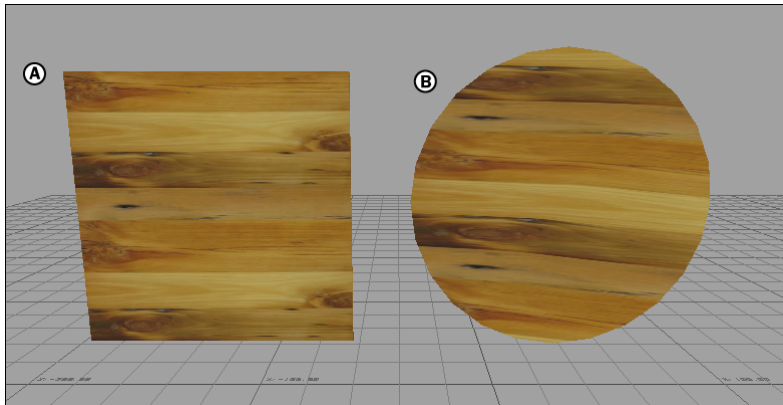
Environment mapping is a form of reflection mapping best suited for situations when you are filming a model from a single point of view. To achieve real-time performance, this method of reflection mapping sacrifices realism that may be noticeable from many different angles or when filming the model using a moving camera. You can see this in the following image, where A has the right side of the first sphere’s stripes as slightly warped.



A. Environment mapping B. Projection mapping

For the best results, test the image by applying the image to a sphere before applying it to your model, and use it with a Reflection shader.

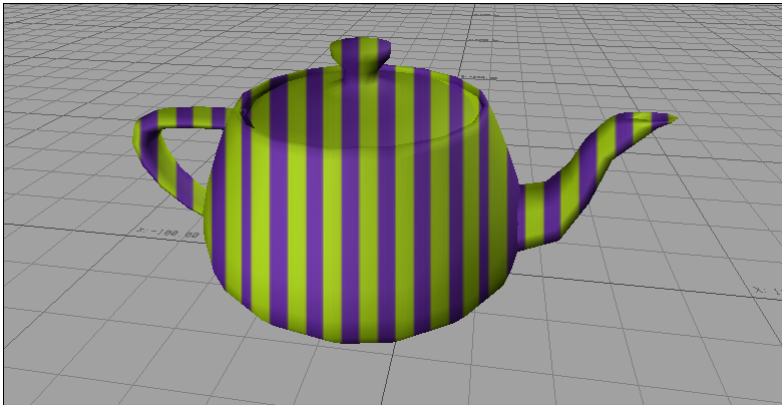
For example, shows the difference between a typical rectangular image, and one that is better suited for Environment mapping. You can use both images, but when using a spheroid image, use Environment mapping for a better result.



A. Original image B. Spherized image

Projection mapping

Projection mapping projects the image straight onto the object, like a slide projector, creating a two-dimensional image that does not “wrap” around the object.



Projection textures do not work well with curved objects.

The image is always projected from the current camera’s viewpoint.

- [Adding a texture to a model](#) on page 394
- [Applying a video texture](#) on page 394
- [Changing a texture’s mapping](#) on page 402

Mipmapping

Mipmapping is a way of compensating for small imperfections created by the computer's graphics card that can appear when you use detailed textures on a small object. Mipmapping creates a version of the original texture that has been reduced in size down to 1 by 1 pixel.

This solves the problem of textures with small objects “flickering” created by the filtering process as the object gets further away. By using many “mipmaps” of the larger texture, the filtering happens on a much smaller level, which improves its overall appearance. See [Use MipMaps](#) on page 413.

Texture settings

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The Texture settings in the Navigator window is where you load and position a texture, once a Texture asset has been applied to a model. See [Adding a texture to a model](#) on page 394 for more on how to apply textures to objects in your scene.

The Texture settings are divided into three areas, the Image Preview area, the Texture Appearance settings, and the Mapping area.

Image Preview area

The Image Preview area contains controls for loading an image or movie, and previewing its RGB or Alpha channels.

RGB and Alpha Options

Select either the RGB or Alpha options to preview the RGB channels or the Alpha channel of a loaded image.

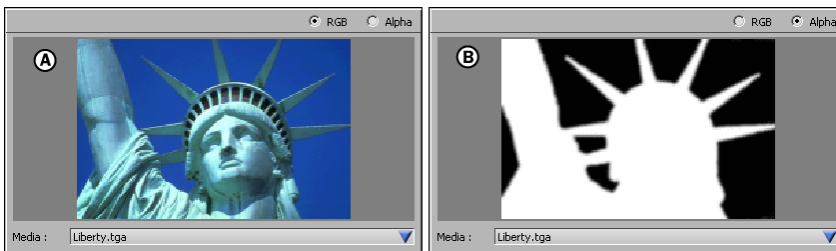


Image Preview RGB (A) or Alpha (B) selected

Texture Proxy

When a texture is selected from the Texture list, the image or video file appears in the Image Preview area.

For video textures, the Image Preview proxy plays the video clip when you play your take. The Texture proxy only appears when a texture is selected in the Scene browser.

The Image preview is where the preview of the RGB or Alpha of the loaded image appears.

Media menu

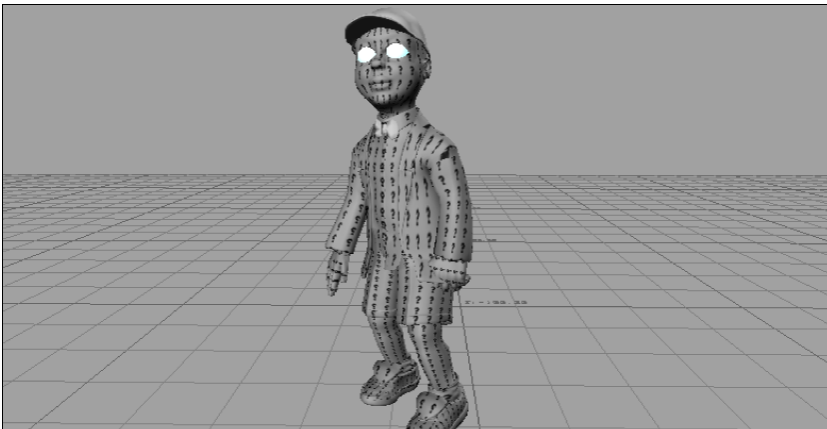
The Media menu displays the name of the loaded image and includes the Media menu where you can choose the appropriate image based on images available in your scene.

You can change the image or video clip used by a texture even after it has been applied to a model. All models using the selected texture are changed to the new image or video clip. The image name and the texture's proxy are updated.

You can choose the media for use by a selected texture. The texture's media can be an image, a video clip, or live streaming video.

Select the following options from the Media menu:

None



Question marks appear if a texture is applied that has no media.

The None option applies no texture to the object. In place of an image, question marks are displayed on the selected object in the Viewer window.

New Media

The New Media option lets you link an image file or video clip to your selected texture.

NOTE MotionBuilder supports .tga, .jpg, .jpeg, .tif, .tiff, .pic, .bmp, .sgi, .rgb, .rgba, .yuv, and .iff image formats, and .avi, .qt, and .mov video formats.

Image files used as texture cannot exceed a maximum size of 1024x1024 pixels. On OpenGL machines, the number of pixels both horizontally and vertically should be to the power of 2. For example, 16, 32, 64, 128, 256, 512, or 1024 pixels.

If the number of pixels is between each range, the image is scaled down to the preceding power of 2. For example, an image measuring 18x32 is scaled to 16x32. An image measuring 40x77 is scaled to 32x64.

NOTE Scaling down images lessens the image's detail. Try to keep your images as close to the power of 2 as possible.

Image Size

The Image Size fields display the X and Y size of your selected texture. These values are included as a reference only; you cannot change these fields.

■ [Adding a texture to a model](#) on page 394

Texture Appearance settings

The Texture Appearance settings let you fine-tune settings related to the appearance of the selected texture. The Texture Appearance settings consist of Texture Type, Blend Mode, Transparency, Use Material and Use Mipmaps.

Texture Type

The Texture Type menu lets you specify the purpose the texture serves. Textures can be applied or mapped to a selected object in various ways.

The texture type you choose for the texture depends on which shaders are already applied to your selected object.

Blend Mode

The Blend Mode menu lets you control how textures are combined when multiple layers of texture are applied to an object.

Translucent

The new texture layer is transparent, depending on the Alpha settings.

| Option | Description |
|-----------|--|
| Additive | The color of the new texture is added to the previous texture. |
| Modulate | The color value of the new texture is multiplied by the color values of all previous layers of texture. |
| Modulate2 | The color value of the new texture is multiplied by two and then multiplied by the color values of all previous layers of texture. |

Transparency

Adjusting the Transparency field changes the transparency levels of multiple textures.

The higher the field value, the more transparent the bottom layers of texture. The lower the field value, the more transparent the top layers of texture become. The bottom layers of texture remain unaffected.

Use Material

Activate Use Material to color an object using a material with the texture. For example, you can apply an image-based texture and a transparent material to a model.

The material acts as a tint, modifying the color of the texture.

Use MipMaps

Activate Use MipMaps to create a proxy of an existing image. Using MipMaps with large image files provides better image Anti-aliasing and gives optimal resolution. See [Mipmapping](#) on page 407 for more information.

Mapping area

The Texture Mapping area of the Texture Settings contains controls related to the mapping of the selected texture. The Texture Mapping settings consist of U and V Tile, Translation, Rotation and Scaling.

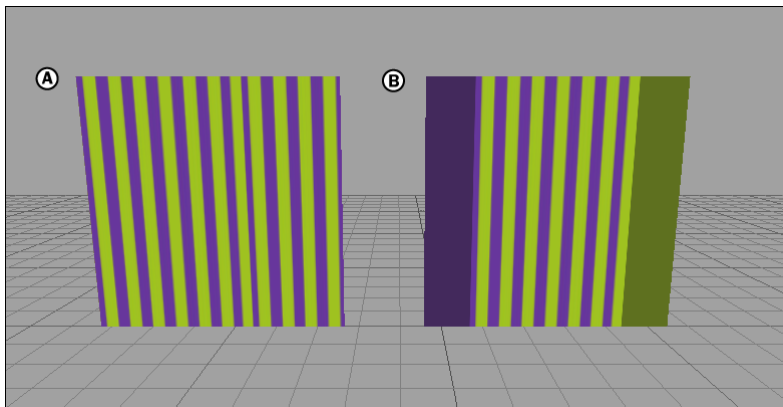
Mapping Method

The Mapping Method menu lets you specify the mapping settings for your texture. Use the Mapping Method options to map your texture to a selected object according to its coordinates (UV, XY, YZ, or XZ), to a designated wrap option (Spherical or Cylindrical), or use Environment mapping.

U/V Tile

The U and V tile menus let you set the repetition of textures on a model's U or V coordinates.

In the following figure, two planes have the same texture applied, but each uses a different mapping method from the U/V tile menu.



The same striped texture on two planes A. Texture set to U repeat. B. Texture set to U Clamp.

Both menus let you choose one of two options, Repeat and Clamp:

| Option | Description |
|--------|---|
| Repeat | Applies the texture over and over on the model's surface until the model is covered. This is the default setting. |
| Clamp | Applies the texture to a model only once, using the color at the ends of the texture as the "filler". |

Swap UV

Activate the Swap UV option to change the direction of the texture's UV map coordinates.

Translation

Use the Translation values to modify the UV starting position of your texture. The data in these fields determines where your texture is applied on a selected model.

Scaling

Use the Scaling values to modify the UV scaling of your texture. The data in these fields determines the size of your texture relative to a selected object. Use Scaling to stretch, shrink, or tile your texture.

Rotation

Use the Rotation slider to adjust the rotation of your texture on the object to which it is applied. Your texture's rotation can range from 0 to 360 degrees. Rotation uses the texture's center as the pivot point.

- [Adding a texture to a model](#) on page 394
- [Mapping method types](#) on page 403
- Texture settings

Shaders

This section is about using Shaders to create effects in MotionBuilder. Like Materials, and Textures, Shaders also control the surface appearance of 3D models, creating further depth and detail.

Unlike a texture, which is simply an image file stretched or tiled across a 3D object, a shader gives your objects descriptive properties like shadowing or reflectivity.

Shaders control the way the surface interacts with the lighting in the scene, creating color, specularity, reflection, transparency, shadowing, and refraction effects.

This section covers MotionBuilder shaders, their settings, properties, and how you can use them to create environmental and surface effects for your scenes.

This section covers the following topics:

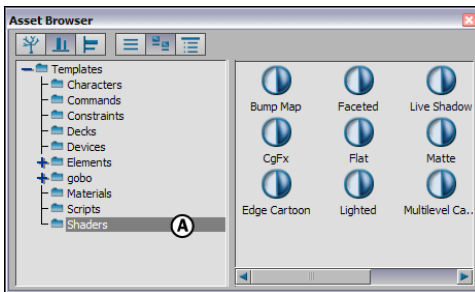
- [Shader basics](#) on page 417
- [Cartoon effects](#) on page 431
- [Environmental effects](#) on page 447
- [Reflection effects](#) on page 463
- [Surface effects](#) on page 469
- [Shadows and lighting effects](#) on page 485
- [Shader manager](#) on page 501

Shader basics

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Like Materials, and Textures, shaders also control the surface appearance of 3D models, creating further depth and detail. Unlike a texture, which is simply an image file stretched or tiled across a 3D object, a shader gives your objects descriptive properties like shadowing or reflectivity.

In the Asset browser, the Shaders folder contains shaders that you can add to a scene. When you drop a shader on an object, you are assigning values to its surface. These values control the way the surface interacts with the lighting in the scene, creating color, specularity, reflection, transparency, shadowing, and refraction effects.



Asset browser A. Shaders folder

In the following figure, three teapots are arranged on a tray. Textures and Materials have been applied to all objects in the scene, a floral texture for the teapots and a wood pattern for the tray.



Textured models with no shaders applied.

Somehow the models are still missing an element of realism. The flat, dull, texture creates the appearance that all objects in the scene are constructed from the same, uniform substance.



Shader examples: A. Lighted shader B. Edge Cartoon shader C. Bump Map shader.

In the examples above, shaders have been applied to the teapots and tray:

- The first teapot has a Lighting shader applied to it, so the “china” reflects the light, making it slightly shiny.
- The second teapot has an Edge Cartoon shader applied to it, so it is outlined like a two-dimensional drawing.
- The third teapot has a Bump Map shader applied to it to give it the appearance of a bumpy, modelled surface.

- The wooden tray has a Live Shadow shader applied to it so it shows the shadow from anything blocking light from it.

While the teapots are all identically modelled and textured, adding shaders makes them appear to be composed of very different materials.

- [Shader effects](#) on page 419
- [Applying a shader to a model](#) on page 424
- [Testing shaders, textures, and materials](#) on page 425
- [Activating and disabling shaders](#) on page 427

Shader effects

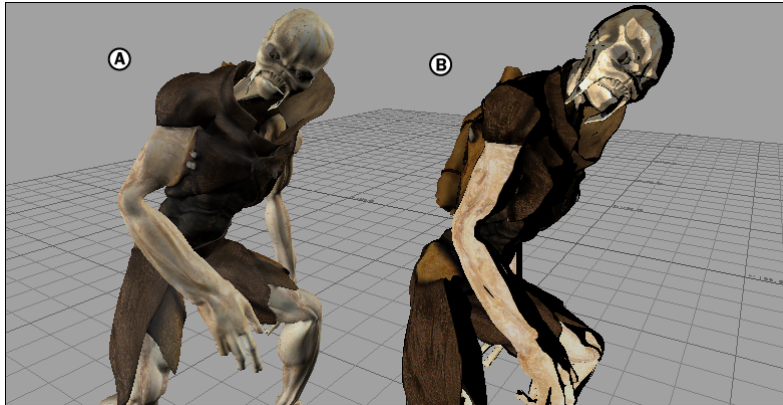
There are many shader types which provide various effects, and used for many purposes. There are equally as many ways to categorize them.

Shaders can provide cartoon, reflection, and environmental effects.

Cartoon look

While most shaders can make your models look more realistic, cartoon-style shaders give your character a comic book look.

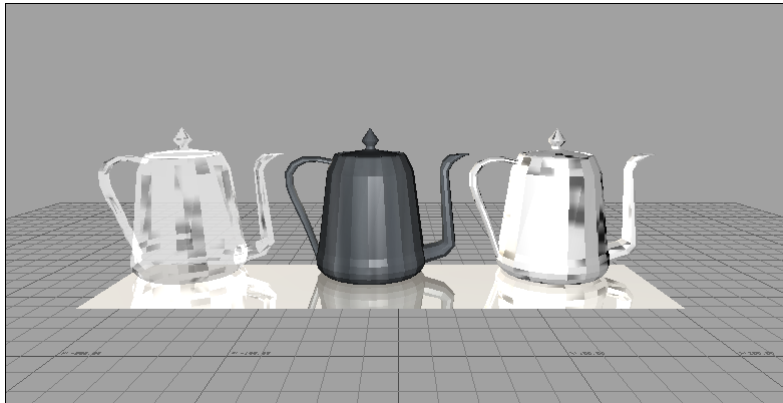
In the following figure, a character has shaders applied which flatten its color depth and outline its form, giving it a two-dimensional cell-animation look to it, even though it is a 3D model.



Cartoon Look A. With no shaders B. With Cartoon shading.

Reflections

Textures and materials applied to a 3D model cannot give you the sharp reflection effects needed to imply glass, chrome, or mirror. For these effects, you must use reflection shaders.



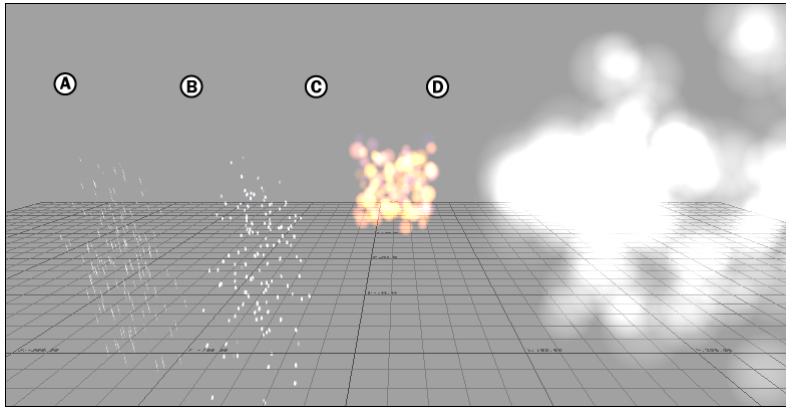
Reflection shader examples

Reflection shaders make your objects reflect the world around them, but their effects are not limited to creating mirrors. Combine them with transparency to create a shiny glass look, or combine them with a dark material to create a brushed steel look.

You can use live reflections, which will accurately reflect animation in the scene, or a map shader to create a static reflection that does not react to animation around it.

Environmental

You can use shaders to create environmental effects such as clouds, fire, fog, and rain.



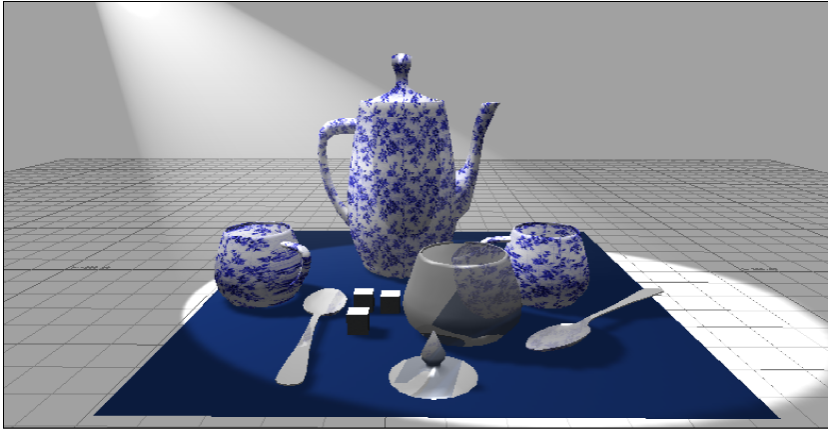
Environmental presets A. Rain B. Snow C. Fireball D. Cloud

Shaders can be applied to objects to create environmental effects like fire, fog, snow, and rain. Because the shader is meant to create an environmental effect, it is applied to a simple object, such as a cube, that defines the area in which the environmental effect occurs. Instead of appending the shader to the object, you replace the object with the shader, so that the model is hidden and only the effect of the shader is visible.

Shadows and lighting

Lighting alone does not convey atmosphere, but how objects react to light does. Use shaders to create realistic shadows and lighting on planes and objects in your scene.

Adjust the shadow intensity to create subtle differences between a ghostly or silhouette effect.

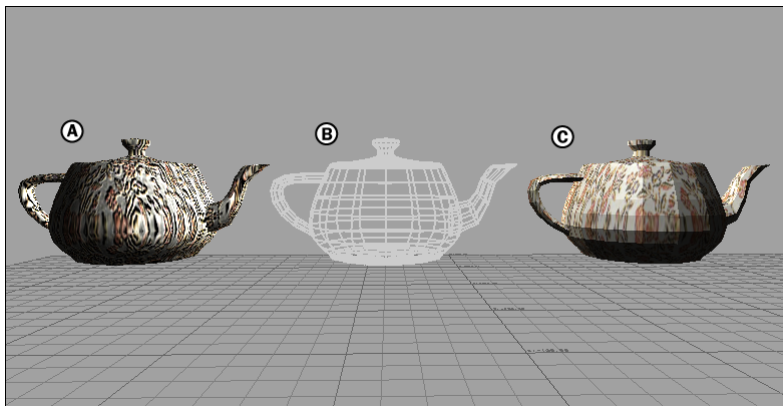


Shadow shader example

Surface effects

You can use shaders to create surface effects on objects that imply that the models have depth and substance, even when the original model was smooth. These effects create further depth and detail.

Some surface effect shaders are derived from the model's construction. like the Faceted or Wireframe shaders, while the Bump Map shader lets you create the appearance of a textured surface.



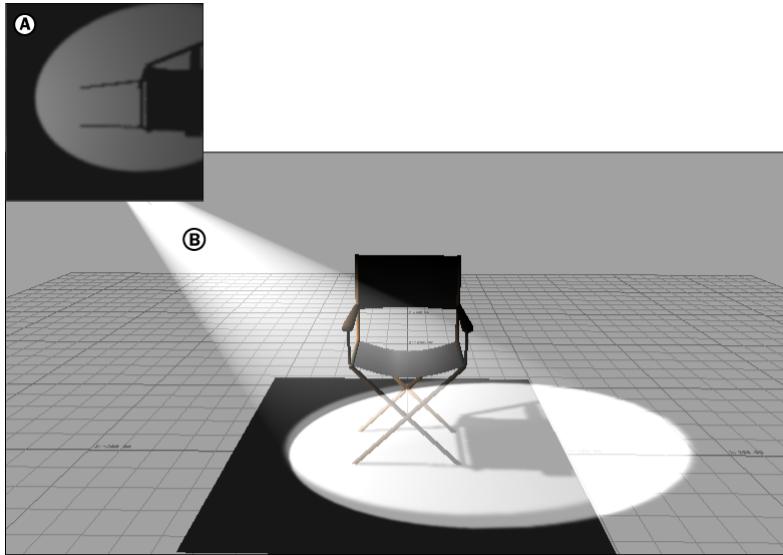
Surface effects A. Bump map B. Wireframe C. Faceted

■ [Testing shaders, textures, and materials](#) on page 425

- [Applying a shader to a model](#) on page 424

Map shaders

Map shaders take a “snapshot” of the scene at the moment it is rendered, and applies it to an object as a texture.



Map examples *A. Created map* *B. Scene with the shadow map applied to the floor plane.*

Map shaders is a useful alternative to live shaders as they do not demand much of the system’s resources to display.

Map shaders are used when the environment surrounding an object does not change. In the figure above, a map shader is used to portray the shadow cast by a chair; as long as the chair, the cast light, and its environment are static, the shadow map is appropriate.

If something crosses the path of the light beam, it does not cast a shadow. You can combine Live Shadow shaders with map shaders in the same scene to save system resources.

That way the light in a scene cast by a sun or lamp never changes by the shadows cast by the animated character does.

- [Shader effects](#) on page 419
- [Applying a shader to a model](#) on page 424
- [Live shaders](#) on page 424

Live shaders

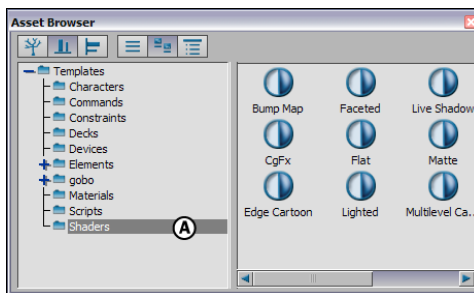
Live shaders are used to show effects caused by moving objects, for example shadows or reflections, providing your animation with a realistic look.

The only setback with live shaders is that they use up active memory, and a scene with too many live shaders can slow down. With careful planning, scenes can be constructed using a combination of live and map shaders to save resources.

- [Shader effects](#) on page 419
- [Applying a shader to a model](#) on page 424
- [Map shaders](#) on page 423

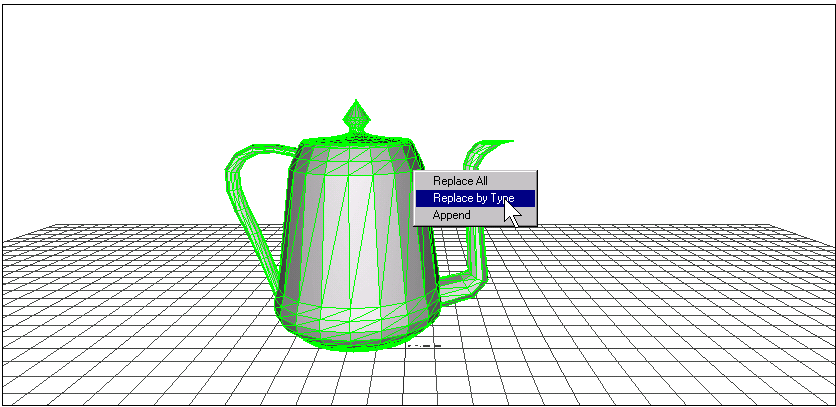
Applying a shader to a model

- 1 Add a shader to an object by dragging a Shader asset from the Asset browser Shaders folder into the Viewer window.



Asset browser A. Shaders folder

- 2 Drop the shader on top of the selected object and a contextual menu appears with the following three choices.



Viewer window A. Shader contextual menu

| Option | Description |
|-----------------|---|
| Replace All | Select Replace All to remove all other shaders applied to this object and use the new shader. |
| Replace by Type | Select Replace By Type to replace all shaders of a certain type with the new shader. |
| Append | Select Append to add the new shader to any shaders already applied to the object. |

- [Activating and disabling shaders](#) on page 427
- [Hiding the Default shader](#) on page 427

Testing shaders, textures, and materials

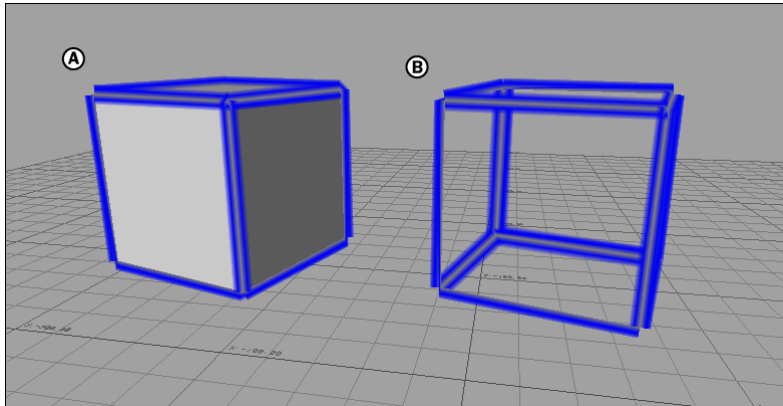
- 1 Drag a cube asset into the scene from the Asset browser's Elements folder.

- 2 Apply the shader, texture, or material you want to test by dragging it from the Asset browser onto the cube.
- 3 Adjust the settings for the shader, texture, or material using the settings in the Navigator window.

- [Shader effects](#) on page 419
- [Applying a shader to a model](#) on page 424

Default shader

The Default shader is automatically applied to every model that appears in the scene. When you apply a shader to an object using the Append or Replace by Type selection from the contextual menu, the model remains.



Edge Cartoon shader A. With the Default shader. B. Without the Default shader.

If there is no shader applied to a selected object, “Default shader” appears in the Shader 1 column of the Shader manager. Use this shader as a quick way to reset shaders applied to your model.

If you want to remove the object so that it reveals only the effect of the shader, right click the Default shader in the Scene browser and select Detach Default shader from Selected Objects.

You cannot delete the Default shader, you can only detach it from all or selected objects.

- [Hiding the Default shader](#) on page 427

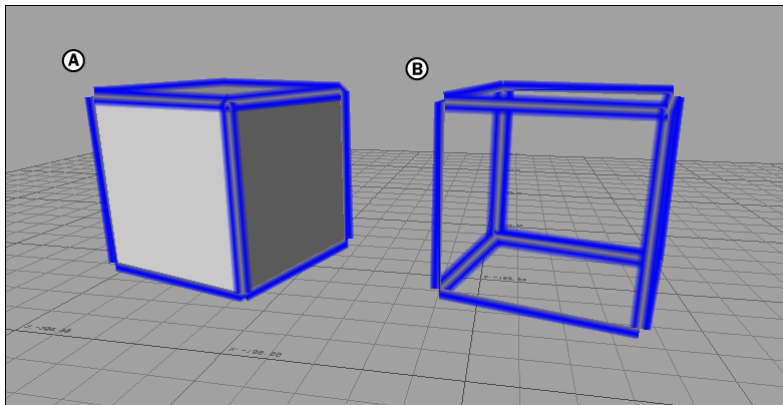
- [Applying a shader to a model](#) on page 424
- [Activating and disabling shaders](#) on page 427

Hiding the Default shader

You cannot delete the Default shader, you can only detach it from all or selected objects

- 1 In the Scene browser, expand the Shaders folder and right-click Default shader.
- 2 Select Detach Default shader From All Objects from the contextual menu.

To remove the object so that it reveals only the other effects applied to it, select the object and right-click the Default shader in the Scene browser, but select Detach Default shader from Selected Objects.



Edge Cartoon shader A. With the Default shader. B. Without the Default shader.

- [Applying a shader to a model](#) on page 424

Activating and disabling shaders

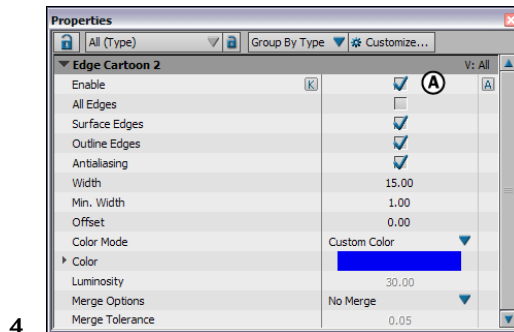
Disable shaders when you want to temporarily remove the effect of the shader from an object. This can be useful when you are working on a scene with

many shaders that are slowing your system down. There are three ways to do this:

- [Properties window](#) on page 428
- [Scene browser](#) on page 428
- [Shader manager](#) on page 429

Properties window

- 1 Select the shader that you want to disable in the Scene browser
- 2 Open the Properties window and disable the Enable option.
- 3 Activate the Enable option to restore the shader.



4
Properties window A. Edge Cartoon shader
Enable option

Scene browser

- 1 Expand the Shaders folder in the Scene browser.
- 2 Right-click the shader you want to remove and select Detach Shader from all Objects. Every instance of this shader is removed.

The shader remains in the Scene browser's Shaders folder, so you must reapply the shader to the model if you want to use it again.

Shader manager

- 1 Select the model with the shader you want to remove in the Viewer window.
- 2 In the Scene browser, double-click the Shaders folder. The Shader Manager displays.
- 3 In the Shader columns area of the Shader Manager, select No Shader to detach the selected shader from the selected object.
If you have no model selected, the No Shader option affects all models in the scene.

Cartoon effects

32

While most shaders can make your models look more realistic, cartoon-style shaders give your character a comic book look.

This sub-section covers the Edge Cartoon, Multilevel Cartoon, and Flat shaders, as well as the various properties contained within the them and how you can use them to create a cartoon effect.

There are three shaders that can give this effect, see:

- [Applying the Flat shader](#) on page 432
- [Applying the Multilevel Cartoon shader](#) on page 437
- [Applying the Edge Cartoon shader](#) on page 441



Cartoon Look A. With no shaders B. With Cartoon shading.

Applying the Flat shader

To apply the Flat shader:

- 1 Drag the Flat shader from the Asset browser and drop it on a model in the Viewer window.
- 2 Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
- 3 Select Custom Color from the Color Source menu to pick a color for the object, or leave it at the default setting to derive its color from the object's material.
- 4 Adjust the object's brightness with the Luminosity slider, if desired.
- 5 Choose a form of transparency for the object with the Transparency Type menu.
- 6 Adjust the amount of transparency applied to the object with the Transparency Factor slider.

Making an object transparent

To make an object transparent:

- 1 Drag the Flat shader from the Asset browser and drop it on a model in the Viewer window.
- 2 Select Append.
- 3 Adjust the object's brightness with the Luminosity slider, if desired.
- 4 Choose a form of transparency for the object with the Transparency Type menu.
- 5 Adjust the amount of transparency applied to the object with the Transparency Factor slider.

If there is a texture applied to the object, its Alpha channel is affected. If there is no texture, the object's material opacity attribute is affected.

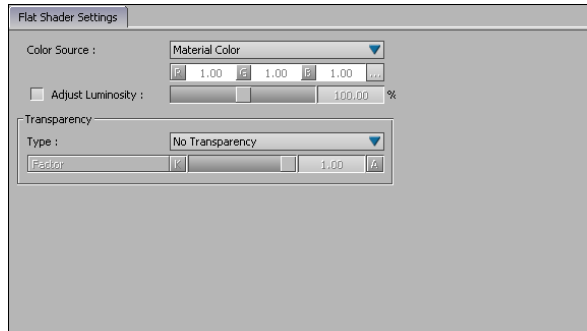
- [Flat Shader transparency types](#) on page 435
- [Edge Cartoon shader settings](#) on page 441

Flat shader settings

Use the Flat shader to color selected objects with a flat color that is unaffected by the lights in your scene.

Note: You can also use the Flat shader to create custom keys with the Image Operators Keyer effect.

The Flat shader lets you color selected objects with a flat color.



Flat shader settings

Color Source menu

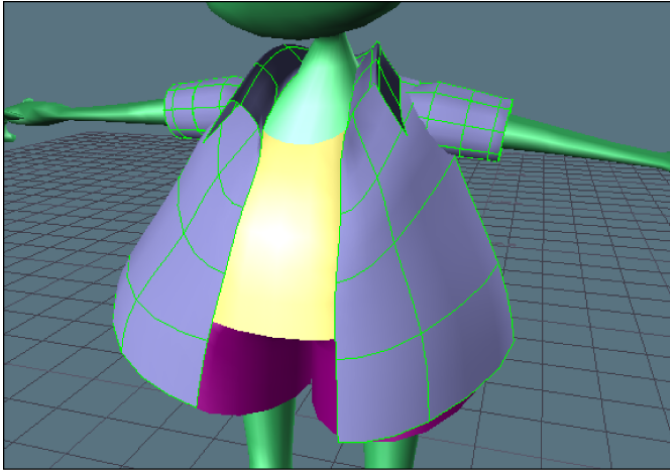
Use the Color Source menu to select one of two options:

Material Color

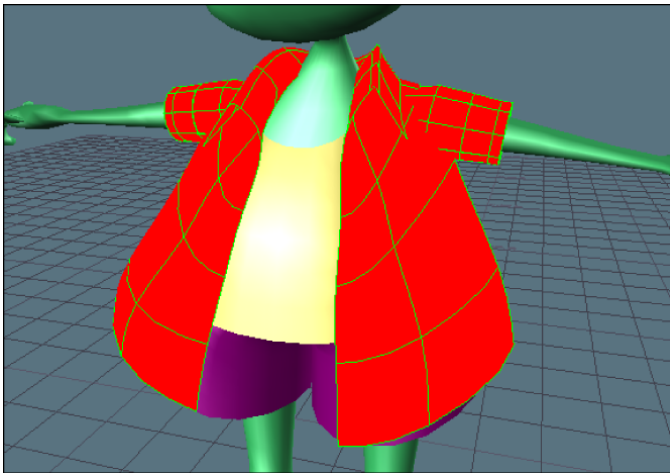
Select Material Color to use the Material Properties in the Materials settings to choose a color for the selected objects. The Color fields are disabled when selecting this material. Use the Luminosity slider to adjust the material's brightness.

Custom Color

Select Custom Color to change the object using the Color field. To change the color, use the Color field or click the Color button to open the Color window. The Luminosity slider is disabled. The following figures show the jacket of a model without a shader, and with the Flat shader applied.



No shader: The jacket is drawn with a smooth 3D look, which is achieved using the Materials settings.



Flat shader: The jacket is drawn with no edges, and its color is changed to red using the Flat shader.

The color fields always show values for the Custom Color option.

Adjust Luminosity option

Activate the Adjust Luminosity option to access the Luminosity slider, which lets you change the brightness of the material.

When the color is set to Custom Color, the Luminosity slider is disabled.

A value of 0% changes the material to pure black. A value of 100% uses the same material color as applied in the Materials settings. A value of 200% changes the material to pure white.

The Luminosity slider only works when the color menu is set to Material Color.

Transparency Type menu

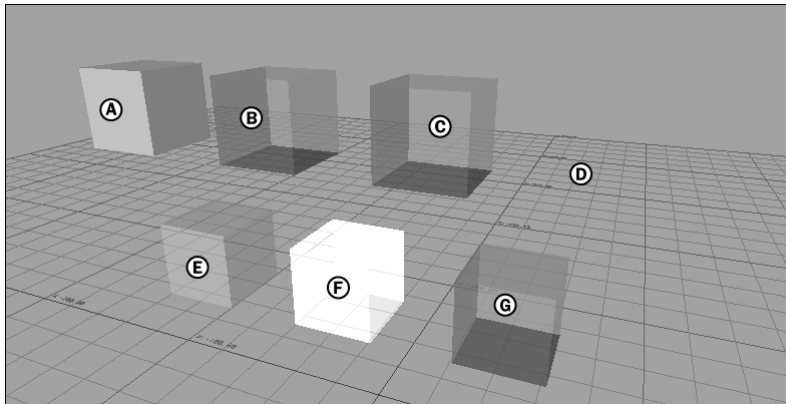
The Transparency Type menu in the Flat shader lets you select a method of calculating transparency and of adjusting the percentage used to boost the object's texture or material opacity.

If there is a texture applied to the object, its Alpha channel is affected. If there is no texture, the object's material opacity attribute is affected. See [Flat Shader transparency types](#) on page 435 for a description of each kind of Transparency.

Transparency Factor slider

The Transparency Factor slider lets you manipulate or animate the Transparency value for the Flat shader. The default setting is 1.00.

Flat Shader transparency types



The Transparency menu in the Flat shader lets you select a method of calculating transparency and of adjusting the percentage used to boost the object's texture or material opacity. A. No Transparency B. Accurate Transparency C. Translucent

D. Matte (set to 0.00) E. 2D Transparency F. Additive Transparency G. Translucent (Z Sort Models)

| Transparency type | Effect |
|-----------------------|---|
| No Transparency | Select the No Transparency option to disable the object or texture's opacity. Applying No Transparency results in a fully opaque object. The Opacity Multiplier is not activated with this selection. |
| Accurate Transparency | Select the Accurate Transparency option to calculate the transparency of the object or texture's opacity using a more accurate, but slower algorithm. Accurate Transparency is intended for objects that are only slightly transparent. Use the Opacity slider to boost the amount of accurate transparency. Low values may show layering problems. |
| Translucent | Select the Translucent option to calculate the transparency of the object or texture's opacity using a less accurate but faster algorithm. Use Translucent for very transparent objects. Use the Opacity slider to boost or reduce the amount of transparency. A value of 0% makes the shaded object invisible. |
| Matte | Select the Matte option to use the quickest method of applying transparency. Use the Matte option for objects with textures that have an Alpha matte. The Opacity Multiplier functions differently for the Matte setting. Changing the percentage boosts or diminishes the matte, changing which Alpha channel values are included in the matte. This creates a thinning or thickening effect on the matte. |

| Transparency type | Effect |
|-----------------------------|--|
| 2D Transparency | Select the 2D Transparency option to apply transparency to the visible surface of the object. When an object has 2D Transparency applied to it, solid objects are visible while partially transparent objects are not. Use the Opacity slider to increase the amount of 2D transparency. |
| Additive Transparency | Select the Additive Transparency option to apply transparency to the whole object. This option incrementally increases the color value of the object. Use the Opacity slider to change the object's level of transparency. A value of 0% makes the object completely transparent. |
| Translucent (Models Z Sort) | Select the Translucent (Models Z Sort) option for more accurate effects whenever you have objects in front of one another using transparency. This Transparency type is the only one that sorts models according to their distance from the camera. In cases where the models are very close to each other or overlapping, the algorithm may not be able to determine which model is in front. |

- [Making an object transparent](#) on page 432

Applying the Multilevel Cartoon shader

- 1 Drag the Multilevel Cartoon shader from the Asset browser and drop it on a model in the Viewer window.
- 2 Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.

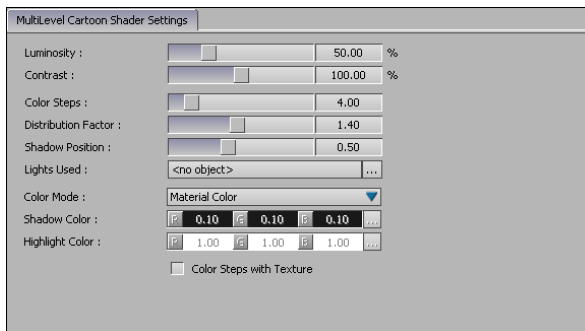
- 3 Adjust the shader's color mode, color steps and shadow settings to suit your needs.

- [Flat shader settings](#) on page 433
- [Multilevel Cartoon shader settings](#) on page 438
- [Edge Cartoon shader settings](#) on page 441

Multilevel Cartoon shader settings

The Multilevel Cartoon shader lets you apply a posterized effect with full control over the luminosity, contrast, and number of steps in the gradient between the shadow and highlight colors.

You can also control the colors used by the gradient, the placement of the shadow color, and the distribution of the steps in the gradient.



Multilevel Cartoon shader settings

TIP To take full advantage of the Multilevel Cartoon shader, you should add at least one light to the scene.

Luminosity and Contrast sliders

When reflecting light, the Luminosity and Contrast sliders change the brightness and contrast of the object. Luminosity changes the overall brightness, including contrast.

A value of 0% changes the material to pure black. A value of 100% uses the same material color as the object. A value of 300% changes the material to pure white.

Color Steps slider

The Color Steps slider lets you select the number of steps in the gradient used to create a transition between the Shadow and Highlight colors. A high Color Step produces a smooth transition .



A high Color Step and high Distribution Factor produces an anti-aliased edge effect.

A low Color Step produces a coarse, posterized effect .



A low Color Step and low Distribution Factor produces an obvious posterized effect.

Distribution Factor slider

The Distribution Factor slider lets you adjust how the gradient is distributed between the Shadow and Highlight colors. A low factor results in a wide distribution where the number of gradients between colors increases. A high factor results in a thin distribution.

For example, if you set both the Color Step and Distribution Factor to high, you can produce an anti-aliased effect with strange color edges.

Shadow Position slider

The Shadow Position slider changes the depth of shadow by changing the gradient when the shadow color begins. This gives the effect of the shadow moving or changing position on the object.

Lights Used field

The Lights Used field lets you select the lights that work with the Multi-Level cartoon shader. Alt-drag any lights in your scene into the Lights Used field. You can also click the Lights Used button next to the field to display the Asset list, where you can choose from the lights in your scene.

Color Mode option

Use the Color Mode option to select the colors and materials for the Multilevel Cartoon shader. The Shadow and Highlight colors are only available when Custom Color is selected.

Material Color settings

Bases the Shadow and Highlight color on the Diffuse and Ambient colors set in the Material settings. The RGB color fields are disabled when Use Material Color is selected. Use the Luminosity slider to adjust the material's brightness.

Custom Color option

Lets you specify your own color for the shadow and highlight color. To select colors, use the RGB color fields.

Shadow and Highlight Color field

The Shadow and Highlight Color field lets you adjust the color of the shaded areas of your model and the color of the non-shaded areas of your model, respectively.

Applying the Edge Cartoon shader

To apply the Edge Cartoon shader:

- 1 Drag the Edge Cartoon shader from the Asset browser and drop it on a model in the Viewer window.
- 2 Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
- 3 In the Edge Cartoon shader settings, select a color and width for the outline, and choose on which edges you want the effect to display.

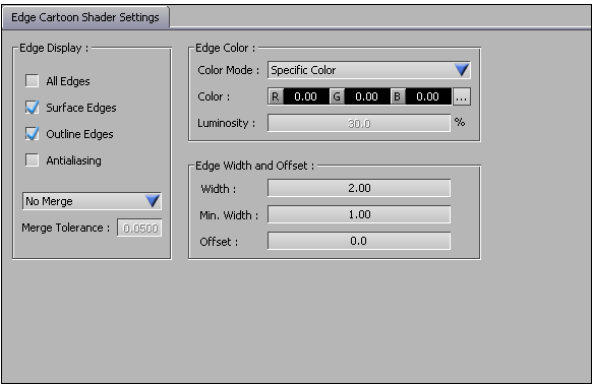
See also [Mesh Tessellation area](#) on page 45, for information on tessellation and the Edge Cartoon shader.

Edge Cartoon shader settings

Use the Edge Cartoon shader to draw a cartoon edge around your objects. For best results, append the Edge Cartoon shader over a Lighted shader, Flat shader, or Multilevel Cartoon shader.

The Edge Cartoon shader settings are in three areas:

- [Edge Display area](#) on page 442
- [Edge Color area](#) on page 444
- [Edge Width and Offset area](#) on page 445



■ [Mesh Tessellation area](#) on page 45

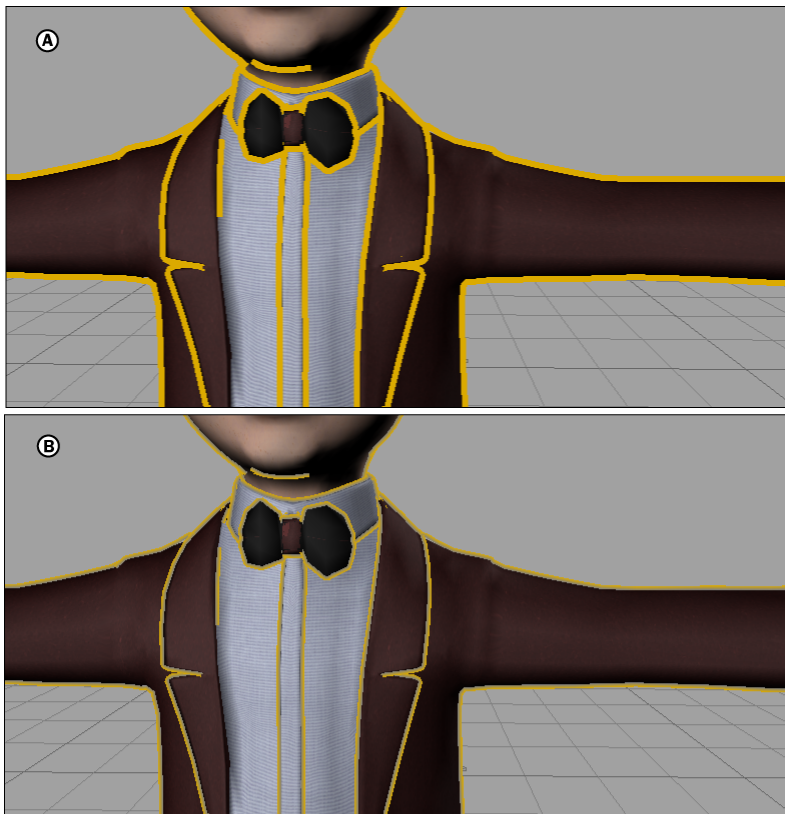
Edge Display area

The Edge Display area lets you activate the type of edge settings used with the selected model.

Activate options in the Edge Display area to choose edges that you want to draw from the list of buttons in the Display Edges area. You can have more than one edge selected at a time.

| Edge type | Effect |
|---------------|--|
| All Edges | Shows all edges, including polygon edges. Use this edge to see each polygon or combine it with other shaders for special effects. |
| Surface Edges | Show the edges of the object. |
| Outline Edges | Activate Outline Edges to draw an edge around the object where it curves away from the camera. If the object rotates, the edge changes with the curvature. |
| Antialiasing | Activate Antialiasing to add an anti-aliased edge to the selected edges. For example, the following graphic shows the difference |

| Edge type | Effect |
|-----------|---|
| | <p>between the edges drawn without Anti-aliasing, and with Anti-aliasing activated. For both objects, the line width is set to 4.0, and the Edge Cartoon shader is appended over a Flat shader. The Anti-aliasing option uses the material color of the object or the custom material you applied in the Materials settings. If you apply a Flat shader with the Edge Cartoon shader, make sure the Flat shader is set to Material Color.</p> |



Anti-aliasing A. Without anti-aliasing. B. Anti-aliasing is activated.

Merge Field

Use the Merge field menu to merge planes together before drawing the selected edge. Merging depends on how you created the selected object before loading it into MotionBuilder.

For example, in the preceding graphic, A shows a cube without any intersecting planes since different vertices are used for each edge. The top and side planes are not connected, so no edge is drawn when Outline Edges is the only selected edge.

In the preceding graphic, B, merging is set to Merge in Model, which detects that the cube's three planes use the same point, even if the object says they are three different points. The outline of the cube is now drawn correctly.

There are three merging options:

| Merge Option | Effect |
|----------------|---|
| No Merge | Disables merging. |
| Merge in Model | Tries to find vertices at the same location as the shaded objects. |
| Merge All | Takes all objects with the Edge Cartoon shader and tries to find vertices at the same location between all objects. This means that when two objects overlap each other, they are drawn with the same edge. |

Merge Tolerance

Enter a value in the Merge Tolerance field to find the maximum distance between vertices where surface merge.

Edge Color area

Use the options in the Edge Color area to select and set the color and material options for a selected edge.

Color Mode

Use the Color Mode menu to select either the object's material or a custom color. Select the Custom Color option to specify your own edge color using

the RGB Color fields. Select the Use Material option to base the edge color on the Diffuse and Ambient colors set in the Material settings.

Color

Use the Color settings to change the color of the edge. The Color field is only available when Custom Color is selected in the Source field. It is disabled when Use Material is selected in the Texture settings.

Luminosity

Enter a value in the Luminosity field to change the brightness of the edge.

NOTE The Luminosity setting is only available when Use Material is selected in the Source field.

Edge Width and Offset area

The Edge Width and Offset area governs the overall appearance of edges used by the Edge Cartoon shader.

Width and Min. Width

Enter a value in the Width field to set the width of the edge. If you increase the width, the object's edge thickens.

The Min. Width field lets you specify the minimum edge width to be drawn when the camera zooms out from the object. As the camera moves away from the object, its edge is drawn using an increasingly smaller width. If you do not want the edge to become less than a specific width, specify the minimum width in the Min. Width field.

You can also use the Min. Width field to provide a constant edge. For example, if you draw an object using a Width of 0 and a Min. Width of 3, the object's edge always has a width of 3 units, regardless of the camera's position.

Offset

Enter a value in the Offset field to offset the edge according to the camera view. If you increase the offset, the edge is drawn closer to the camera and over the object.

You may need to specify an offset if a character is comprised of two or more objects that do not fit together perfectly, and the edge of one object is drawn behind another object.

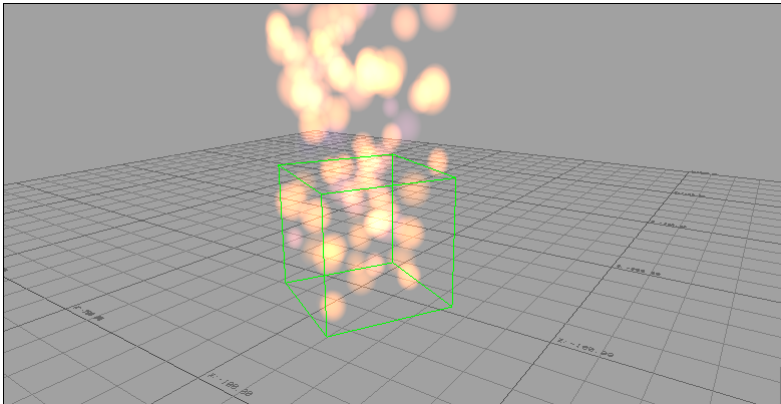
For example, if the arm of a character is built from different objects, the shoulder may occasionally be drawn over the arm when the arm moves. This might not become apparent until a Cartoon shader is added.

Environmental effects

33

Use the Particle shader to apply a particle generator to objects for creating environmental effects such as fog, rain, and fire.

After you apply or append the Particle shader to an object, you can change the shader's settings. The Particle shader updates in real time, which lets you fine-tune the particle settings while watching how it affects your objects. An example of a Particle shader applied to a cube is shown in the following image.



Cube with Particle shader applied.

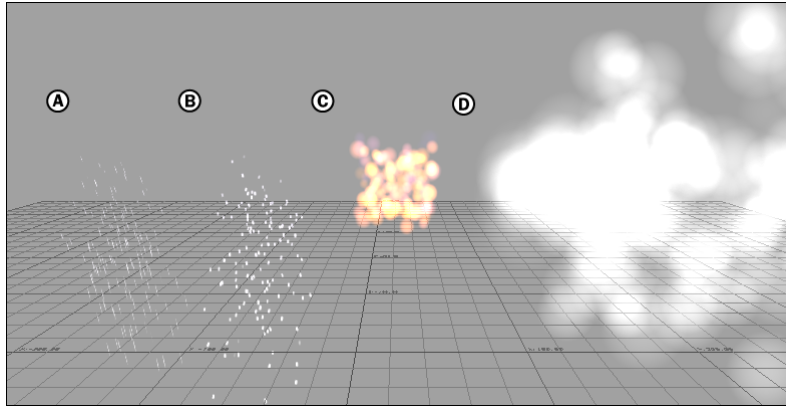
When you apply a texture to an object with a Particle shader, the texture is applied to both the object and the particles.

The Particle shader settings are divided into three panes:

- [Particle Physics pane settings](#) on page 450
- [Particle Shading pane settings](#) on page 456
- [Global Controls pane settings](#) on page 459
- [Increasing the size, quantity, and color of particles](#) on page 449

Creating environmental effects with shaders

Shaders can be applied to objects to create environmental effects like fire, fog, snow, and rain.



A. Rain B. Snow C. Fire Ball D. Cloud

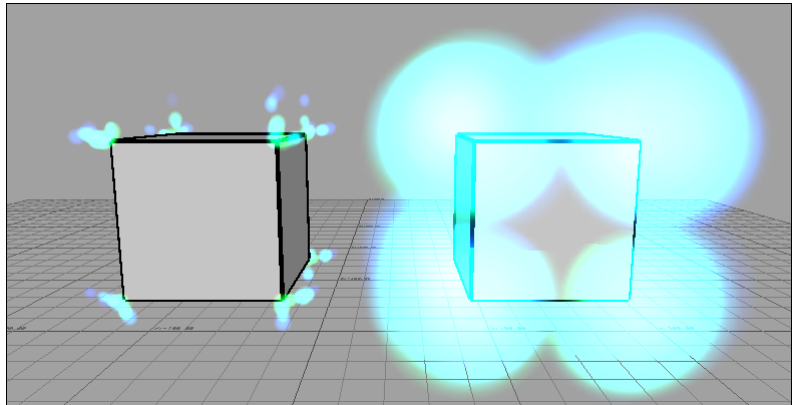
To create environmental effects:

- 1 Drag a cube into the Viewer window and resize it so that it is the size of the environmental effect you want to create. Do not worry, it will cover your scene, but the application of the shader makes it invisible.
- 2 Drag a particle shader from the Asset browser onto the cube and select Replace All from the menu that appears.
- 3 In the Particle shader settings, select Scaling Volume from the Emit From menu in the Particle Physics pane.
- 4 In the Particle shader settings' Global Controls pane, select Rain, Snow, Fireball, or Cloud from the Preset menu.
- 5 Adjust the speed and scale with the appropriate sliders.

Increasing the size, quantity, and color of particles

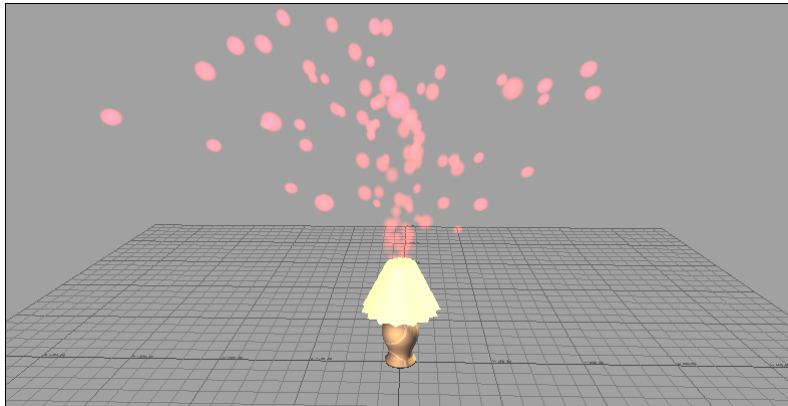
To increase the size, quantity, and color of particles:

- 1 Select the particle shader in the Scene browser.
- 2 In the shader's Particle Physics pane, drag in or type a value in the Quantity field to increase the amount of particles emitted by the shader.
- 3 To increase the size of each particle, go to the Size slider in the shader's Particle Physics pane, and move the slider to the right.



Use the Size slider to affect the size of the particles used by the shader.

- 4 In the shader's Particle Shading pane, drag in or type a value in the R, G, and B In Color fields to set the color that particles are originally created.
- 5 The extra value next to the In Color field lets you influence the transparency of the In Color, with 0.0 being invisible and 100.00 being solid.
- 6 In the shader's Particle Shading pane, drag in or type a value in the Out Color field to set the color that particles end up as they fade away.
- 7 The extra value next to the Out Color fields lets you influence the transparency of the Out Color, with 0.0 being invisible and 100.00 being solid.
- 8 Use the Life Time settings in the Particle Physics pane to determine how long a particle lasts before changing color and then fading out.



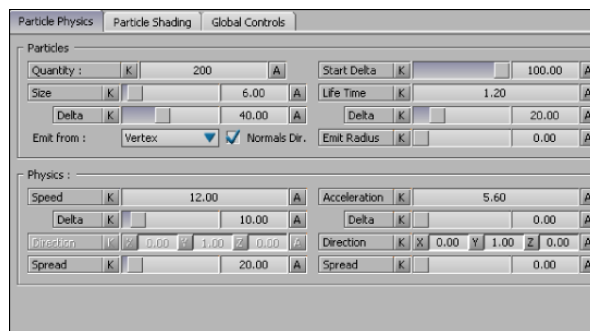
The Life Time setting affects how long a particle lasts.

- [Using the Color window](#) on page 9

Particle Physics pane settings

The Particle Physics pane in the Shader settings lets you customize the size, speed, direction and duration (known as “Life Time”) of the particles used in the Particle shader. It is divided into the Particles area and the Physics area.

NOTE You can key and animate these settings to create dynamic environmental effects.



Particle shader: Particle Physics pane

Particles area

The Particles area governs the actual particles to be used in the shader, and the Physics area which governs the behavior of the particles used in the shader and are divided into the Speed and Acceleration columns.

Quantity

Double-click the Quantity field to enter the specific number of particles you want to appear.

Size

Use the Size slider to increase or decrease the size (in MotionBuilder units, like the grid) of each particle.

Size Delta

Use the Size Delta slider to set the percentage of the size that is allowed beyond the Size settings. The Size field determines the minimum value. For example, if Size is set to 10 and Size Delta is 20%, the particles range from 10 to 12.

Emit From

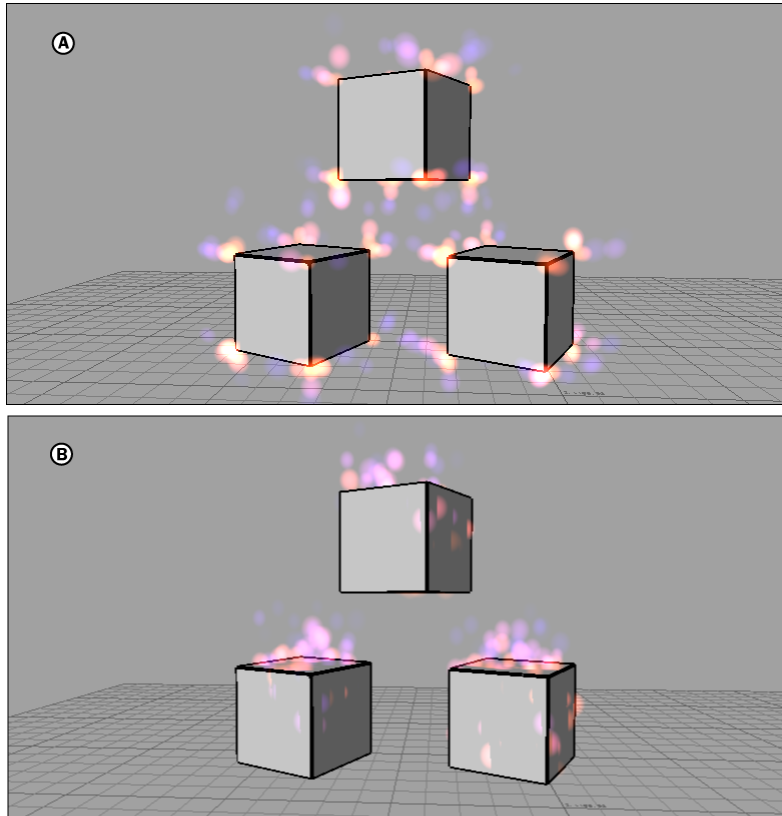
Use the Emit From menu to select from two particle display options:

Vertex

Emits particles from the model's vertices.

Scaling Volume

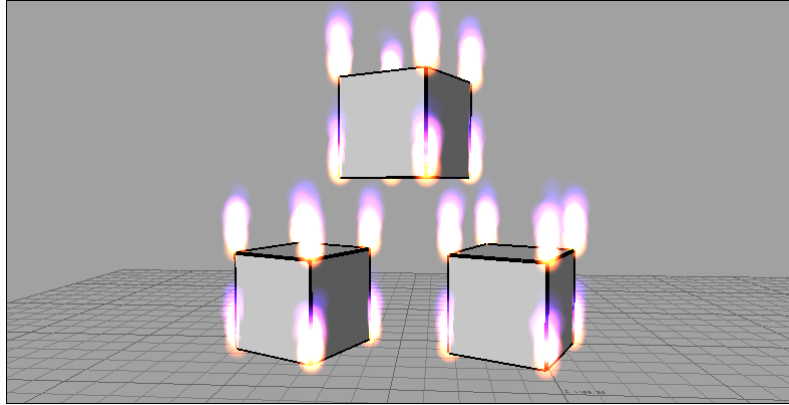
Emits particles from the model's scaling volume



Emit From menu options A. Particles emitted from vertices B. Particles emitted from Scaling Volume

Normals Dir

Deactivate the Normals Direction option if you do not want particles emitted along the object's normals.



Normals Direction disabled

Start Delta

Use the Start Delta slider to choose a creation delta of the particles. A value of 0 percent means that all particles are created at the same time. A value of 100 percent distributes the creation of particles evenly over the Life Time.

Life Time

Double-click the Life Time field to enter the length of time (in seconds) you want each particle to exist.

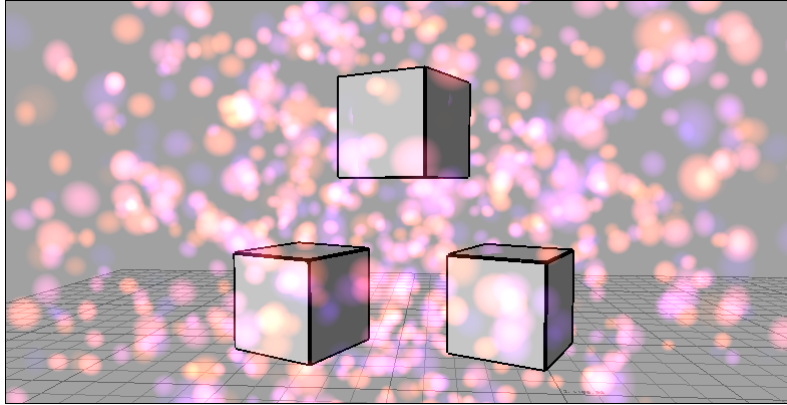
Life Time Delta

Use the Life Time Delta slider to set the percentage of the duration allowed beyond the Life Time settings, with the Life Time field determining the minimum value.

For example, if Life Time is set to 1.2 and Life Time Delta is 50%, the Life Time ranges from 1.2 to 1.8.

Emit Radius

Use the Emit Radius slider to increase or decrease the radius of emission around a source.



Emit Radius value set to 100%.

Speed

Double-click the Speed field to set the speed at which particles initially travel. The higher the value, the faster the particles travel, and the further they can get in the designated lifetime. For example a value of 2 in the Speed field plays your particles twice as fast. Therefore, the distance particles travel increases. Speed coordinates are local values.

Unlike the Play Speed slider in the Global Controls pane, this setting influences distance as well as speed.

Speed Delta

Use the Speed Delta slider to set a percentage of the speed that is allowed beyond the Speed settings. The Speed field determines the minimum value. For example, if Speed is set to 12 and Speed Delta is set to 75%, the speed ranges from 12 to 21.

Direction

Set an X, Y, and Z coordinate in the Direction settings to represent the initial direction that particles travel. This direction may be altered by Speed Spread and Acceleration Direction.

Spread

Use the Spread slider to set a range of the initial direction that individual particles travel. Speed Direction determines the center point for this range. This range is measured in degrees.

Acceleration

Double-click the Acceleration field to enter a constant acceleration to be applied to particles after their creation. A higher Acceleration value changes the Speed Direction to the Acceleration Direction more quickly. Acceleration coordinates are global values.

Acceleration Delta

Use the Acceleration Delta slider to set a percentage of the acceleration that is allowed beyond the Acceleration settings. The Acceleration field determines the minimum value. For example, if Acceleration is set to 6 and Acceleration Delta is set to 60%, the acceleration ranges from 6 to 9.6.

Direction

Set an X, Y, and Z coordinate in the Direction settings to represent the direction that particles travels after the initial Speed Direction based on the Acceleration rate. A higher Acceleration setting causes the Acceleration Direction to come into effect faster. If the Life Time value is low, you may not be able to see this change.

Spread

Use the Spread slider to set a range of direction that individual particles travel based on the Acceleration Direction. Acceleration Direction determines the center point for this range. This range is measured in degrees.

- [Increasing the size, quantity, and color of particles](#) on page 449
- [Creating environmental effects with shaders](#) on page 448

Particle Shading pane settings

The Particle Shading pane in the Shader settings lets you customize the visual appearance of the particles used in the Particle shader, such as lighting, color and motion blur.



Particle Shading pane

NOTE If you use an NVidia video card, be aware that a driver conflict causes problems with Particle shader display. This occurs especially in cases where the Particle Quantity is set to a value greater than 1000.

Display mode menu

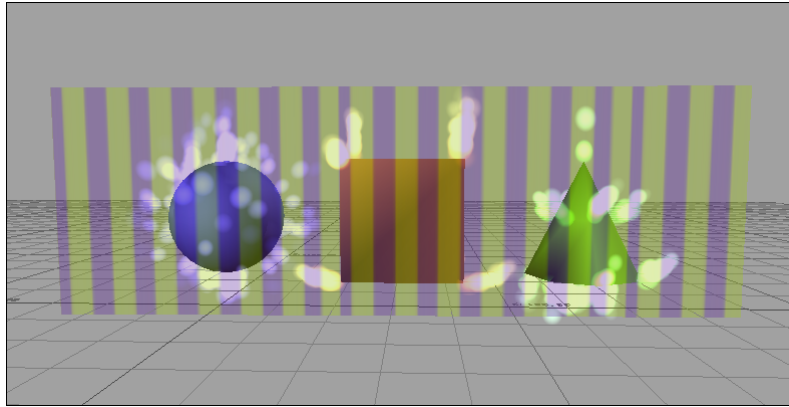
Use the Display mode menu to set the way particles are shown in the Viewer window.

| Display mode | Effect |
|--------------|---|
| Additive | Displays particles in additive transparency mode. |
| Matte | Displays particles in the opaque matte mode. |
| Translucent | Displays particles in translucent mode. |

Models Z Sort option

Activate Models Z Sort when you want to show particles behind other transparent models. Models Z Sort redraws the particles so that they appear behind transparent or translucent objects when in Additive or Translucent Display mode.

The Models Z Sort option sorts models by bounding volume and then draws each model from back to front.



Activate Models Z Sort to show particles behind transparent models.

TIP For best results, the bounding volume of a model should not intersect other bounding volumes. Also, the Models Z Sort option works best with simple geometry and polygon culling, if your geometry is constructed with consistent polygon orientation (all polygons should be constructed either clockwise or counter-clockwise). Polygons with opposing orientation are clearly shown as artifacts when attempting transparency.

Polygon culling is specified for each model in the Shader manager. See [Flat Shader transparency types](#) on page 435 for a description of transparencies you can use on your models.

Particle Object M option

When using Models Z Sort, activate this setting so that each particle is sorted individually, creating a more realistic particle effect.

Real Time option

Activate this option to view the sorting effects of the Models Z Sort and Particle Object M options in real time. If this option is disabled, the Models Z Sort and Particle Object M effects are only used when rendering.

NOTE Due to the complex particle solving that these three Z-Sorting options present, activating the Real Time option causes processing speed delays.

Lighting menu

The Lighting menu lets you select a method to light the particles.

No Lighting

The Particles are not lit. This is the default setting.

TIP This method renders particles more quickly.

Simple Lighting

Performs a rough calculation of lighting: 1 normal is used per particle. In this method, the normals always face the camera.

TIP This method renders particles more quickly than the Smooth Lighting selection.

Smooth Lighting

Performs a more advanced calculation of lighting to create a smooth effect: 5 Normals are used per particle. In this method, Normals surround the particle to create a more realistic effect.

NOTE This method is slower than the Simple Lighting selection.

In Color settings

Use the In Color settings to set the color applied to particles at the beginning (In point) of their life time.

Out Color settings

Use the Out Color settings to set the color applied to particles at the end (Out point) of their life time.

Fade In slider

Use the Fade In slider to set a percentage of the particle's life time that is used to fade in the particle.

Fade Out slider

Use the Fade Out slider to set the percentage of the particle's life time that is used to fade the particle out.

Enable Motion Blur option

Activate the Enable Motion Blur option when you want the particles to have a blur applied to them to imply motion. The higher the value, the more particles deformed.

Motion Blur slider

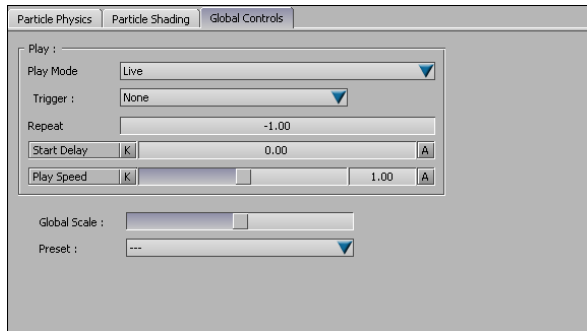
Use the Motion Blur slider to set the blur amount for the particle as it travels, creating a stretching effect. Values range from 0.00 to 1.00.

You can animate the Motion Blur setting.

- [Increasing the size, quantity, and color of particles](#) on page 449
- [Global Controls pane settings](#) on page 459
- [Creating environmental effects with shaders](#) on page 448

Global Controls pane settings

The Global Controls pane in the shader settings lets you control the activity of the particles used in the Particle shader, such as setting the playing speed, playing mode, and scaling.



Play Mode menu

Use the Play Mode menu to select a play mode for particle creation.

| Option | Description |
|-----------|---|
| Live Mode | Select Live Mode to create particles in real time. |
| Play Time | Select Play Time to create particles when the Play button in the Global Controls is clicked. To view changes while in Play Time mode, you must play the take. |

Trigger menu

Use the Trigger menu to select a trigger created in the Trigger settings. This lets you control particles with a keyboard or joystick. If no keyboard or joystick has been added to the Trigger settings, you can only select None.

| Option | Description |
|----------|---|
| None | Select None if you do not want to use triggers for your Particle shader. You can create a refresh trigger to restart your particles from the beginning of their life. |
| Activate | Select Activate in the Trigger Type field in the Keyboard pane of the Trigger settings, and give the trigger a descriptive name. |

| Option | Description |
|--------|---|
| | Activate restarts your Particle shader when you press the appropriate keyboard key. |

Repeat field

Double-click the Repeat field to enter the number of times you want each particle created. The default value -1 creates each particle in a continuous loop. A value of 2 means that each particle is created twice and a value of 3 repeats the particle emanation three times.

Start Delay slider

Use the Start Delay slider to set a value for the Delay (in seconds) before particles are created.

Play Speed slider

Use the Play Speed slider to set a multiplication factor of the speed at which particles are created.

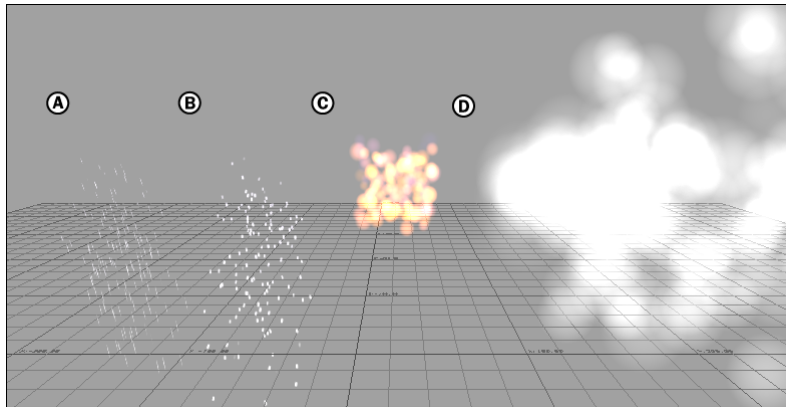
A Play Speed of less than 0.00 freezes the particles. Play Speed differs from the Speed field because it does not alter the distance or direction travelled.

Global Scale slider

Use the Global Scale slider to scale all particle values including size, speed, acceleration, and so on at the same time.

Preset menu

Use the Preset menu to select one of four preset particle options:



Global Presets A. Rain B. Snow C. Fire Ball D. Cloud

- Rain
- Snow
- Fire Ball
- Cloud

NOTE You can animate the Start Delay, Play Speed, and Global Scale settings.

- [Increasing the size, quantity, and color of particles](#) on page 449
- [Particle Shading pane settings](#) on page 456
- [Creating environmental effects with shaders](#) on page 448

Reflection effects

34

Use the Reflection shader to produce reflections from object to scene, scene to object, and object to object.



Live Planar Reflection shader effect.

When a Reflection shader is appended to an object, a map or live reflection plane is generated. Sphere or Spherical reflections are mapped, and Live Planar or Live Planar On Video reflections are generated in real time.

A new map should be generated whenever you want to save adjustments made to the Reflection settings of a selected object.

Reflection types

You can choose from four types of reflections in the Reflection Type menu:

- [Live Planar Reflection option](#) on page 464
- [Live Planar Reflection on Video option](#) on page 464
- [Sphere Map option](#) on page 464

- [Spherical Map option](#) on page 464

Live Planar Reflection option

Causes a plane to reflect moving objects. For example, a floor reflects a character that is walking across it.

Live Planar Reflection on Video option

Causes a plane to reflect moving objects when a video is applied to the camera background. The plane is transparent except for the reflections, so 3D objects appear to be reflected in the video.

You must Apply (not Append) all Reflection shaders that use Live Planar Reflection On Video.

Also, your background color must be black for the effect to be realistic.

Sphere Map option

Creates a flat map (texture) that causes a 3D object to reflect the contents of its scene from only one point of view, that is, the reflection is frozen and does not change when filmed by a moving camera.

Sphere Map uses Open GL acceleration. The Texture settings' Texture Type must be set to Sphere Map for this effect to succeed. See [Texture types](#) on page 401 for more information.

Spherical Map option

Creates a flat map (texture) that causes a 3D object to reflect the contents of its scene. Unlike the Sphere map, it can be viewed omnidirectionally. A camera can move around the object and still show the reflection.

The Texture settings' Texture Type must be set to Spherical Map for this effect to succeed. See [Texture types](#) on page 401 for more information.-

- [Making objects reflective](#) on page 465
- [Texture types](#) on page 401

Making objects reflective

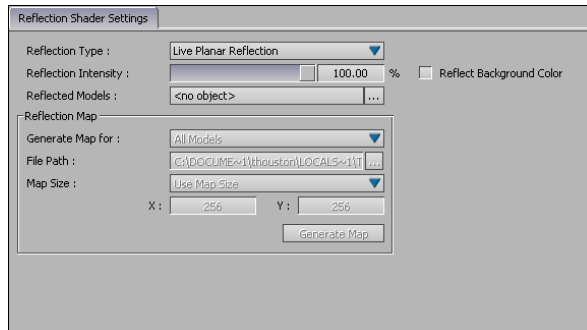
To make objects reflective:

- 1 Drag the Reflection shader from the Asset browser and drop it on a model in the Viewer window.
- 2 Select Append to maintain the object's original textures and any other applied shaders.
- 3 Expand the Reflection Type menu in the Reflection shader settings and select the appropriate reflection type from the menu. See [Reflection types](#) on page 463.
- 4 If you select a map shader, adjust the intensity slider and click generate.
- 5 If you want, you can drag a Material asset onto the object you want to make reflective from the Asset browser and adjust the Reflectivity and Specularity sliders. See [Material Settings](#) on page 387 for more on Materials.

- [Reflection shader settings](#) on page 465
- Use Additive Specular Lighting option

Reflection shader settings

The Reflection shader lets you append a regular reflection to any model, or a live reflection to any planar surface in your scene.



Reflection shader settings

Once you apply a Reflection shader to a selected object or plane, you can adjust its various settings. Use these settings to specify map size, reflection intensity, and so on.

Reflection type menu

You can choose from four types of reflections in the Reflection Type menu:

- [Live Planar Reflection option](#) on page 464
- [Live Planar Reflection on Video option](#) on page 464
- [Sphere Map option](#) on page 464
- [Spherical Map option](#) on page 464

See [Reflection types](#) on page 463 for information about each Reflection type.

NOTE You cannot generate a reflection map unless the Save Map Path is valid.

Reflection shader texture settings

When you choose Spherical Map or Sphere Map as a Reflection shader type, a texture is generated to project the reflection map. You can manipulate this texture and its appearance when you select either Spherical reflection map or Sphere Map from the Texture Type menu.

| Option | Description |
|--------------------------|--|
| Reflection Intensity | The Reflection Intensity slider lets you change the level of reflection for a selected object or plane. The Reflection Intensity can be modified in a generated map. The default intensity is 100%. |
| Reflect Background Color | Activate Reflect Background Color to match the reflection color in the selected plane or object with the background color. Reflect Background Color is not available for Live Planar Reflection On Video. This option is only available for Live Planar Reflection and Live Planar Reflection On Video reflection types. |

Reflected Models field

Alt-drag any models in your scene that you want to use with the Reflection shader into the Reflected Models field. You can also click the Reflected Models button next to the field to display the Asset list, where you can choose from the models used in your scene.

The Models Casting Reflections area lists all the objects in your scene that cast reflections. If you want several object to cast reflections on a plane that uses the Reflection shader, select and Alt-drag each object into this list, or keep the default All option. If the All value is in the list, all objects in your scene cast reflections.

Add All

Adds all objects in the scene to the Models Casting Reflections list.

Remove

Removes a selected object from the Models Casting Reflections list.

Remove All

Removes all objects from the Models Casting Reflections list.

Reflection Map area

The reflection map area is only active when you select Spherical Map or Sphere Map from the Reflection Type menu.

These settings let you control the creation of a reflection as a static map or texture. This map can also be controlled in the Texture settings' Texture Type window. For more, see [Texture types](#) on page 401.

| Setting | Description |
|------------------|---|
| Generate Map For | The Generate Map For menu lets you select which objects are included in the Reflection shader's map texture. Choose either All Models or select particular models you want to appear and choose Selected Shaded Models. |

| Setting | Description |
|-----------|---|
| File Path | The File Path specifies the location of the file and saves the generated map to disk as a texture file. The default path is C:\temp. |
| Map Size | Use the Map Size menu to choose the size (in pixels) of the generated map. The default size is 256 x 256. This option is only available with the Spherical Map and Sphere Map. There is a higher resolution, a longer generation waiting period, and a greater memory requirement with a larger map size. |
| X and Y | The X and Y menus let you choose the size (in pixels) of the generated map. The default is 128 by 128. There is a higher resolution, a longer generation waiting period, and a greater memory requirement with a larger map size. For more information, see Mapping method types on page 403. |

Generate Map option

Click Generate Map to create a map for all objects with the Reflection shader applied. Choose whether you want to generate a map for All Models or only the Selected Shaded Models in your scene. You must have a valid Save Map Path before you can generate a map.

- [Making objects reflective](#) on page 465
- [Materials and surface consistency](#) on page 385

Some shaders create effects that appear to alter the surface of your objects. They give the illusion of texture without actually changing your models, such as the Bump Map, Matte, Faceted, and Wireframe shaders.

NOTE The Normal map shader is in the Shadows and Lighting topic. See [Normal Map shader](#) on page 499 for more information.

This sub-section covers those shaders, their settings, and how you can configure them to give your models more depth and realism.

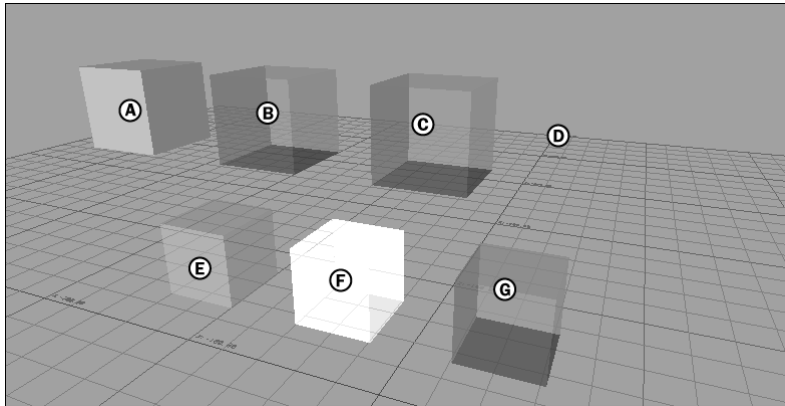
Creating transparent objects

You can use the Flat shader to create models that are partially visible.

To create transparent objects:

- 1 Drag the Flat shader from the Asset browser and drop it on a model in the Viewer window.
- 2 Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
- 3 In the Flat shader settings, select one of the following types from the Transparency type menu.

For a description of the different effects caused by the Transparency types see [Shader transparency types](#) on page 493.



A. No Transparency B. Accurate Transparency C. Translucent D. Matte (set to 1.00) E. 2D Transparency F. Additive Transparency G. Translucent Models Z sort

- [Creating transparent objects](#) on page 469
- [Shader transparency types](#) on page 493

Creating a Bump Map

Make sure that there are lights in your scene or the Bump Map will not work.

To create a Bump Map:

- 1 Drag a Texture asset from the Materials folder in the Asset browser, and drop it onto your model.
- 2 Select Replace by Type from the contextual menu that appears.
- 3 In the Texture settings, select New Media and browse for the Bump Map image you created.
- 4 Select the Bump Map (NormalMap) option from the Texture settings Texture Type menu.
- 5 Select a Bump Map shader from the Shaders folder in the Asset browser, and drop it onto your model.
- 6 Select Replace by Type from the contextual menu that appears.

- 7 Use the Bump Map shader settings to adjust and fine-tune your bump effect.

- [Adding color to Bump textures](#) on page 471
- Texture settings

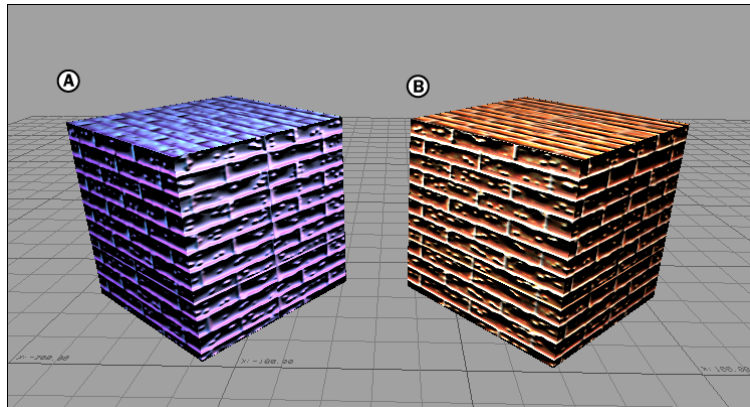
NOTE The Normal map shader is in the Shadows and Lighting topic. See [Normal Map shader](#) on page 499 for more information.

Adding color to Bump textures

You can increase the realism of a Bump Map texture by adding a second, colored version of the Bump Map shader image and use it to color the Bump Map.

To add color to Bump textures:

- 1 Save a color image of the Bump Map texture and append it to the object that has already had the Bump Map shader applied to it.



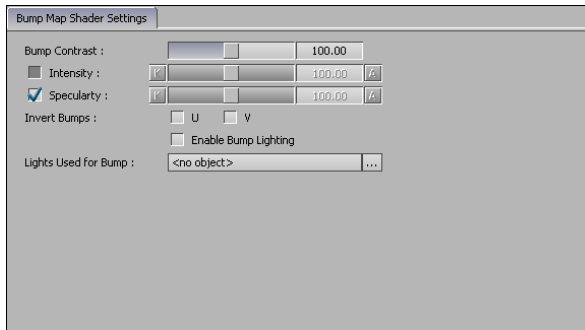
Bump Map shader A. No color texture applied B. Color texture applied

- 2 Set this second texture to Color in the Texture settings Texture Type menu.

- 3 Ensure that the texture is positioned exactly as the Bump Map texture is positioned by comparing the U and V tiling, as well as the Translation, Rotation, and Scaling coordinates in the Texture setting.

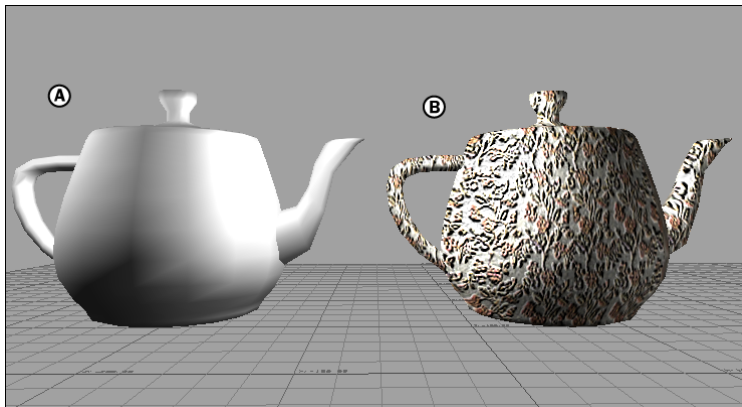
Bump Map shader settings

Use the Bump Map shader to create a three-dimensional texture effect on models from a normal map texture.



Bump Map shader settings

This lets you simulate roughness or smoothness, depending on how the texture reflects light, such as in the image below.



Bump Map shader A. An object with no shader. **B.** The same object with the Bump Map shader applied.

Use the Bump Map settings to create specular effects and increase the contrast of the Bump Map texture.

A texture must be applied to the object for the Bump Map shader to work. This texture must have a normal map where the three channels of information, that is R, G, and B, are stored.

The effect of the applied Bump Map shader texture is visible as soon as any lights are added to the scene.

NOTE Some sliders in the Bump Map shader settings require a video card capable of supporting 4 textures, such as the NVIDIA GeForce 3 (or higher). Otherwise some settings are disabled.

The Bump Map shader uses a texture to project the texture map. This texture appears when you select Bump Map (Normal Map) in the Texture setting's Texture Type menu. Otherwise, the texture's normal map is displayed.

NOTE Make sure that the Bump Map (Normal Map) texture type is selected in the Texture settings or the Bump Map shader does not achieve its maximum effect.

Bump Contrast slider

Use the Bump Contrast slider, or enter a value in the Bump Contrast field to adjust the level of contrast created by the Bump Map. Increasing the contrast creates a higher texture relief.

Intensity option

Activate the Intensity option to apply the Bump Map's color concentration as a map for the shader.

Only one light is used to create the Bump Intensity effect. This is always the last light in the Lights Used For Bump list.

Intensity slider

Use the Intensity slider to manipulate the dark areas of the texture created by the Bump Map, which creates a high relief effect. The default intensity is 100%.

You can animate this setting.

Specularity option

Activate the Specularity option to apply the Bump Map's light reflection which define the Bump Map's light peaks.

Use the Specularity slider to manipulate how the Bump Map reflects light peaks, which creates matte or shiny effect.

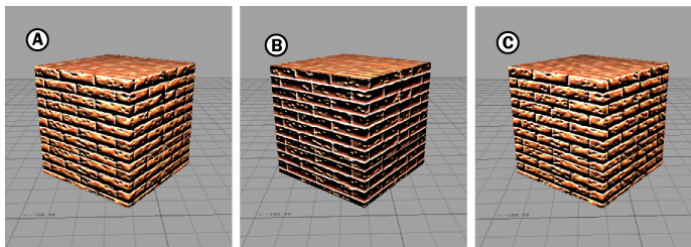
You can animate this setting.

Invert Bumps option

Select either the U or V Invert Bumps option to choose which UV coordinate creates the Bump Map texture.

Choosing either U or V inverts the normals of the Bump Map in order to create the opposite texture effect. For example, raised textures appear lower and lower textures appear raised.

The U and V direction can be important if, for example, you were using a brick wall texture and you did not want the mortar to stand out beyond the brick surface.



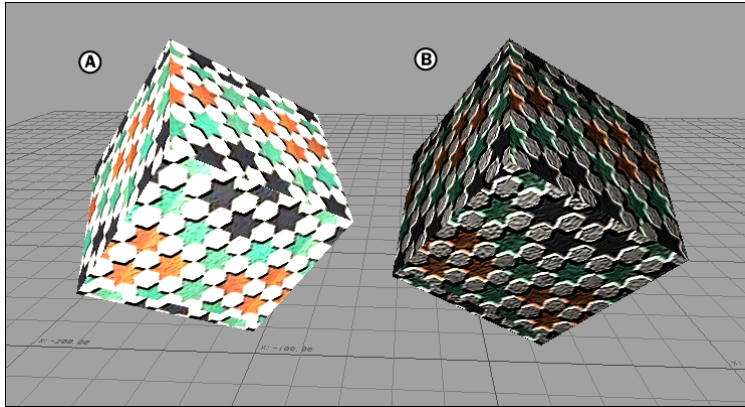
Invert Bumps A. U is activated. B. V is activated. C. Both U and V activated.

Activating both the U and V settings flattens the texture's appearance.

Enable Bump Lighting option

Activate the Enable Bump Lighting option to use a more accurate per-pixel lighting effect on the bump texture, instead of vertex-based lighting. Using Enable Bump Lighting creates a dramatic contrast on the object.

The Enable Bump Lighting option uses only one light to create its effect.



Enable Bump Lighting option A. Disabled B. Activated

Lights Used for Bump field

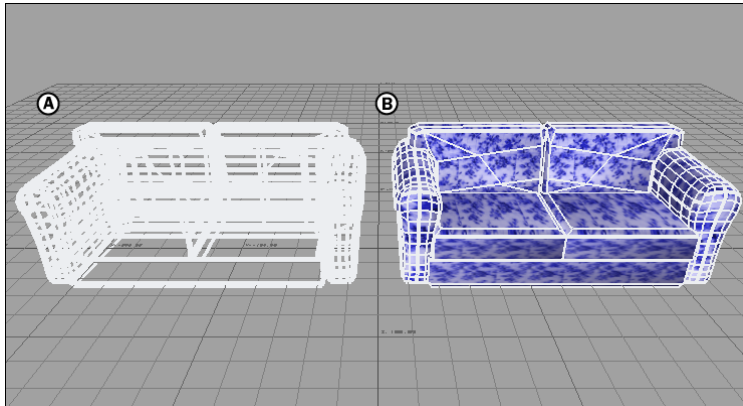
The Lights Used for Bump field lets you select the lights that produce Bump Map textures. Alt-drag any lights in your scene into the Lights Used for Bump field. You can also click the Lights Used for Bump button next to the field to display the asset list, where you can choose from the lights in your scene.

- [Creating a Bump Map](#) on page 470
- [Texture types](#) on page 401
- [Adding color to Bump textures](#) on page 471

Drawing a object's wireframe

To draw an object's wireframe:

- 1 Drag the Wire Frame shader from the Shaders folder in the Asset browser, and drop it onto your model.
- 2 Select Replace by Type from the contextual menu that appears to completely hide the object and display only the wireframe, or select Append to show the object with the wireframe outline.



Wire Frame shader: A Replacing sofa B. Appended to sofa

3 In the Wire Frame shader settings, set a the line width you want.

- [Displaying a model's polygons](#) on page 477

Wire Frame shader settings

Use the Wire Frame shader settings to draw objects using their wireframes.



Wire Frame shader settings

You can adjust the size of the wireframe using the Line Width field. The wireframe uses the material color from the Material settings.

The example in shows the effect of a Wire Frame shader appended over a Flat shader. The wireframe has a Line Width of 2.0.



A Wire Frame shader is appended to the jacket with a Line Width of 2.0.

Displaying a model's polygons

To display a model's polygons:

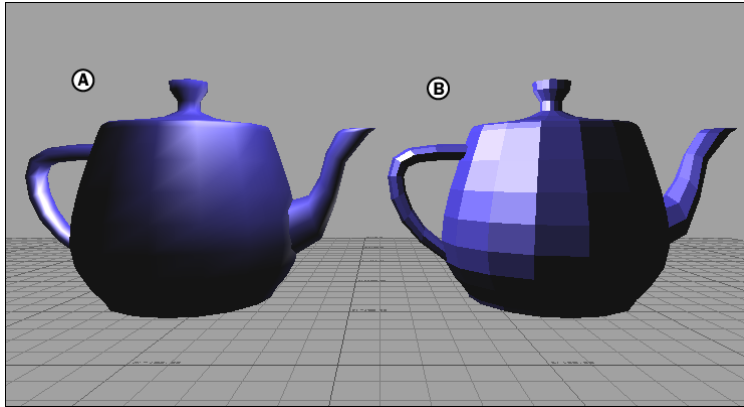
- 1 Drag the Faceted shader from the Shaders folder in the Asset browser, and drop it onto your model.
- 2 Select Replace by Type from the contextual menu that appears.

NOTE There are no controls for the Faceted shader; the polygons are drawn from the model.

- [Faceted shader settings](#) on page 477
- [Drawing a object's wireframe](#) on page 475

Faceted shader settings

The Faceted shader lets you display your model's original polygon shape.



Faceted shader A. Without shader.B. Faceted shader applied.

The Faceted shader has no options to adjust; it reads the polygons directly from the model.

Creating a 3D matte

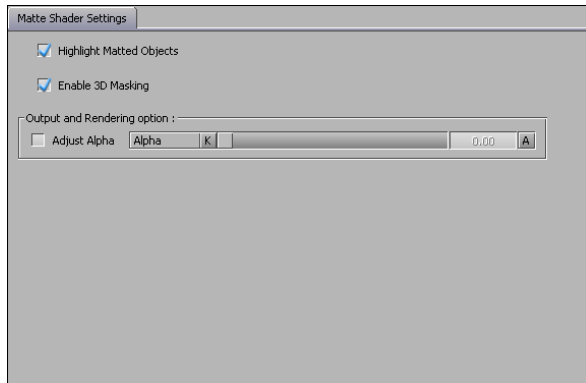
To create a 3D matte:

- 1 Drag the Matte shader from the Shaders folder in the Asset browser, and drop it onto your model.
- 2 Select Replace by Type from the contextual menu that appears.
- 3 In the Matte shader settings, select Highlight Matted Objects to surround the object with a faint outline if you are having trouble viewing the matted objects in your scene.
- 4 Activate Enable 3D Masking option to apply the 3D Matte shader to the selected object. When Enable 3D Masking is not active, the shader appears as a wireframe.
- 5 Activate Adjust Alpha to control the video Alpha channel sent either through your video option board or viewed in the Render window.
- 6 Use the Alpha slider to manipulate the transparency of the Alpha channel. This lets you, for example, make the output slightly transparent so you can pre-visualize characters interacting with live Actors.

■ [Matte shader settings](#) on page 479

Matte shader settings

Use the Matte shader to create a 3D matte for a scene. When you apply the Matte shader to an object, the object turns into a colorless 3D matte.



Matte shader settings

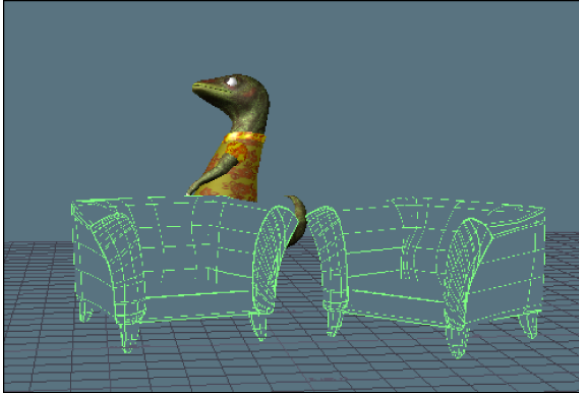
A 3D matte has depth, and is therefore respected by all other 3D objects in the scene. A 3D matte lets you block out parts of a scene to be replaced by video footage.

For example, shows the Matte shader applied to objects representing chairs and a film projector. This gives the illusion that the lizard character named Bill Gecko is walking behind the chairs and talent.



There are no objects representing the chairs. Bill Gecko walks in front of the video clip that is being broadcast on the back plane of the current camera.

In the following image, you can see how after the models of the chair are added to the scene, and then had the Matte shader applied to them. This creates them as matte objects. The video clip is not applied to the back plane of the current camera.



Models are added to the scene. The Matte shader is applied to the chairs, making them matte objects. The video clip is not applied to the back plane of the current camera.

In the next image, you can see the composite image, and how the gecko character interacts with the matted chair models, giving the impression that he has walked behind them.



. The left chair obstructs Bill Gecko. Bill Gecko now appears to walk behind the chairs in the video clip as if they were 3D objects.

Highlight Matted Objects option

When you apply the Matte shader to an object, the object becomes invisible against the background of your screen. For example, you would not be able to see the objects in if there was not a wireframe outlining them.

Activate Highlight Matted Objects to make it easier to locate the objects in your scene.

Enable 3D Masking option

The Enable 3D Masking option allows the 3D Matte shader to be applied to the selected object. When Enable 3D Masking is not active, the shader appears as a wireframe.

Adjust Alpha option

The Adjust Alpha option lets you control the video Alpha channel sent either through your video option board or viewed in the Render window.

Activate Adjust Alpha to create an Alpha channel matte for the model shaded with the Matte shader.

Alpha slider

The Alpha slider lets you manipulate the transparency of the Alpha channel so you can, for example, make the output slightly transparent so you can pre-visualize characters interacting with live Actors.

Using Alpha Matte and its slider does not affect what displays in the Viewer window. To use this feature, you must render your scene using a 32-bit format (such as *.tiff*), or send your output through a video board that supports the Alpha channel.

Controlling a CgFX shader

You can control the CgFX shader using the CgFX shader properties in the CgFX shader settings.

These controls are read from the shader and only adjust the parameters that have been programmed with the shader.

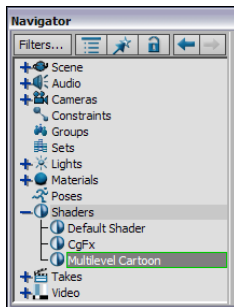
NOTE Using Transparency and Alpha channels with the CgFX shader has limitations as there are some render problems whenever you use the Accurate Transparency and Z-Sort options with self-hiding or intersecting models.

- [CgFX shader settings](#) on page 482
- [Flat Shader transparency types](#) on page 435
- [Testing shaders, textures, and materials](#) on page 395

CgFX shader settings

Use the CgFX shader settings to access controls specific to the CgFX shader you are using.

When you open an object with a CgFX shader in MotionBuilder, the CgFX shader appears with any other MotionBuilder shaders in the Asset and Scene browsers.



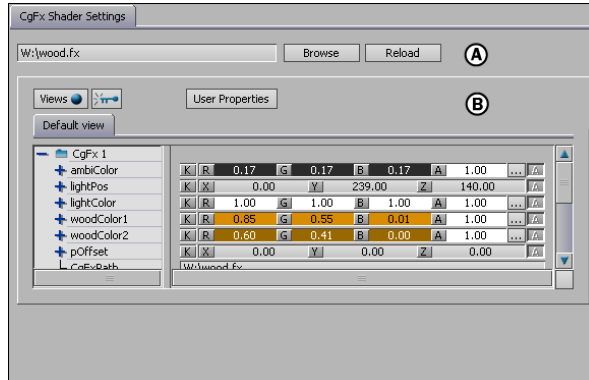
CgFX shaders are displayed with MotionBuilder shaders in the Scene browser.

The CgFX shader settings are split into two parts, the Shader area, and the Shader properties.

NOTE Use conversion utilities available from Nvidia to convert older .fx files to the .cgfx format. For more information about Cg and CgFX consult your Nvidia documentation.

Shader area

The Shader area displays the name of the .fx file in the Name field. Click Browse to open a file browser and locate an .fx file, then click Reload to refresh the CgFX shader's appearance.



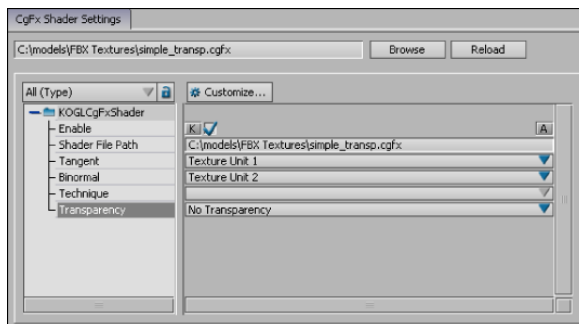
CgFX shader settings A. Shader area B. Shader properties

Shader properties

You can control the CgFX shader in the Shader properties. These controls are read from the shader and only adjust the parameters that have been programmed with the shader.

Transparency Type menu

The Transparency Type menu lets you select a method of calculating transparency, and set a percentage to boost or reduce the object's texture or material opacity. For a description of the transparency types you can select, see [Shader transparency types](#) on page 493.



NOTE Do not use the Transparency Type menu if your shader does not use transparency or alpha blending, as it slows down scene rendering.

Limitation

Using Transparency and Alpha channels with the CgFX shader has limitations as there are still some render problems when you use the Accurate Transparency and Z-Sort options with self-hiding or intersecting models.

- [Controlling a CgFX shader](#) on page 481
- [Testing shaders, textures, and materials](#) on page 395

Shadows and lighting effects

36

How models react to lighting is one of the keys to creating realistic scenes. This is done using the Shadow Map, Live Shadow, Selective Lighting, and Dynamic Lighting shaders.

This sub-section covers those shaders, their settings, and how you can configure them to give your models more realism and drama.

Applying shadows to objects

There are two shaders you can add to models that will cause them to make shadows, the Live Shadow and Shadow Map shaders.

To apply the Live Shadow shader:

- 1 Drag the Live Shadow shader from the Asset browser and drop it on a model in the Viewer window.
- 2 Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
- 3 Alt-drag any models in your scene that you want to cast shadows into the Models Casting Shadows field in the Live shader settings.
You can also click the Models Casting Shadows button next to the field to display the Asset list, where you can choose from models used in your scene.
- 4 Adjust the other shader settings to suit your needs.

To apply the Shadow Map shader:

- 1 Drag the Shadow Map shader from the Asset browser and drop it on a model in the Viewer window.
- 2 Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
When you apply the Shadow Map shader, the selected object turns blue. Your object or plane is then ready for the Shadow Map shader.
- 3 Alt-drag any models in your scene that you want to cast shadows into the Models Casting Shadows field in the Live shader settings.
You can also click the Models Casting Shadows button next to the field to display the Asset list, where you can choose from models used in your scene.
- 4 Click Generate Map in the shader settings. The shadow map is generated and is visible in the Viewer window.
Generate a new map each time you want to save adjustments made to the Shadow Map shader settings.

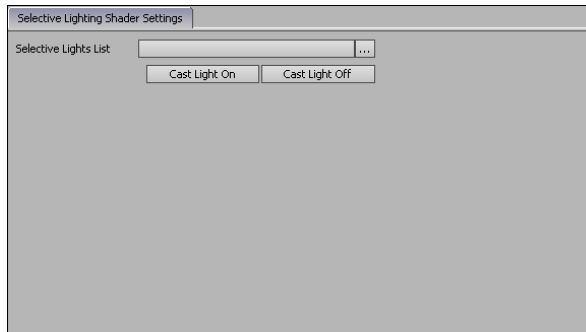
To apply the Dynamic Lighting shader:

- 1 Drag the Dynamic Lighting shader from the Asset browser and drop it on a model in the Viewer window.
- 2 Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
- 3 In the Light settings pane of the light affecting the object, select Linear or Quadratic from the Attenuation menu.

- [Live Shadow shader settings](#) on page 488
- [Image Map textures](#) on page 399
- [Shadow Map shader settings](#) on page 495

Selective Lighting shader settings

The Selective Lighting shader lets you specify which lights illuminate an object in your scene.



Selective Lighting shader settings

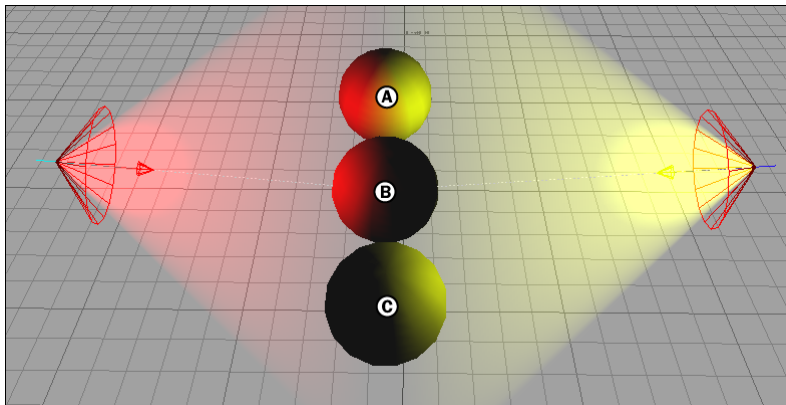
NOTE You can also perform selective lighting effects using the Cast Light On option in the light settings. See [Cast Light on Object](#) on page 369.

Lights Used field

The Lights Used field lets you select the lights you want to use with the Selective Lighting shader.

Alt-drag any lights in your scene into the Selective Lights field. You can also click the Selective Lights button next to the field to display the Asset list, where you can choose from the lights used in your scene.

After applying the Selective Lighting shader to a model, you can select which lights you want to apply to the model using the Selective Lights list. The default option is All. To select an individual light,



A. All lights B. Left (red) light only C. Right (yellow) light only

Cast Light On/Off buttons

The Cast Light On and Cast Light Off buttons are the same as the Cast Light On Object button in the Lights settings. Click one of these buttons to change the settings for all lights in the Lights Producing Shadows list without modifying each light separately in the Lights settings.

Live Shadow shader settings

Use the Live Shadow shader to apply real-time shadows to models. You can specify shadow intensity as well as the lights and objects that cast shadows in a scene.

Adjust the Live Shadow shader settings and apply or append the Live Shadow shader to the plane.

When you apply the Live Shadow shader to your plane, this new layer of real-time shadows replaces the selected plane's texture, material, and other shaders. The areas of your plane that are without shadows become transparent.

When you append the Live Shadow shader to a plane, a layer of real-time shadows generates on top of the shaders already present on the plane. Use the Append option when you want to retain the selected plane's material, textures, or previously created shaders.

Shadow Type menu

The Shadow Type menu lets you select from five different kinds of shadow:

| Shadow type | Effect |
|----------------------|--|
| Planar Shadow | The default shadow setting. Use this shadow type to create darkened shadow areas only on planar surfaces. |
| Projective Shadow | Uses a texture projection to create a shadow. Like the Planar shadow, it darkens the shadowed areas, but you can apply this shadow to non-planar surfaces. |
| Projective Light Map | Uses a texture projection as a shadow, like the Projective Shadow, but instead of |

| Shadow type | Effect |
|------------------------|---|
| | darkening the shadow area, it remains the same and the areas hit by light are brightened. The Projective Light Map can be applied to non-planar surfaces. |
| Projective Z Shadow | Similar to the Projective Shadow, except that it uses a boolean algorithm to create a self-shadow. This shadow does not work with translucent objects. |
| Projective Z Light Map | Similar to the Projective Light Map except that it uses a boolean algorithm to create a self-shadow. |

Shadow Intensity slider

The Shadow Intensity slider lets you manipulate the darkness of shadows cast by a selected object. The default intensity is 100%.

The Shadow Intensity affects the intensity of all shadows created in the Live Shadow shader because shadow intensity is a global value. The strength of a shadow is also affected by the Light Intensity option in the Lights settings. Light Intensity is a local value specified for each individual light.

Shadow Z Offset field

The Shadow Z Offset field is available only when the Shadow Type is set to Projective Z Shadow or Projective Z Light Map.

The Shadow Z Offset field lets you specify the offset of the Live Shadow shader's plane from the original selected plane. It alters the direction in which the object's shadow falls on the plane.

This is useful when two planes, objects, or shaders are too close to each other and there is a conflict between the two locations.

Local (Per Object Shadow) option

The Local (Per object shadow) option is available only when the Shadow Type is set to Projective Shadow or Projective Light Map.

Activate the Local (Per object shadow) option to create an accurate projection of a shadow for each object. This allows for more precision but creates a slower display.

If you disable the Local (Per object shadow) option, all the shadows cast are combined into one large projection. This method is less accurate but does not slow down the display, as one shadow is created instead of many.

Use gobo option

The Use Gobo option is available only when the Shadow Type is set to Projective Shadow or Projective Light Map.

Activate the Use Gobo option if you want the gobo to be included in the shadow map calculation. See [Attaching a gobo to a light](#) on page 358 for more on Gobos.

Framing Type menu

The Framing Type menu is available only when the Shadow Type is set to Projective Shadow or Projective Light Map.

Use the Framing Type menu to select the shadow calculation method.

Shadow Receiver option

Select Shadow Receiver to base the shadow calculation on the size of the Shadow Receiver.

Shadow Caster option

Select Shadow Caster to base the shadow calculation on the size of the Shadow Caster.

Lights Producing Shadows field

Alt-drag any lights in your scene that you want to produce shadows into the Lights Producing Shadows field. You can also click the Lights Producing Shadows button next to the field to display the Asset list, where you can choose from the lights in your scene.

The Lights Producing Shadows area lists all the lights in your scene that produce shadows. If you want a light to produce shadows on a plane that uses the Live Shadow shader, select and Alt-drag each light into this list.

Models Casting Shadows field

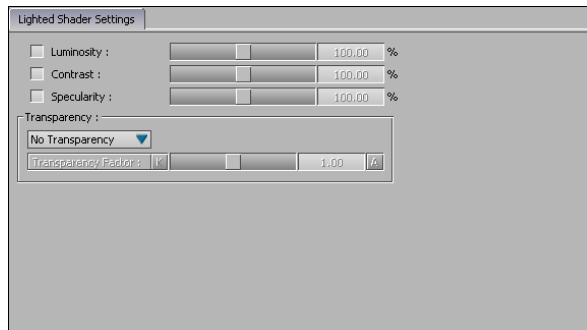
Alt-drag any models in your scene that you want to produce shadows into the Models Casting Shadows field. You can also click the Models Casting Shadows button next to the field to display the Asset list, where you can choose from the models in your scene.

The Models Casting Shadows area lists all the objects in a scene that cast shadows. If you want an object to cast shadows on a plane that uses the Live Shadow shader, select and Alt-drag each object into this list.

Lighted shader settings

Use the Lighted shader settings to control how your object reacts to lighting in the scene.

The Lighted shader contains three color controls: Contrast, Luminosity, and Specular Factor. To use one of these controls, activate the Use option beside the control. The corresponding color control bar is activated.



Lighted shader settings

Luminosity option

Activate the Luminosity option and use the Luminosity slider to change the brightness of the object when reflecting light. This increases overall brightness, including contrast.

Contrast option

Activate the Contrast option and use the Contrast slider to change the contrast of the object when it reflects light.

Specularity option

Activate the Specularity option and use the Specularity slider to change an object's level of shininess when it reflects light by increasing or decreasing the size of the specular highlight.

The specular highlight is the reflection of the light source, and usually appears as a bright circular area.

Transparency Type menu

The Transparency Type menu lets you select a method of calculating transparency, and set a percentage to boost or reduce the object's texture or material opacity. For a description of the transparency types you can select, see [Shader transparency types](#) on page 493.

The following figures show the vest of a model with no shader and with a transparent Lighted shader.



A. Vest with no transparency shader B. Vest with Lighted shader Accurate Transparency set to 0.43.

Transparency Factor slider

The Transparency Factor slider lets you manipulate or animate the Transparency value for the Lighted shader. The default setting is 1.00.

You can also set Transparency using Materials. See [Opacity slider](#) on page 390.

- [Applying shadows to objects](#) on page 485

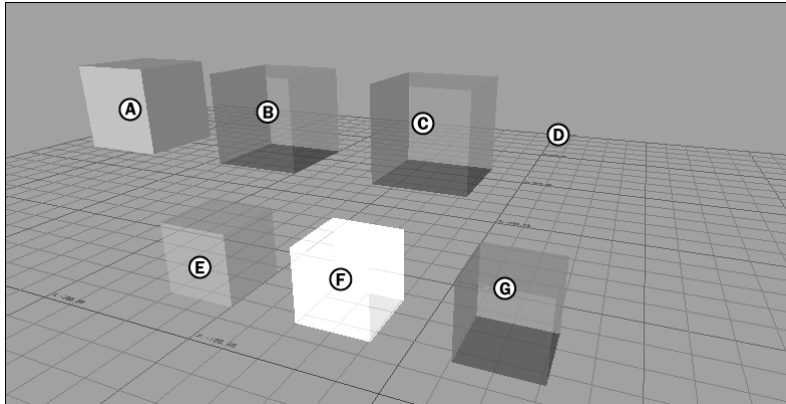
Shader transparency types

The Transparency menu in the Flat, Lighted, CgFX, and Dynamic Lighting shaders lets you select a method of calculating transparency and of adjusting the percentage used to boost the object's texture or material opacity.

NOTE The CgFX shader has limitations with using the Transparency and Alpha channels with the Accurate Transparency and Translucent (Models Z-Sort) options with self-hiding or intersecting models.

No Transparency option

Select the No Transparency option to disable the object or texture's opacity. Applying No Transparency results in a fully opaque object. The Opacity Multiplier is not activated with this selection.



A. No Transparency B. Accurate Transparency C. Translucent D. Matte E. 2D Transparency F. Additive Transparency G. Translucent (Z Sort Models)

Accurate Transparency option

Select the Accurate Transparency option to calculate the transparency of the object or texture's opacity using a more accurate, but slower algorithm.

Accurate Transparency is intended for objects that are only slightly transparent.

Use the Opacity slider to boost the amount of accurate transparency. Low values may show layering problems.

Translucent option

Select the Translucent option to calculate the transparency of the object or texture's opacity using a less accurate but faster algorithm. Use Translucent for very transparent objects.

Use the Opacity slider to boost or reduce the amount of transparency. A value of 0% makes the shaded object invisible.

Matte option

Select the Matte option to use the quickest method of applying transparency. Use the Matte option for objects with textures that have an Alpha matte.

The Opacity Multiplier functions differently for the Matte setting. Changing the percentage boosts or diminishes the matte, changing which Alpha channel values are included in the matte. This creates a thinning or thickening effect on the matte.

2D Transparency option

Select the 2D Transparency option to apply transparency to the visible surface of the object. When an object has 2D Transparency applied to it, solid objects are visible while partially transparent objects are not.

Use the Opacity slider to increase the amount of 2D transparency.

Additive Transparency option

Select the Additive Transparency option to apply transparency to the whole object. This option incrementally increases the color value of the object.

Use the Opacity slider to change the object's level of transparency. A value of 0% makes the object completely transparent.

Translucent (Models Z Sort) option

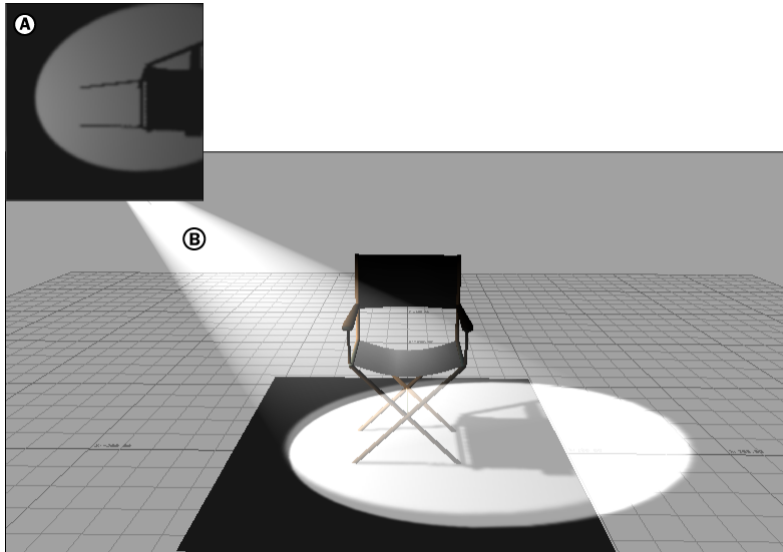
Select the Translucent (Models Z Sort) option for more accurate effects whenever you have objects in front of one another using transparency.

NOTE This Transparency type is the only one that sorts models according to their distance from the camera. In cases where the models are very close to each other or overlapping, the algorithm may not be able to determine which model is in front.

Shadow Map shader settings

The Shadow Map shader settings govern the use of shadow maps in the shader.

Map shaders take a “snapshot” of the scene at the moment it is rendered, and applies it to an object as a texture.



Map examples *A. Created map* *B. Scene with the shadow map applied to the floor plane.*

The Shadow Map shader is a useful alternative to live shaders as they do not demand much of the system’s resources to display. Use the Shadow Map shader to apply a shadow image to an object or a plane.

Map Type menu

The Map type menu lets you create textures that appear in the Texture settings when you generate a map. The resulting texture depends on the shadow type that you choose.

For more on Map textures, see [Image Map textures](#) on page 399.

Shadow Map option

The Shadow Map selection creates a texture combining all shaders, materials, textures, and lights applied to your material. Shadow Map is faster but less accurate than Light Map.

Light Map option

The Light Map selection creates a texture using only the lights in your scene. Other textures, materials, and shaders do not affect the Light Map texture. It is best to use this option with another shader to add a more realistic color to the object.

Contrast slider

The Contrast slider lets you manipulate the contrast of shadow to the surrounding plane. Contrast must be set before the map is generated. You cannot modify the contrast after generating the map, unless you regenerate the map. The default intensity is 70%.

Generate Map For menu

Use the Generate Map For menu to select the objects on which you would like to generate a shadow map.

Model Casting Shadows field

The Models Casting Shadows field lists all the objects in your scene that cast shadows. You can also click the Models Casting Shadows button next to the field to display the Asset list, where you can choose from models in your scene.

The Models Casting Shadows area lists all the models in your scene that can produce shadows. If you want an object to cast shadows on a plane that uses the Shadow Map shader, select and Alt-drag each object into this field.

If the Asset list shows the Scene with a check mark next to it, all objects in your scene cast shadows.

Generate Map For menu

The Generate Map For menu lets you choose the models for which you want to create maps. You can select All Models or Selected Shaded models.

File Path field

The File path field lets you specify the path used for the file as well as save the generated map to disk as a texture file. The default path is C:\temp.

You can only save maps that are generated using the Generate Map For button. Define a Save Map Path before generating a map.

Map Size settings

You can choose to use the size of the texture (if there is a texture applied to the selected object) or you can use the size of the map as defined in Map Size. This option is only available with the Spherical Map and Sphere Map.

X and Y menu

The X and Y menus let you choose the size (in pixels) of the generated map. The default is 128 x 128.

There is a higher resolution, a longer generation waiting period, and a greater memory requirement with a larger map size.

Preview Map button

Click Preview Map to generate a preview map for all or selected objects with the Shadow Map shader applied. Use this option to quickly generate a low resolution map, so that you can preview the result of the Shadow Map shader.

Use the Generate Preview Map option with the adjacent menu. This lets you choose between generating the map for all objects or only selected shaded objects in your scene.

Generate Map button

Click Generate Map to generate a full resolution map of all or selected objects with the Shadow Map shader applied.

Use the Generate Map button with the adjacent menu to select between generating the map for all objects or only selected shaded objects. The shadow map cannot be generated unless the Save Map Path is valid.

Lights Producing Shadows field

Alt-drag any lights in your scene that you want to have cast shadows into the Lights Producing Shadows field. You can also click the Lights Producing

Shadows button next to the field to display the Asset list, where you can choose from lights used in your scene.

The Lights Producing Shadows area lists all the lights in your scene that produce shadows. If you want a light to produce shadows on a plane that uses the Shadow Map shader, select and Alt-drag each light into this list.

If the Asset list shows Lights with a check mark next to it, all lights in your scene will produce shadows.

Cast Light On/Off buttons

The Cast Light On and Cast Light Off buttons are shortcuts to the Cast Light On Object button in the Lights settings. Click these buttons to globally change the settings for all lights in the Lights Producing Shadows list without modifying each light separately in the Light settings.

Shadow Map texture settings

The Shadow Map shader creates a *.tiff* image of the shadow to be projected as the shadow map. You can manipulate this *.tiff* in the Texture settings.

The two Texture Type settings that can be used with the Shadow Map shader are Shadow Map and Light Map

Light Area field

The Light Area field contains settings that let you create soft shadows in your scene.

Sample Count field

Enter a value in the Sample Count field to create a more precise map of the lighted area. The more light area sampled, the longer the generating time, and the better the resolution.

The default Sample Count is 3.

Radius setting

The Radius determines the light radius distribution (in centimeters) for all the light in a scene. A larger radius results in a larger penumbra, which is the space between perfect shadow and full light.

NOTE The default Radius is 1.000 cm.

You must use Generate Map to view the results of Radius and Sample Count. Generate Preview Map does not show changes.

■ [Applying shadows to objects](#) on page 485

Dynamic Lighting shader settings

Use the Dynamic Lighting shader settings to control the light falloff your object reacts to lighting in the scene. MotionBuilder uses vertex per-face lighting by default, but the dynamic Lighting Shader gives you a softer per-pixel falloff, for more realistic effects.

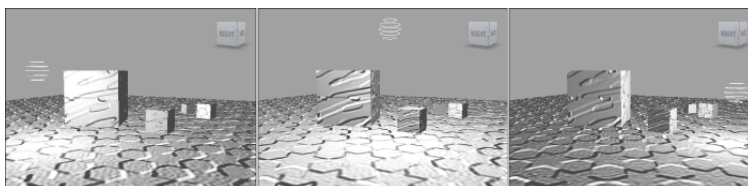
NOTE The Dynamic Lighting shader works in conjunction with the Light Settings pane Attenuation menu. See [Attenuation](#) on page 367.

Transparency Type menu

The Transparency Type menu lets you select a method of calculating transparency, and set a percentage to boost or reduce the object's texture or material opacity. For a description of the transparency types you can select, see [Shader transparency types](#) on page 493.

Normal Map shader

You can also use the Dynamic Lighting shader to read relief from Normal maps.



Use the Dynamic Lighting shader to create Normal map effects

To add relief with a normal map:

- 1 From the Asset browser, drag a Dynamic Lighting shader onto the objects you want to affect.
- 2 From the Asset browser, drag a texture asset onto the same objects.
- 3 From the Texture settings pane Media menu browse to select a Normal map texture.
- 4 Select Bump Map (Normal Map) from the Texture settings Texture Appearance menu.

Shader manager

37

When you add a shader to a model, that shader's settings appear in the Navigator window. These settings let you adjust the shader so that you can customize and refine its effect.

Each shader's settings are specific to the shader applied.

Shader columns

The Shader columns in the Shader manager let you prioritize any Shaders used in your scene.

Shader 1 menu

Use the Shader 1 menu to select a base shader to be used with your model.

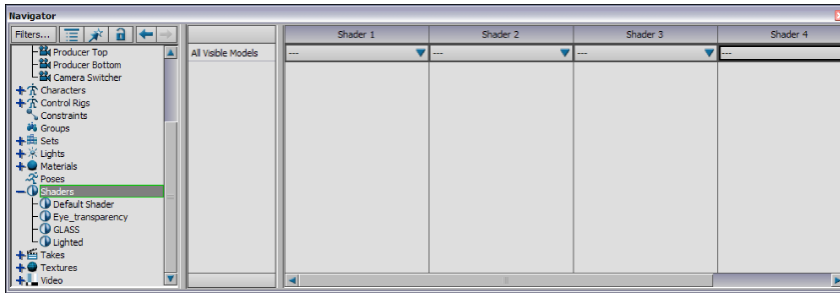
No Shader option

Select No Shader to detach the selected shader from the selected object. The shaders listed include all the shaders created using the shader options in the Asset browser.

Use the Shader 2 through Shader 5 columns to append additional shaders. Each shader is applied over the previous one, letting you combine shaders.

To view hidden Shader Manager columns:

- 1 Double-click the Shaders root folder in the Scene browser.
- 2 Shift-click and drag left in the table or resize the columns.



Shader Manager

- [Defining settings for a shader](#) on page 502

Defining settings for a shader

Define the shader's settings using the shader settings in the Navigator window.

To define settings for a shader:

- 1 Double click to expand the Shaders folder in the Scene browser.
- 2 Double-click the shader whose settings you want to change.
- 3 The shader is selected and its settings appear in the Navigator and Properties windows.
- 4 Adjust the settings as directed in the appropriate shader reference.

Culling Mode menu

Use the Culling Mode menu in the to select a method to suppress the drawing of back-facing polygons. There are three culling modes:

- Culling Off
- Culling On (CW): Clockwise culling
- Culling On (CCW): Counter-clockwise culling

For NURBS and Patch-based models, the Culling mode is always counter-clockwise (CCW). If the model is based on polygons and stripped, culling has no effect. Otherwise, the proper culling mode depends on the order of points used when you build your polygon model.

Manipulating Objects

Knowing how to effectively manage, move, and alter objects is an important part of animation. In MotionBuilder, you can manually manipulate an object using the simple Transformation modes, or you can associate the object with a device that controls its movement. You can adjust the pivot points from which the object is manipulated, or control it using an associated Handle. You can also define Degrees of Freedom to limit an object's movement.

This section includes the following topics:

- [Transformation](#) on page 507
- [Handles](#) on page 541
- [Degrees of Freedom \(DOF\)](#) on page 555

You can also manipulate objects in 3D space using constraints and devices. These topics are covered in the following sections:

- [Animating with Devices](#) on page 1019
- [Animating with Constraints](#) on page 819

Transformation

38

All 3D objects have groups of values (X, Y, Z values) that describe the size of the object, the orientation of the object, and the location of the object in 3D space. At the origin of an object, all three values have a zero value. This means that $X=0$, $Y=0$, and $Z=0$, defined as $(0,0,0)$.

By changing the X, Y, or Z coordinate values of an object in 3D space, you can reposition, resize, or re-orient it. Any time this is performed on an object in 3D space, it is called transformation.

There are three fundamental transformation methods for changing objects in 3D space:

- [Translation](#) on page 514
- [Rotation](#) on page 517
- [Scaling](#) on page 523
- [Setting a default manipulation mode for objects](#) on page 512

Reference modes

When you transform an object, you can change the way the values that define its location, size, and orientation are displayed. Any transformation value can be defined relative to the scene (globally) or relative to the object itself (locally). Rotation values can also be defined using the Additive Reference mode.

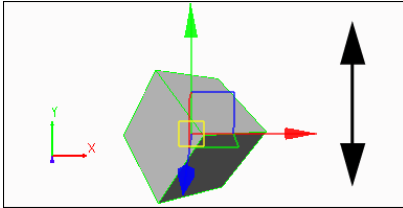
The Reference mode menu in the Viewer window lets you choose which way you want to define transformation values. See Reference mode menu for more information.

Global Reference mode

Select the Global Reference mode if you want an object's transformation values displayed relative to the center of the scene (the global axis).

When you activate the Global Reference mode while transforming objects, the Translation arrows and Rotation rings are shown with the same orientation as the center of the scene. Scaling handles are always oriented to match the axis of the object itself.

For example, in the figure below, Global Reference mode is selected so that when the object is translated along the Y-axis, it moves along the global Y-axis.



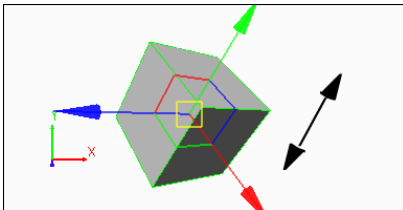
Global Reference mode: The marker translates along the global Y-axis.

Local Reference mode

Select Local Reference mode if you want an object's transformation values to be displayed relative to its own center, or from the center of its parent if it is parented. If the object does not have a parent, the values of Local mode are the same as Global mode.

When you activate Local Reference mode while transforming objects, the Translation arrows, Rotation rings, and Scaling handles all display relative to the center of the object itself.

For example, in the figure below, Local Reference mode is active, so the marker is translated along its local Y-axis.



Local Reference mode: The marker translates along the local Y-axis.

The object's center (its local axis) is determined by the placement of its [Transformation pivots](#) on page 529. You can offset an object's Transformation pivots using the Transformation pivots properties. (See [Transformation pivots](#) on page 529.)

While the Local Reference mode can be used to rotate any group of objects, it is particularly useful when you rotate objects that are part of the same hierarchy, such as a character's spine, fingers, or tail. Since the rotation of each object in the hierarchy is calculated relative to its parent, you can easily create natural bending.

Additive Reference mode

NOTE Additive Reference mode is only available if you are in Rotation mode. In addition, you cannot use it when you have selected a Control rig effector while in Full Body or Body Part keying mode.

Select Additive Reference mode if you want the selected object's transformation values to reflect its actual local coordinates on the current layer only. This is useful when you are working with FCurve values because it lets you work with each axis independently.

The Additive mode lets you perform individual and continuously incrementing axis rotations. It lets each axis rotate freely to show the calculation behavior of the real Euler rotations, which can help identify why gimbal locks occur in your animation.

■ [Scaling mode](#) on page 524

Transforming objects

There are two basic methods to transform your objects: using the Transformation handles, or by entering specific coordinates.

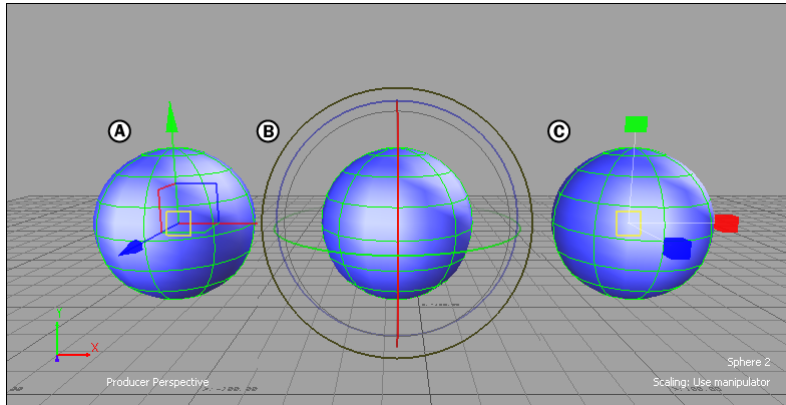
By default, when you transform an object, the transformation is applied from a starting point or 'pivot' at the center of the object. If you want to transform an object from a point other than its own origin, you can adjust the Transformation pivots. See [Transformation pivots](#) on page 529 for more information.

To transform objects with Transformation handles:

- 1 Select Translation, Rotation, or Scaling manipulation mode by clicking the appropriate Transformation button in the Viewer window toolbar. (See Transformation buttons.)

- 2 Select an object.

Transformation handles (arrows for translation, rings for rotation, and handles for scaling) appear on the selected object.



Transformation handles on a sphere A. Translation B. Rotation C. Scaling

- 3 Drag these handles to manipulate your objects in the Viewer window.

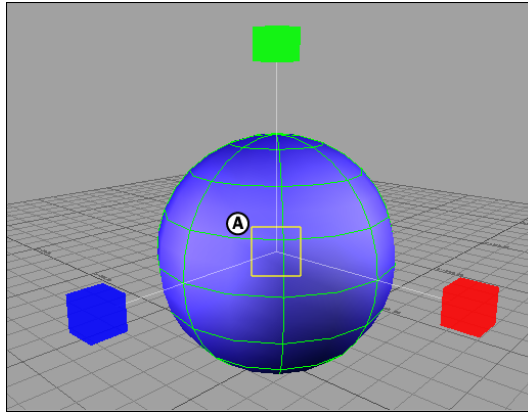
You can Increase or decrease the size of the Transformation handles (arrows, handles, or rings) by pressing the plus sign or minus sign keys of the numeric key pad when they are the active selection.

To transform objects using the Free Transform plane:

- 1 Select the object you want to transform.

NOTE Make sure you are in Selection or XYZ mode in the Selection Mode Menu at the side of the Viewer window.

- 2 Click in the Viewer window and press T, S, or R on the keyboard to activate translation, scaling, or rotation mode for the object. The yellow Free Transform plane (or ring) appears.



Sphere in Scaling mode A. Free Transform plane

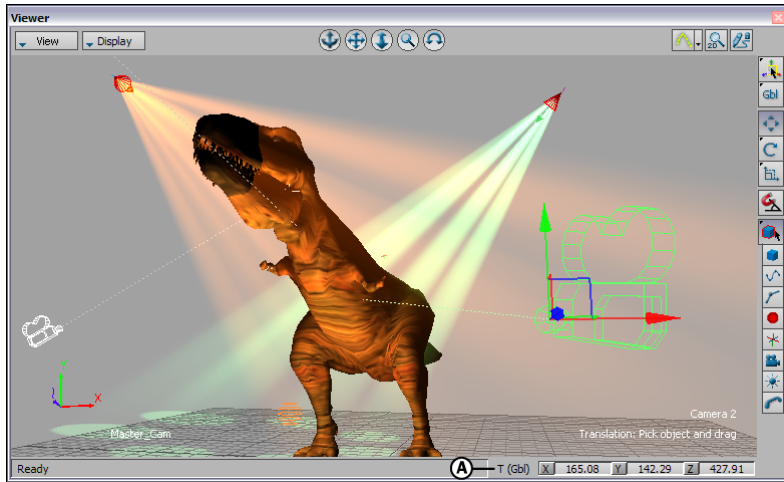
- 3 If translating or scaling, hover your mouse over the Transform plane; the transform plane highlights as the mouse passes over.
- 4 When the plane is highlighted, drag the object. If rotating the object, drag the yellow rotation ring.

- [Scaling mode](#) on page 524
- [Free Transform plane](#) on page 513
- [Transformation pivots](#) on page 529

To transform objects using specific coordinates:

- Click and drag left or right in the Global/Local/Layer fields of the Viewer window to decrease or increase the value.
To drag through numbers more slowly, right-click and drag in the field.
- Double-click in the X, Y, or Z fields, type the new value, and click Enter.

The currently selected Transformation and Reference modes are displayed beside the Global/Local/Layer fields in the Viewer window.



Viewer window A. Global/Local/Layer fields

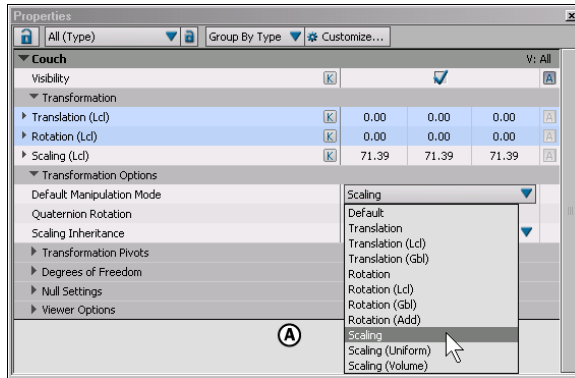
- [Transforming objects](#) on page 509
- Global/Local/Layer fields

Setting a default manipulation mode for objects

You can specify a default manipulation mode (Translation, Rotation, or Scaling) for any object, so that when you select the object it is automatically set to the preferred manipulation mode.

To set a default manipulation mode:

- 1 Select the object in the Viewer window.
- 2 In the Properties window, expand Transformation Options.
- 3 From the Default Manipulation mode menu, select a manipulation mode that you want to be active whenever you select the object.



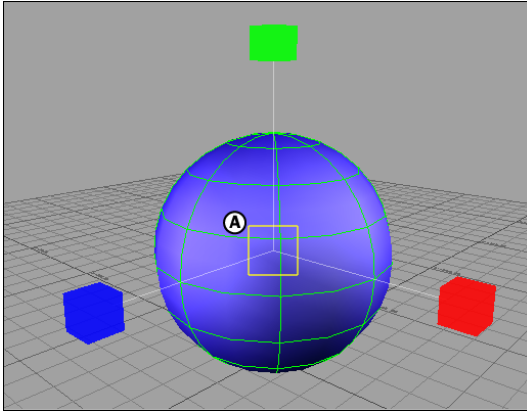
Properties window A. Setting a model's Default Manipulation mode to Scaling.

NOTE This mode is overridden whenever a new manipulation mode is selected.

- [Translation](#) on page 514
- [Rotation](#) on page 517
- [Scaling](#) on page 523

Free Transform plane

A yellow square appears at the center of the Transformation planes when you are in the Selection or XYZ Selection mode. This is the Free Transform plane.



Sphere in Scaling mode A. Free Transform plane

Dragging the Free Transform plane in Translation or Scaling mode lets you move or scale an object in any direction.

In Rotation mode, the Free Transform Plane becomes a yellow Free Rotation ring so you can rotate your object in any direction.

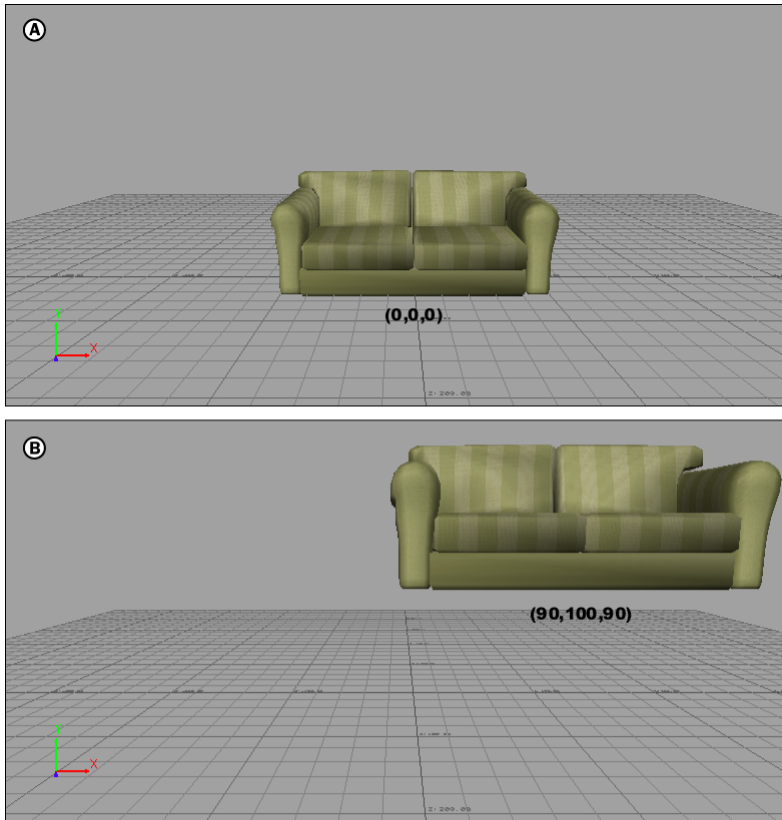
- [Scaling mode](#) on page 524
- [Translation mode](#) on page 515
- [Rotation mode](#) on page 518
- [Transforming objects](#) on page 509
- Selection Mode Menu

Translation

You can define the location of any point in 3D space relative its original position by specifying a value for each point. Assigning a positive or negative value for each point in the XYZ coordinate system lets you move, or translate, the object in 3D space.

Translating an object moves all the points of the object by the same amount, without changing its orientation.

For example, to move an object in a scene to the location defined by (90,100,90), start at the origin (0,0,0) move 90 units in the X (left) direction, 100 units in the Y (up) direction, and then 90 units in the Z (forward) direction.



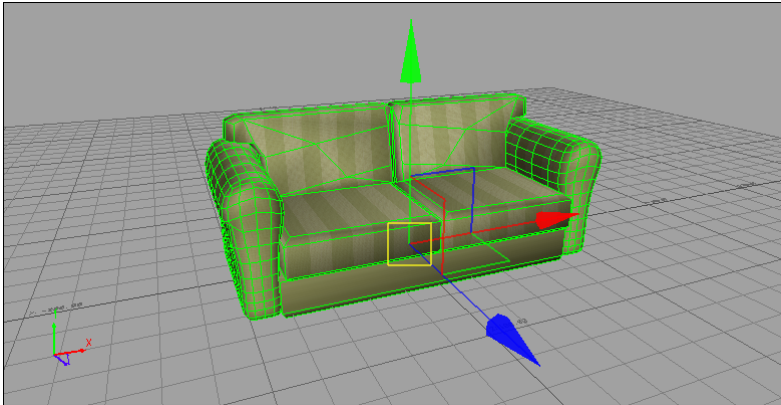
Viewer window A. Sofa's position at the center of the 3D world (0,0,0) B. Sofa's position at (90,100,90)

In the Viewer window, when you are using Translation mode, the object can be transformed using graphically selected's rotation rings with your mouse in the Viewer window, or this can be done precisely by entering values in the Properties window.

Translation mode

When you activate Translation mode in the Viewer window, you can move selected objects up, down, and back and forth using the Translation arrows. Depending on what you have selected in the Selection Mode Menu, you can move the object by dragging these handles around the camera view.

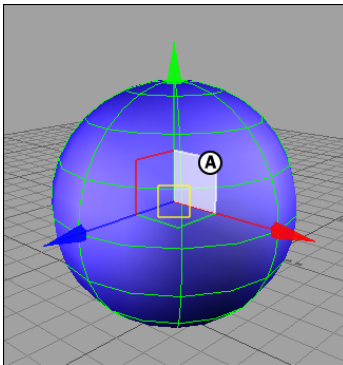
For example, in the figure below, a sofa is shown in the Viewer window with Translation arrows, representing each axis. If you select one of the arrows and move the mouse in a direction, the sofa is translated along that axis.



Selected object in the Viewer window displays with Translation arrows for translating on the X, Y, or Z axis.

NOTE You can transform objects using transformation handles in the Viewer window or by specifying exact coordinates in the Transforms or Properties windows.

Each Translation arrow is color-coded to its specific axis. The red arrow translates along the X-axis, the blue arrow translates along the Z-axis, and the green arrow translates along the Y-axis.



**Transformation arrows A.
Transformation plane**

At the centre of the Translation arrows, Transformation planes appear at the center of the handles. These Transformation planes let you move an object exclusively along a plane, for example, the XY plane.

- [Translating an object](#) on page 517
- [Transforming objects](#) on page 509
- Global/Local/Layer fields
- [Transformation pivots](#) on page 529

Translating an object

- 1 Activate the Translation manipulation mode by doing one of the following:
 - Select the Translation mode button from the Transformation buttons in the Viewer window.
 - Click in the Viewer window and press T.
- 2 Select the object and drag the translation arrows that appear to move your object in the Viewer window.
You can also enter specific coordinates in the Global/Local/Layer field.

- [Translation](#) on page 514
- [Transforming objects](#) on page 509
- [Transformation pivots](#) on page 529

Rotation

The rotation of an object is its orientation in the scene. When you rotate an object, you are changing the properties that define its degree of rotation around each of the three axes.

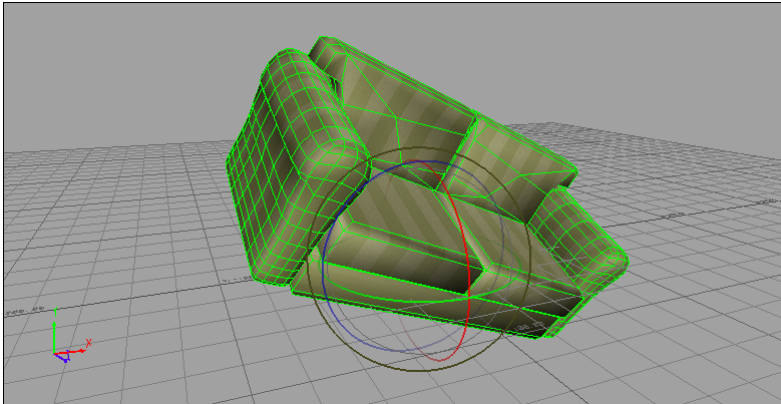
To rotate objects, you must be in Rotation mode.

Rotation mode

Rotation mode lets you change the orientation of selected objects in the Viewer window. To activate Rotation mode, select the appropriate button from the Transformation buttons, or click in the Viewer window and press R.

Activating Rotation mode makes Rotation rings appear on selected objects, so you can change the orientation of objects by dragging the rings.

For example, shows a sofa in the Viewer window with Rotation rings representing each axis.



Selected object in the Viewer window displays with Rotation rings for rotating on the X, Y, or Z axis.

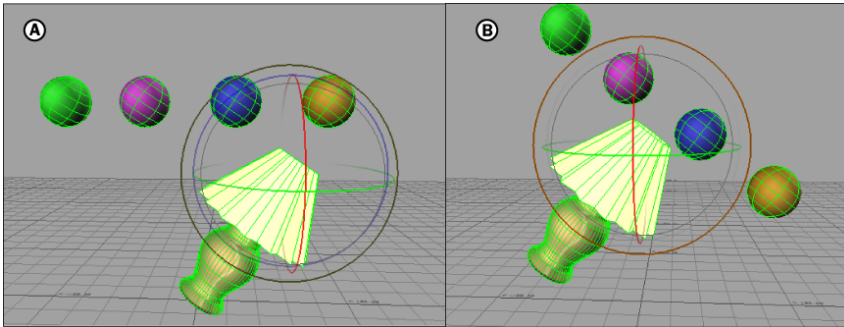
Three of the Rotation rings are color-coded to their specific axis. The red ring rotates the object along the X-axis, the blue ring rotates along the Z-axis, and the green ring rotates along the Y-axis. The brown ring rotates along a perpendicular angle from wherever the camera projects its angle.

NOTE When in Rotation mode, you can also use the Layer (Additive) mode from the Reference mode menu in the Viewer window. See Reference mode menu for more information.

Rotate Around mode

Rotate Around mode lets you take a group of selected objects, designate one object as the ‘manipulation point’, and rotate all other objects around that manipulation point.

In this mode, Rotation rings appear only on the manipulation point object, and as you rotate, the other objects in the selection rotate around it.



Rotation modes: A. Rotate B. Rotate Around

This manipulation point creates a new center of rotation for the selected objects, replacing the local or global origin as the center of rotation.

This manipulation mode can be very powerful when used with effector pivots, for example to rotate a character's entire foot around the toes.

You can also change the center of rotation for each individual object using the [Rotation Pivot properties](#) on page 532.

NOTE When you keyframe objects using the Rotate Around mode, remember that as the manipulation point rotates, the other selected objects rotate and translate.

- [Rotation Pivot properties](#)
- [Rotating an object](#) on page 520
- [Global/Local/Layer fields](#)
- [Transformation pivots](#) on page 529
- [Setting a default manipulation mode for objects](#) on page 512

Activating Rotation mode

To activate Rotation mode, do one of the following:

- Select Rotation from the Transformation buttons in the Viewer window.
- Click in the Viewer window and press R.

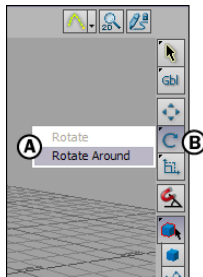
You can now rotate any selected object. See [Rotating an object](#) on page 520 for more information.

- [Rotation](#) on page 517
- [Setting a default manipulation mode for objects](#) on page 512

Rotating an object

To rotate an object:

- 1 Activate Rotation mode. (See [Activating Rotation mode](#) on page 519.)
- 2 Expand the Rotate menu from the Viewer window Transformation buttons and select a Rotation mode from the Rotate options.

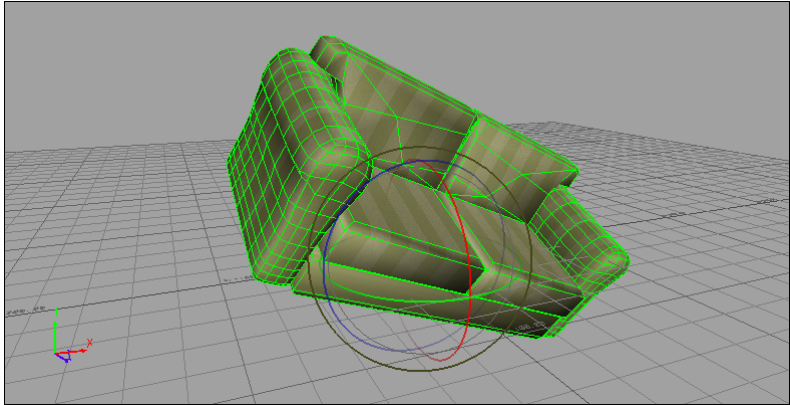


Viewer window
Selection mode menu
A. Rotate menu B.
Rotate options

- Select Rotate if you want to “spin” the object.
- Select Rotate Around if you want the other objects in the selection group rotate to around the manipulation point.
- If you want to rotate objects incrementally, use the Snap Angle button. See Snap Rotation.

NOTE When in Rotate transformation mode, the reference menu includes the Layer (Additive) option.

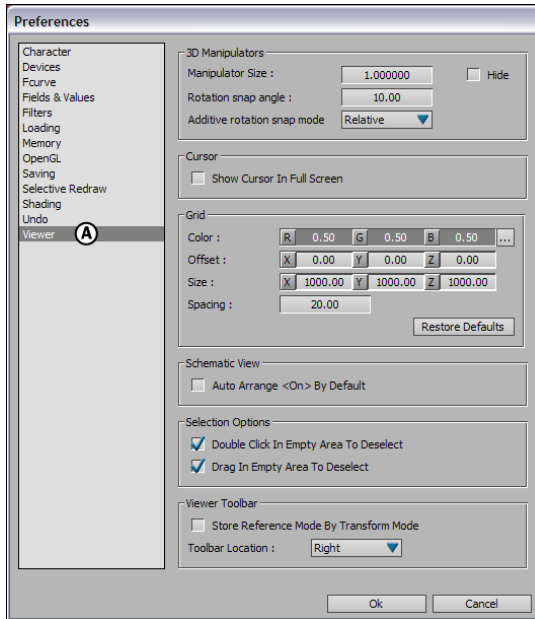
- 3 Select the object’s rotation rings in the Viewer window and drag them or enter precise values in Properties windows.



Selected object in the Viewer window displays with Rotation rings for rotating on the X, Y, or Z axis.

To snap the rotation of objects at specific increments:

- 1** Select Settings > Preferences from the menu bar.
- 2** In the Preferences window, select the Viewer preferences.

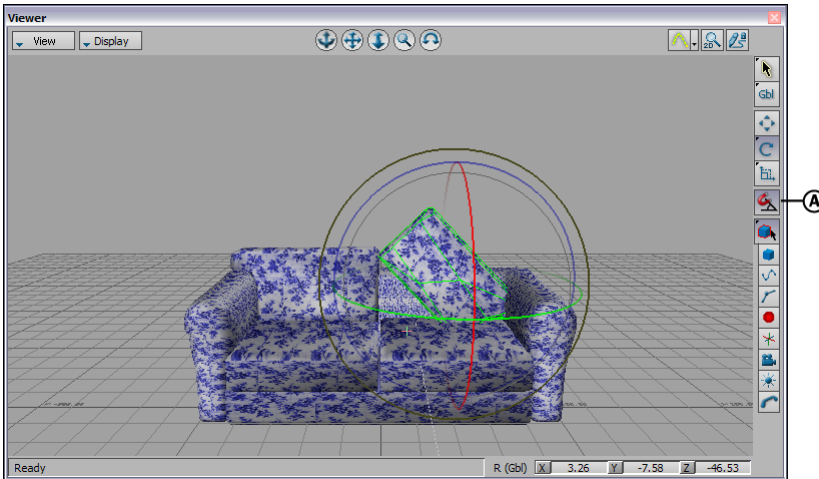


Preferences window A. Select the Viewer preferences.

- 3 In the 3D Manipulators area, enter the size of increment (in degrees) in the Rotation snap angle field.

TIP Right-click the Snap Rotation button to view the last five increments set for the Snap Rotation and to open the Preferences window and set a new increment size.

- 4 Activate the Snap Rotation button in the Viewer toolbar. You can also hold down the M key to activate Snap Rotation mode temporarily.



Viewer window: A. Snap Rotation button

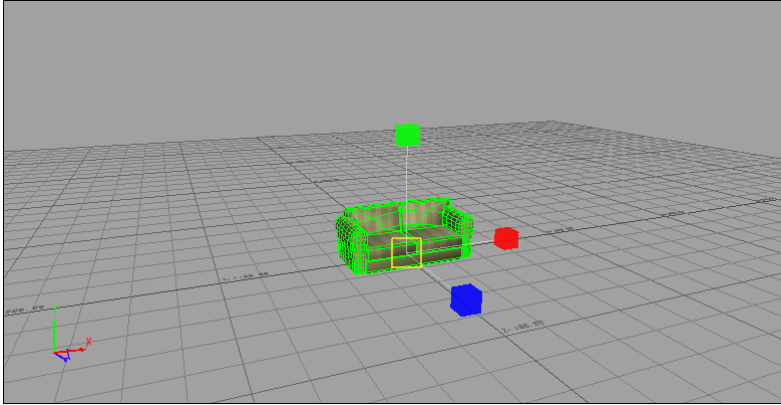
NOTE If no rotation increment is specified, objects rotate in 10-degree increments by default.

To return to regular (non-incremental) rotation, disable the Snap Rotation button.

- [Rotation](#) on page 517
- [Transformation pivots](#) on page 529
- Rotation Pivot properties

Scaling

Scaling an object changes its size. You can uniformly expand or shrink an object on all axes to uniformly change its size, or you can scale an object on only one axis to deform it.



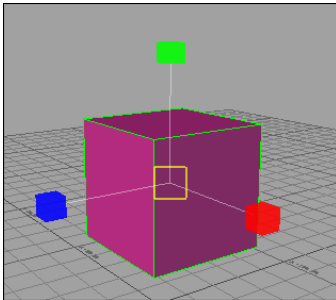
Selected object in the Viewer window displays with Scaling handles for scaling the object on each axis.

For example, in the figure above, the sofa has Scaling handles that you can drag with your mouse to scale the object.

In order to scale objects, you must put the Viewer window in scaling mode.

Scaling mode

When you are in Scaling mode, Scaling handles appear on any selected object. Each Scaling handle is color-coded to its specific axis. The red handle scales along the X-axis, the blue handle scales along the Z-axis, and the green handle scales along the Y-axis.



Scaling handles appear on the selected object.

There are two types of Scaling used in MotionBuilder, Volumetric and Uniform. The following table explains the differences between the two:

| Scaling mode | Purpose |
|--------------|--|
| Volumetric | Choose Volumetric scaling mode to scale your object without changing its volume. Volumetric scaling uses the same manipulation principles as XYZ, but scaling a model in Volume mode does not change the surface volume. Instead, the non-edited axes compensate for the axis that is being scaled. For example, when scaling out your model along the Y-axis, the model simultaneously scales in along the X- and Z- axes in order to keep the volume constant. |
| Uniform | Choose Uniform scaling mode to scale a selected object uniformly along the XYZ axes, without changing its proportions. |

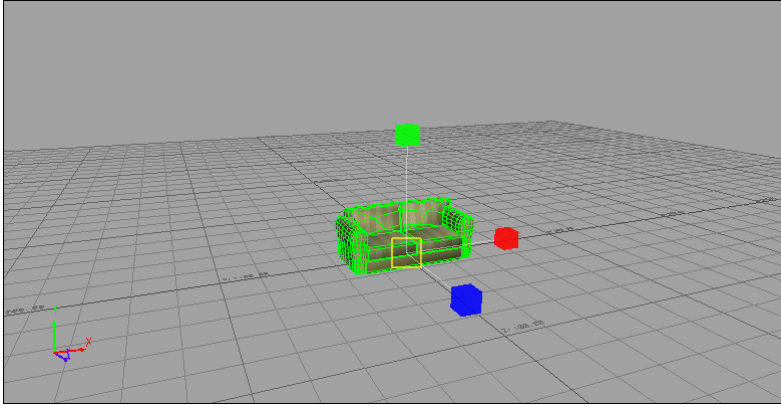
- [Scaling an object](#) on page 526
- [Activating Scaling mode](#) on page 525
- [Setting a default manipulation mode for objects](#) on page 512
- Viewer toolbar

Activating Scaling mode

To activate scaling mode in the Viewer window, do one of the following:

- Click in the Viewer window and press S.
- Select the Scaling button from the Transformation buttons in the Viewer window.

Depending on what you have selected in the Selection Mode Menu, Scaling handles appear on any selected object. If you select “Selection” you can drag the scaling handles to change the size of the object on any axis.



The selected object in the Viewer window displays with Scaling handles for scaling the object on each axis.

See [Scaling an object](#) on page 526 for more information on scaling objects.

- [Setting a default manipulation mode for objects](#) on page 512

Scaling an object

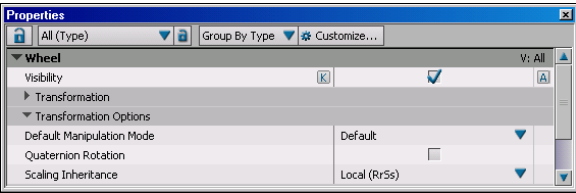
- 1 Activate Scaling mode. (See [Activating Scaling mode](#) on page 525.)
- 2 Optional: Expand the Scaling mode button to choose one of the following scaling modes:
 - Choose Uniform to scale a selected object uniformly along the XYZ axes, without changing its proportions. (This option is selected by default.)
 - Choose Volumetric to scale your object without changing its volume.
- 3 Select the object you want to scale and drag the scaling handles to resize it.

You can also enter specific coordinates in the Global/Local/Layer fields.

- [Scaling mode](#) on page 524
- Global/Local/Layer fields
- Viewer window

Transformation Options properties

In the Properties window, the settings found in the Transformation Options group let you set advanced properties for transforming objects.



Properties window: Transformation options

Default Manipulation mode

This menu lets you set a default manipulation mode (translation, rotation, scaling, and so on,) to be the active transformation mode whenever you select an object.

Quaternion Rotation

This option lets you activate or disable quaternion rotation calculations, which can help to avoid gimbal lock problems when rotating some objects.

Scaling Inheritance

When you modify the scaling of a parent object, the child object is affected. This menu lets you select what type of scaling inheritance you want between parent and child objects. Choose from the following three types:

| Scaling type | Description |
|--------------|---|
| Local (RrSs) | Activates local scaling mode. If you scale a parent object on its X-, Y-, or Z-axis, child objects scale on their local X-, Y-, or Z-axis. The child objects also translate to keep proportional distance from the parent. You can still scale the child object without affecting the parent. |

| Scaling type | Description |
|---------------|---|
| Parent (RSrs) | Activates parent scaling mode. If you scale a parent object on one axis, Child objects deform to maintain their volume while stretching to scale on the same axis. For example, you can use this option if you have a group of models and you want them all to scale down on the same axis and appear squashed. |
| None (Rrs) | In this mode, Child objects do not inherit scaling from parent objects at all. When a parent object is scaled, the child does not scale, but translates in order to keep proportional distance between models. |

Creating pivot offsets

There are two ways you offset a transformation pivot from its object: in the Viewer window or properties window:

To create a pivot offset in the Viewer window:

- 1 Select the object with the pivot you want to offset.
- 2 Switch to Pivot in the Viewer window Object Mode selection menu.
- 3 Select Translate.
- 4 In the Viewer window, select and drag the pivot to reposition it. To specify exact XYZ coordinates, enter them in the Global/Local/Layer fields at the bottom of the Viewer window.

NOTE You can only offset rotation and scaling values.

To create a pivot offset in the Properties window:

- 1 Select the object with the pivot you want to offset.
- 2 Open the Properties window (or the Properties tab in the Asset browser).

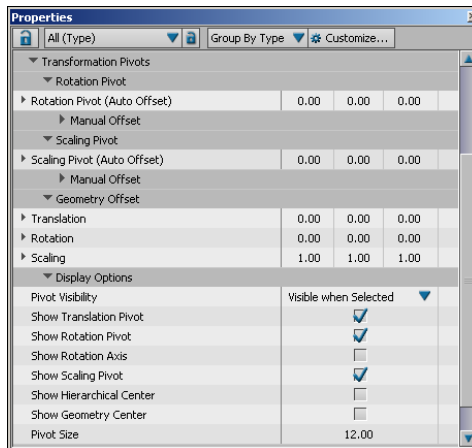
- 3 Switch to All (Type) in the Select Property View menu.
- 4 Expand Transformation Pivots, expand Rotation Pivot or Scaling Pivot and specify coordinates in the Auto Offset XYZ fields.

NOTE You can only offset rotation and scaling values.

Transformation pivots

A pivot is the point from which a selected object is transformed. MotionBuilder lets you adjust the position of pivots so that you can manipulate an object from a point other than the default.

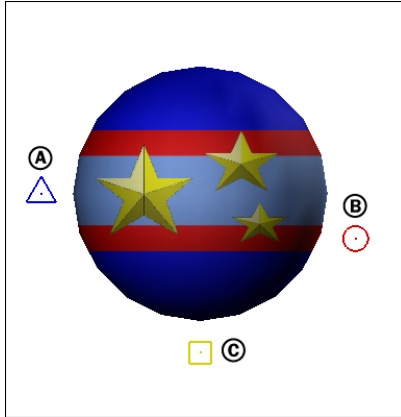
The Transformation Pivot group of properties lets you manipulate separate pivots for rotation and scaling. Each pivot can be positioned independently relative to the object's geometry. This lets you move the point on which an object's transformational properties are based. See [Creating pivot offsets](#) on page 528 for information on how to repositioned pivots independently of your object's geometry.



Properties window, Transformation Pivots properties

For example, to animate a bouncing ball, you might rotate the ball around the center of the model, but scale the ball from the top or bottom to simulate a squash and stretch effect as the ball hits the ground.

In the Viewer window, pivots are represented by two-dimensional icons that always face the camera and always appear to be the same size regardless of the position or zoom of the camera. Translation pivots are represented by a blue triangle icon, rotation pivots by a red circle icon, and scaling pivots as a yellow square icon.



Transformation pivots display on a ball.
A. Translation pivot B. Rotation pivot C. Scaling pivot

The visibility of transformation pivots is automatically turned on when you offset the pivots of a selected object. You can also change the Pivots Visibility options in the Viewer Options section of the Properties window. There are additional properties in the Viewer Options to specify how you want each pivot to display.

NOTE Transformation pivots are only visible in X-ray and Normal display modes. You can convert Transformation pivots created in Maya using the FBX plug-ins.

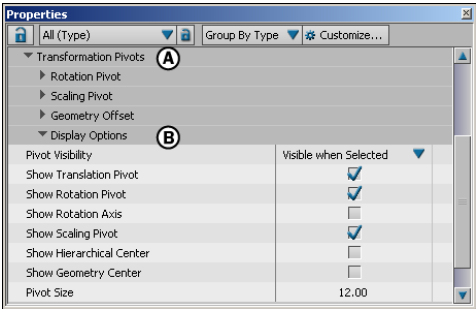
See [Transformation Pivots properties](#) on page 532 for descriptions of each type of Transformation pivot and the properties you can define in order to offset pivots from objects.

- [Viewing Transformation pivots](#) on page 531
- [Transformation Pivots properties](#) on page 532

Viewing Transformation pivots

- 1 Select the object on which you want to view the transformation pivots.
- 2 In the Properties window, expand the Transformation Pivots group of properties.
- 3 Expand the Display Options heading and select Visible from the Pivot Visibility menu.

You can also select Visible on Selection if you only want the pivots to display when objects are selected.



Properties window A. Transformation Pivot properties B. Display Options

- 4 Enable the Show option for any of the pivots that you want to view for the selected object. For example, enable Show Rotation Pivot if you want to view Rotation pivots.

NOTE When the Transformation pivots visibility options are active, the pivots might still be hidden within an object. To view the pivots, define offsets to set them apart from the model, or switch the model to display as a wireframe.

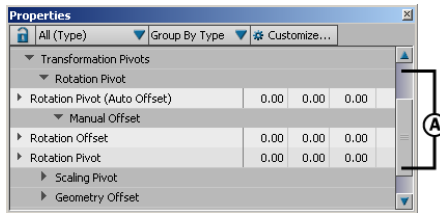
- [Transformation pivots](#) on page 529
- [Transformation Pivots properties](#) on page 532

Transformation Pivots properties

In the Properties window, the Transformation Pivots group of properties let you define the placement of Transformation Pivots for all objects.

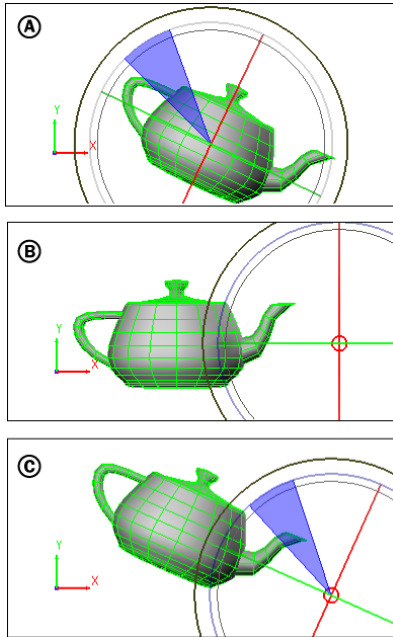
Rotation Pivot properties

Use the Rotation Pivot properties to define the placement and behavior of Rotation pivots.



Properties window A. Rotation Pivot properties

Rotation pivots let you rotate an object from a point other than its own default pivot. When you rotate an object without adjusting its pivots, it rotates around itself. If you use the Pivots properties to offset the Rotation pivot for the object, you can define a new point from which you want the object to rotate. Instead of rotating in place, the object rotates around the offset pivot.



- A. A tea pot rotates in place on the Z-axis.
 B. The tea pot's Rotation pivot is offset.
 C. The tea pot rotates around the offset pivot.

Rotation Pivot (Auto Offset)

These values let you define where the rotation pivot is offset on the X-, Y-, and Z-axis. The selected object is rotated around this point.

Adjusting the position of the rotation pivot does not affect the translation of the selected object, as an offset is automatically calculated to keep the object in place. The values used to create this offset display in the Rotation Offset fields.

Manual Offset

Exact Rotation Offset values are calculated by MotionBuilder when you adjust the Rotation Pivot (Auto Offset) values, and you do not need to adjust them

manually. The following table describes the options in the Manual Offset group of properties:

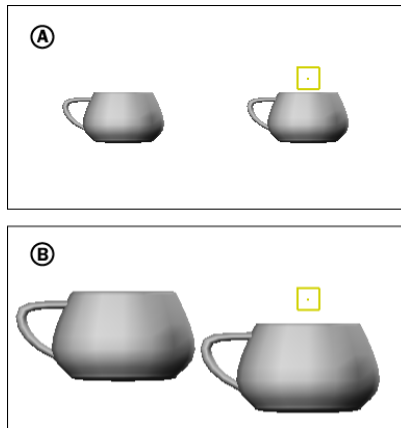
| Option | Description |
|-----------------|--|
| Rotation Offset | These values make it possible for you to offset rotation pivots using the Rotation Pivot (Auto Offset) values without affecting the translation of the selected object. These fields display the values used to compensate for changes to the selected object’s translation caused when the “real” Rotation Pivot offset is calculated. |
| Rotation Pivot | These values display the real X, Y, and Z position of the rotation pivot, relative to the local translation point of the selected object. Adjusting these values can cause the selected object to move in translation. Instead of adjusting the position of rotation pivots using these values, you should use the Rotation Pivot (Auto Offset) values. The Rotation Pivot (Auto Offset) values automatically calculate Rotation Offset values to preserve the current location of the selected model. |

■ [Rotating an object](#) on page 520

Scaling Pivot properties

Scaling pivots let you define the point from which you want a selected object to be scaled.

For example, in the figure below, the mug on the left has a scaling pivot placed at its approximate center. The mug on the right has a scaling pivot offset to the top of the mug. When both mugs are scaled the same amount, the one on the left expands outward from the center, and the one on the right expands outward from the pivot.



A. For the mug on the right, the Scaling pivot is offset on the Y-axis. B. The models are scaled from the two different points.

Scaling Pivot (Auto Offset)

These values let you define where the scaling pivot is offset on the X-, Y-, and Z-axis. The selected object is scaled from this point.

Adjusting the position of the scaling pivot does not affect the translation of the selected object, as an offset is automatically calculated to keep the object in place. The values used to create this offset display in the Scaling Offset fields.

Manual Offset

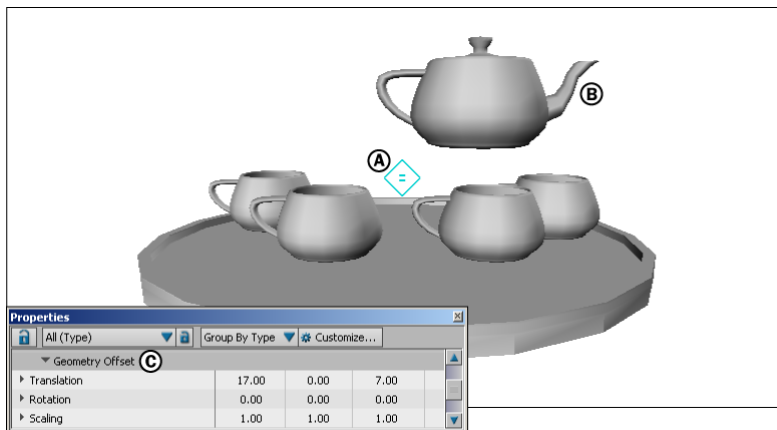
Exact Scaling Offset values are calculated by MotionBuilder when you adjust the Rotation Pivot (Auto Offset) values, and you do not need to adjust them manually. The following table describes the options in the Manual Offset group of properties:

| Option | Description |
|----------------|--|
| Scaling Offset | These values make it possible for you to offset the scaling pivots using the Scaling Pivot (Auto Offset) values without affecting the translation of the selected object. These fields display the values used to compensate for changes to the selected ob- |

| Option | Description |
|---------------|---|
| | ject's translation caused when the "real" Scaling Pivot offset is calculated. |
| Scaling Pivot | These values display the real X, Y, and Z position of the scaling pivot, relative to the local translation point of the selected object. Adjusting these values can cause the selected object to move in translation. Instead of adjusting the position of scaling pivots using these values, you should use the Scaling Pivot (Auto Offset) values. The Scaling Pivot (Auto Offset) values automatically calculate Scaling Offset values to preserve the current location of the selected model. |

Geometry Offset properties

The Geometry Offset properties let you define offsets between the geometry of the selected model and its hierarchical center. This means you can offset an object from its pivots without affecting its children.



A. The hierarchical center icon indicates the hierarchical center of the tea pot object. B. The tea pot geometry is offset from its hierarchical center, and the tea cup children are not affected. C. Properties window, Geometric Offset properties

Translation

These X, Y, and Z values define the translation offset of a selected object from its hierarchical center.

Rotation

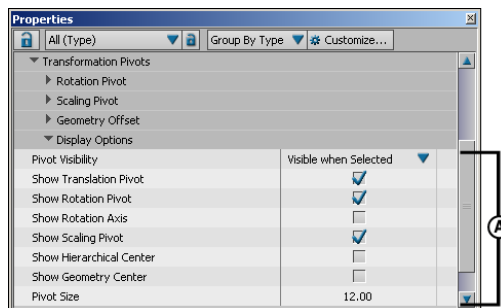
These options let you set X, Y, and Z values to offset the orientation of selected model's geometry from its hierarchical center.

Scaling

Use these X, Y, and Z values to define an offset when scaling the selected object from its hierarchical center.

Display Options properties

The Display Options group of properties let you decide when Transformation pivots display, show or hide individual Transformation pivots, and define their size.



Properties window A. Pivot Display Options

Pivot Visibility

This menu lets you specify when you want translation, rotation, and scaling pivots for selected models to display. You can choose from the following three options:

| Option | Function |
|----------------------|--|
| Disabled | Pivots are never visible. |
| Visible on Selection | Pivots are visible only when the object is selected. |
| Visible | Pivots are always visible. |

Pivot Options

Expand the Pivot Options group of properties to view a set of properties that let you show and hide each type of Transformation pivot, as well as set their size.

Show Translation Pivot

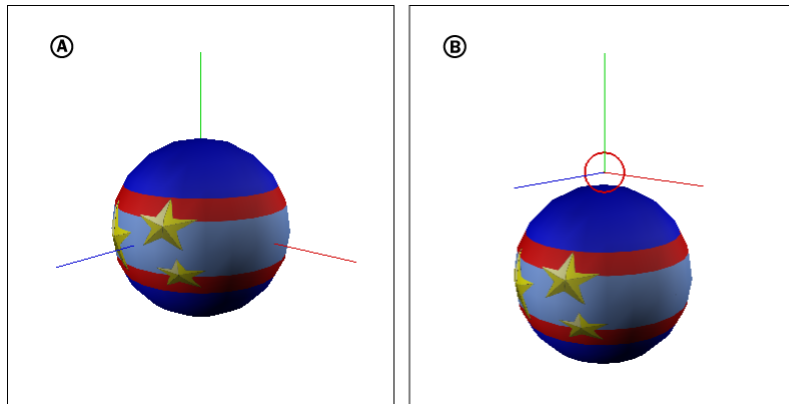
Displays the translation pivot, indicating where the local translation of the selected object is calculated.

Show Rotation Pivot

Displays the rotation pivot, indicating where the local rotation of the selected object is calculated.

Show Rotation Axis

Displays an axis icon that represents the rotational axis of the selected object. If you have not offset a rotation axis for the selected object, the axis displays at the object's center. If the rotation pivot is offset from the object, the axis displays on the rotation pivot.



Rotation axes A. The Rotation Axis at the center of a ball. B. The Rotation Axis is offset with the Rotation pivot to the top of the ball.

Show Scaling Pivot

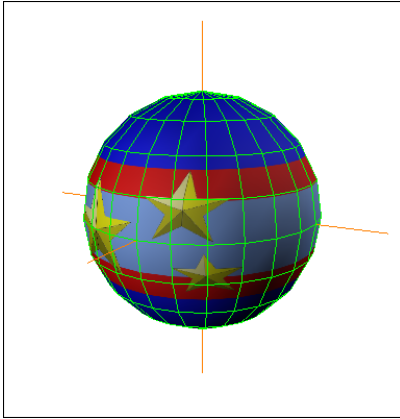
Displays the scaling pivot to show the point from which the local scaling of the selected object is calculated.

Show Hierarchical Center

Displays a light blue icon to indicate the final transformation of the selected object after the influence of transformation pivots, Degrees of Freedom, and pre- and post-rotation order are calculated. If the selected object is a parent to any child objects, transformations for the child objects are calculated from this point.

Show Geometry Center

Displays an orange axis at the center of a selected object when it is offset from its hierarchical center.



The geometry center icon displays on a ball.

Pivot Size

Sets the size of the transformation pivots. The default size is 12. Pivots always appear the same size in the Viewer window even when you zoom in or out.

- [Transformation pivots](#) on page 529
- [Manipulating Objects](#) on page 505

Handles

39

Handles are 3D controls that give you quick access to the manipulation of objects in a scene. There are two ways you can use a Handle. The first use is to let you select objects, and the second is to let you access specific manipulation modes for the objects.

For example, you can use the handle to select a group of objects that do not have a hierarchy relationship, for example, a character's hand model and a teapot model.



Handle attached to the character's wrist.

This way, a Handle lets you select and manipulate a group of unrelated objects.

The second use of a Handle is that once you add a Handle to an object, it lets you create Follow objects which let you create a Parent/Child relationship that can be used as an instant transformation pivot.

With both of these uses, Handles let you quickly establish links between objects, and then use the Follow object as a pivot. See [Connecting a Handle to an object](#) on page 543.

In the image above, a Handle is attached to the model's wrist effector and a teapot model. You can then use the Handle to move both objects together.

Handles are Viewer window-based, which means the handle is applied directly to the object you want to affect in the Viewer window, and are created so you can easily select or disable them.

The Handle protrudes from the object, and always faces the camera. You can change the size, color, and position of the Handle, or attach an image to it to make it more easy to identify and select in scenes with many objects.

You can only see Handles when you are in X-Ray viewing mode in the Viewer window.

Follow and Manipulate objects

When you create a Handle you must assign objects to the Follow and Manipulate fields in the Handle settings.

Follow objects

Creating a Handle requires you to assign objects to the Follow field in the Handle settings. The Follow object is used as a Reference point for the Handle as well as a pivot point for the Manipulate object.

When you select a Handle, the Follow object is considered to be the only selected object within the Handle. This means that if you activate pinning when a Handle is selected, pinning is activated only for the Follow object. If you paste a pose with Match options activated, the pose is matched to the Follow object.

Manipulate objects

There are four kinds of Manipulate object types: Manipulate TR, Manipulate Translation, Manipulate Rotation, and Manipulate Scaling.

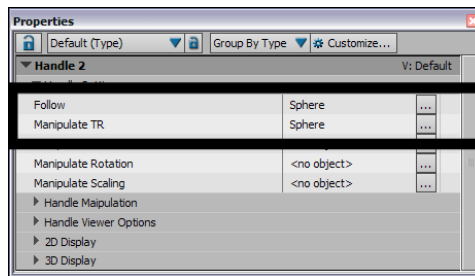
These are used to specify which way each object is transformed.

| Object type | Description |
|------------------------|--|
| Manipulate TR | Uses the Handle to influence translation and rotation of the Manipulate objects. |
| Manipulate Translation | Limits the Handle's influence to the translation of the Manipulate objects only. |

| Object type | Description |
|--|---|
| Manipulate Rotation | Limits the Handle's influence to the rotation of the Manipulate objects only. |
| Manipulate Scaling | Limits the Handle's influence to the scaling of the Manipulate objects only. |
| <p>NOTE If you set an IK key with a Handle selected, a keyframe is set on all objects selected by the Handle. All Reach properties are keyed, but only the Reach of the Follow object is keyed at 100%. Reach values for all other objects are keyed at 0%.</p> | |

Connecting a Handle to an object

- 1 Drag a Handle asset into the scene from the Elements folder in the Asset browser.



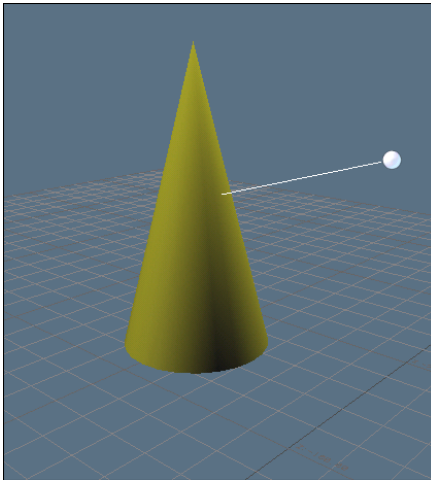
When you drop a Handle asset on an object, it is assigned to both the Follow and Manipulate TR fields.

- 2 Expand Handles in the scene browser. The new Handle is listed, named "Handle" by default.
- 3 Alt-drag the object to be affected by the Handle from either the Scene browser or the Viewer window into the Manipulate TR field.

NOTE If you drop a Handle on top of an object, that object is automatically assigned to both the Manipulate TR and Follow fields in the Handle settings.

- 4 Assign any objects that you want to manipulate the translation, rotation, or scaling exclusively to the Manipulate Translation, Rotation, and Scaling fields. See [Manipulate objects](#) on page 542.
- 5 Alt-drag an object or objects into the Handle settings and drop it in either the Manipulate or Follow fields.

You can also drag a Handle into an empty space in the Viewer window and then assign objects to both the Manipulate and Follow fields. The Handle appears in the Viewer window as a line with a round knob protruding from of the Follow object.



A handle sticks out of an object with a round knob.

NOTE If you cannot see the Handle's knob, try changing the offset values.

Defining Handle Follow and Manipulate objects

To set a Follow object:

- 1 Select the Handle in the scene browser.
- 2 Expand the Handle settings in the Properties window.

- 3 Do one of the following things:
 - Alt-drag the object(s) that you want to use to lead the Manipulate objects into the Follow field.
 - Expand the Follow field's Asset list and activate the models that you want to assign as follow objects.

NOTE When you select a handle, the follow object is considered the only "selected object" within the handle.

To set a Manipulate object:

- 1 Select the Handle in the scene browser.
- 2 Expand the Handle settings in the Properties window.
- 3 Do one of the following things:
 - Alt-drag the object(s) that you want to be affected by the actions of the Follow objects into the Manipulate TS, T, R, and/or S fields.
 - Expand the Manipulate fields' Asset list and activate the models that you want to assign as Manipulate objects.
 - Assign the object(s) you want to make the child of the Follow object to the Manipulate object field. The Manipulate object pivots around the Follow object.

Manipulating objects with Handles

Once you have created a Handle that connects objects, you can do the following:

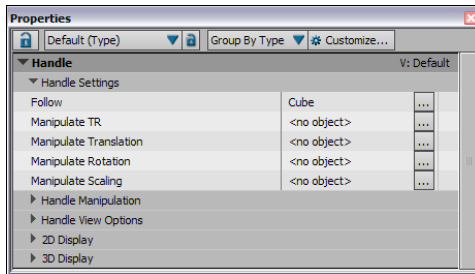
- Select the Handle and transform the Manipulate object.
- Select the Manipulate and/or Follow objects by themselves and transform them.

Handles can be resized, angled (offset), colored, and have text and images attached to them. See [Handle settings](#) on page 546.

Handle settings

The Handle settings let you set up your handle, assign Follow and Manipulate objects, and change other settings that affect the behavior of Handles.

Select the Handle to display the Handle settings in the Properties window.



Handles properties

The following settings appear in the Properties window when a Handle is selected in the Scene browser:

Follow

Contains the names of the objects designated to lead the Manipulate object. The Follow object is used as a reference point for the Handle as well as a pivot point for Manipulate objects.

The Follow object is not transformed if it is not assigned to any Manipulate fields. See [Follow and Manipulate objects](#) on page 542.

NOTE When you select a handle, the Follow object is considered the only “selected object” within the handle.

Manipulate TR

Assign the object(s) that you want to be manipulated in both Translation and Rotation mode to this field.

Manipulate Translation

Assign any Manipulate object(s) whose translation you want the Handle to influence to this field.

Manipulate Rotation

Assign any Manipulate object(s) whose rotation you want the Handle to influence to this field.

Manipulate Scaling

Assign any Manipulate object(s) whose scaling you want the Handle to influence to this field.

Handle Manipulation properties

The Handle Manipulation settings represent the translation and rotation modes you use when transforming objects with Handles.

| Property | Function |
|--------------------------|---|
| Translation Mode menu | Select Rigid to lock the rotation of the effector. This is useful when you work with a character's hand and a prop. |
| Translate in Local | Activate to translate the object(s) relative to its Local coordinates, instead of the Scene's coordinates. |
| Rotate in Local | Activate to rotate the object(s) relative to its Local coordinates, instead of the Scene's coordinates. |
| Manipulate Around Handle | Activate to make the manipulator assume the Handle's position. You can use the |

| Property | Function |
|--------------------------------|--|
| | Handle as the pivot for the object's translation and rotation. |
| Manipulate Around Origin menu | When Manipulate Around Handle is activated, select from this menu which handle you want to use as a center of manipulation. Select Prefer 2D to use the 2D Handle or Prefer 3D to use the 3D Handle. |
| Default Manipulation Mode menu | Lets you set a default manipulation mode (translation, rotation, scaling, and so on,) to be the active mode whenever you select the handle. See Manipulate objects. |

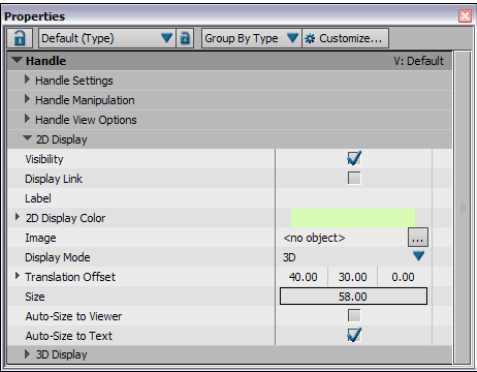
Handle Viewer Options

The Handle view options let you control for the visibility of Handles.

| Visibility mode | Description |
|-----------------|---|
| Show Handles | Disable this option to hide both the 2D and 3D Handles. Activate to show them. This option is different from the Visibility option in the 2D and 3D Handle settings. The Show Handle option hides the handle object, whereas the 2D or 3D Visibility options only hide the 2D or 3D view of the handle. |
| Visibility Mode | Lets you show or hide the Handle independently of the model being shown or hidden. Select Independent so the Handle continues to show even when you have hidden the Manipulate object. |

2D Display properties

The 2D display settings let you customize the look of the 2D Handle and the Handle’s knob so you can easily identify and select it.



Handles: 2D Properties

Customizing Handles is a good idea if you have a crowded scene where you cannot easily select the Handle without selecting something else.

NOTE You can have both 2D and 3D handles simultaneously.

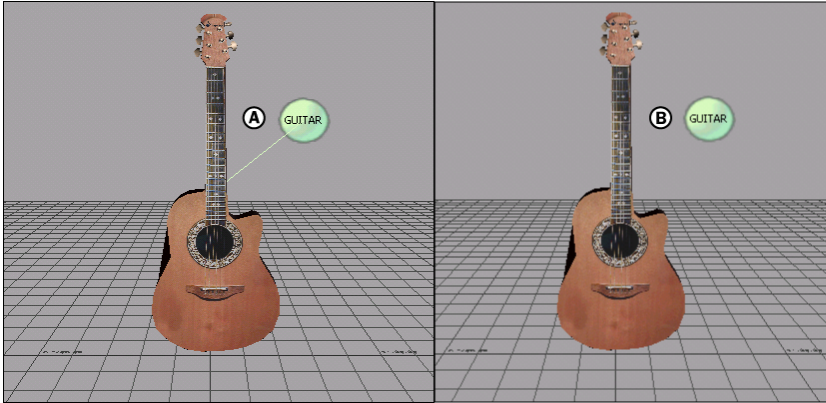
Select the Handle to display the Handle settings in the Properties window.

Visibility

Deactivate the Visibility option to hide the 2D Handle.

Display Link

Lets you show or hide the line that displays between the Handle knob and the Follow object.



Show Link option A. The Show Link option is active. B. Show Link is disabled.

Label

Click the Label field to give the Handle a name that appears on the handle. This is not the same as renaming a handle in the Scene browser.

2D Display Color

Use the Color R, G, and B fields to set a different color for the 2D Handle. (The default is white.)

Image

Attach an image to your Handle so you can identify it quickly in crowded scenes. To do so, click the Asset List button in the Image field and select an image from the Asset list.

Display Mode menu

Lets you choose how the 2D Handle knob is shown in the Viewer window. There are two options:

2D

Always the same XY distance from the object, relative to the Viewer.

3D

Always the same XYZ distance from the object, relative to the 3D world of the scene.

Translation Offset

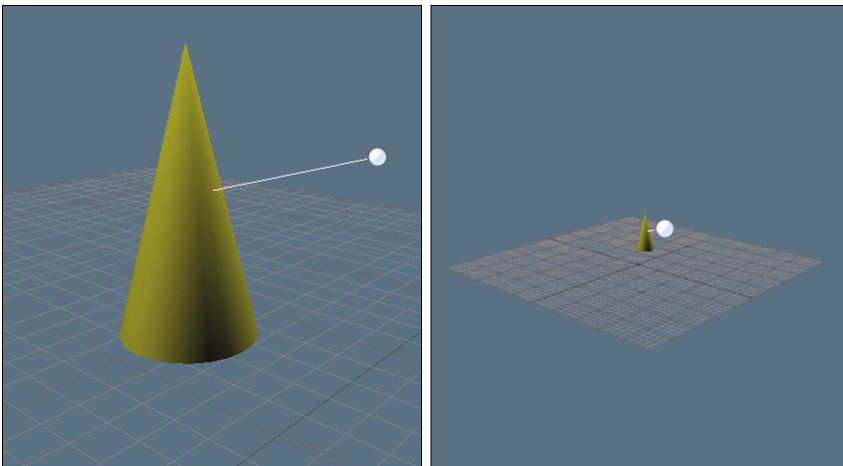
Lets you modify the X, Y and Z distance of the 2D Handle from the Follow object.

Size

Increase or decrease the size of the Handle knob so you can select it easily.

Auto-Size to Viewer

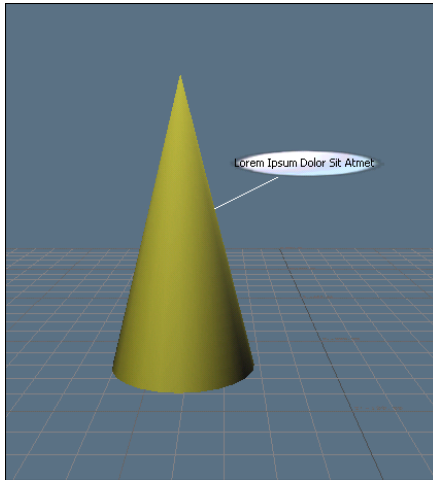
Activate to make the Handle a consistent size Label text, no matter how far away you get from it.



Activate Autosize to Viewer to make the handle the same size no matter how close you zoom in.

Auto-Size to Text

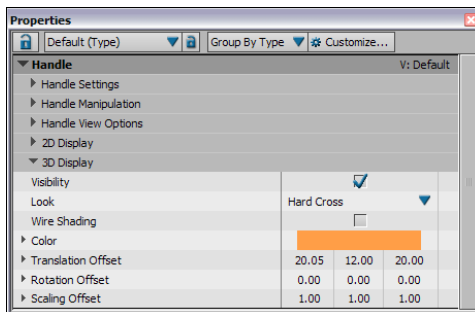
Activate to make the 2D Handle accommodate the label text (Label field), regardless of the Handle size or camera distance.



Using Auto-Scale to Text, the handle accommodates any text entered in the Label field

3D Display properties

The 3D display settings create a handle that appears in three dimensions. The 3D Display settings also let you customize aspects of the Handle's appearance, so you can easily identify and select it.



Handles: 3D Properties

Select the Handle to display the Handle settings in the Properties window.

NOTE You can have both 3D and 2D handles simultaneously.

Visibility

Deactivate the Visibility option to hide the 3D Handle.

Look

Lets you select a shape for the handle to assume, so you can easily distinguish it from the objects in the scene.

There are 4 shapes for the Handle knob:

- Cube
- Hard Cross
- Light Cross
- Faceted Sphere

Wire Shading

Lets you display the Handle in wireframe.

Color

Use the Color R, G, and B fields to set a different color for the Handle. (The default is gray.)

Translation Offset

Lets you modify the X, Y and Z distance of the 3D Handle from the Follow object.

Rotation Offset

Lets you rotate the handle so you can identify and select it easily.

Scaling Offset

Lets you scale the handle so you can identify and select it easily.

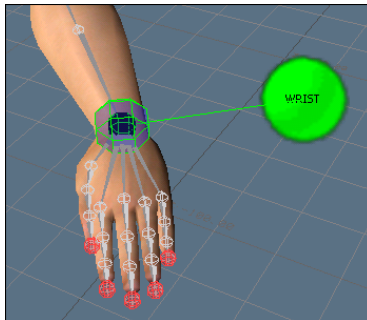
Transparency

Lets you set the visibility of the handle, with 0.0 being invisible and 100 being solid.

Auto Position 3D Model

Activate to center the 3D Handle to the geometry of the object that it is applied to. You can resize the handle to make a group of bones, for example, in a hand, easier to select.

This is useful for selecting bones on a complicated Control rig.



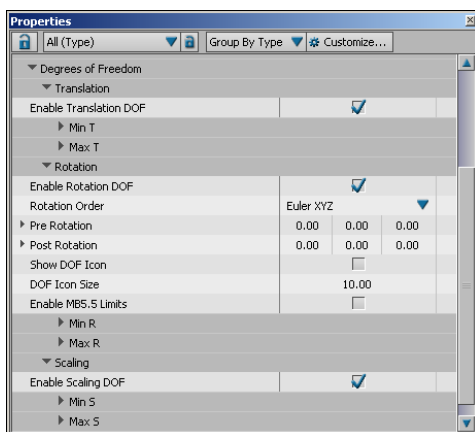
Activate Auto Position 3D Model to center the 3D Handle (the black sphere) on the object to which it is applied (the wrist bone).

- [Connecting a Handle to an object](#) on page 543

Degrees of Freedom (DOF)

40

Degrees of Freedom (DOF) are a set of properties that let you set limits on the translation, rotation, and scaling of any selected object or animated hierarchy. Defining Degrees of Freedom for objects in a scene lets you restrict their range of movement.



Degrees of Freedom properties

Degrees of Freedom for translation let you define the coordinates an object is allowed to occupy on the X-, Y-, and Z-axes. For rotation, Degrees of Freedom properties let you define the angles an object can rotate through on the X-, Y-, and Z- axes. Degrees of Freedom properties for scaling let you limit the size of the selected object.

Although many objects can have DOF properties to limit their movement, these properties are commonly used with characters. For example, you can define Degrees of Freedom for the bones in a skeleton so that the arms of a model do not rotate through the body. You can also use DOF to prevent a character's limbs from colliding with other limbs in the same chain, or to ensure that their joints do not rotate in impossible directions. You can also define Degrees of Freedom for a glove device even if no character is used.

With Degrees of Freedom, you can set limits on both the axis and rotation of any bone in a model's skeleton. You can retarget animation including DOF from one character to another, keeping the amount of data required low.

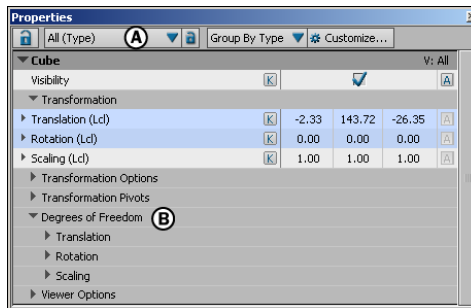
Degrees of Freedom are also important in terms of performance and overall efficiency, as they allow you to reduce the number of keyframes going into a project. This is crucial if you are trying to create animation with lighter amounts of data, such as in game development.

The DOF properties consist of the following main areas:

- [DOF Translation Properties](#) on page 557
- [DOF Rotation Properties](#) on page 558
- [DOF Scaling Properties](#) on page 563
- [Viewing and modifying Degrees of Freedom](#) on page 556

Viewing and modifying Degrees of Freedom

- 1 Select an object, such as a Skeleton node, and open the Properties window.



Properties window A. View menu B. Degrees of Freedom group of properties

- 2 Select the All (Type) view in the View menu so that all available properties display, if it is not already selected.

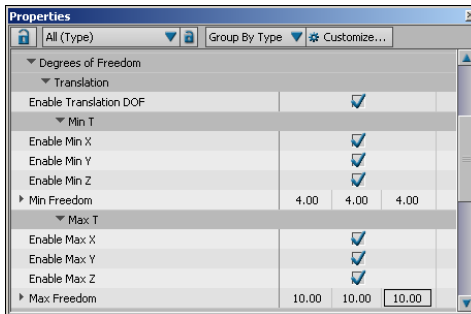
- 3 Expand the Degrees of Freedom folder to view and modify the DOF properties for the selected object.

- [Degrees of Freedom \(DOF\)](#) on page 555
- [DOF Translation Properties](#) on page 557
- [DOF Rotation Properties](#) on page 558
- [DOF Scaling Properties](#) on page 563

DOF Translation Properties

The DOF Translation properties let you restrict an object's linear movement between a minimum and maximum translation value.

You can use these properties to limit the movement of various models and prevent them from coming into contact with each other.



Degrees of Freedom Translation properties

Enable Translation DOF

Activates the limits on translation specified for each axis in the Translation Min and Max fields. When DOF translation properties are disabled, the Min T and Max T values are ignored and the object can translate in any direction.

Min T

Contains options that let you activate, disable, and define the minimum limits on translation for each individual axis. The following table illustrates the options found in the Min T group of properties.

| Option | Description |
|--------------------|--|
| Enable Min X, Y, Z | Activate and disable the limits on translation specified for each axis in the Min Freedom fields. |
| Min Freedom | Sets the minimum translation values the selected object can occupy on each individual axis. If an object tries to move past these values, its translation is constrained by the DOF. |

Max T

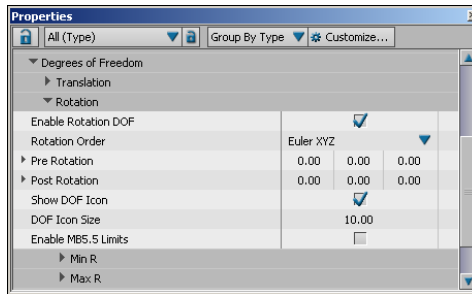
Contains properties that let you activate, disable, and define the maximum limits on translation for each individual axis. The following table illustrates the options found in the Max T group of properties.

| Option | Description |
|--------------------|---|
| Enable Max X, Y, Z | Activate and disable the limits on translation specified for each axis in the Max Freedom fields. |
| Max Freedom | Specifies the maximum translation value the selected object can occupy on each individual axis. |

■ [Degrees of Freedom \(DOF\)](#) on page 555

DOF Rotation Properties

The DOF Rotation properties let you limit an object's rotational movement.



Degrees of Freedom Rotation properties

Enable Rotation DOF

This option lets you activate or disable the DOF rotation properties. When DOF rotation properties are disabled, the Min R and Max R values are ignored and the object can rotate in any direction. When DOF Rotation properties are active, a wireframe sphere displays on the selected object.

Rotation Order

This menu lets you select the order of calculation for Euler rotations, which can help to prevent gimbal locks. The default Rotation Order is X, Y, Z. These options are useful if you want to change the main axis of a bone after the bone structure has already been created. You can also avoid problems such as gimbal locks by making the middle axis something other than Y.

When you select a Rotation Order for a bone, the first axis listed is used as the roll axis for that bone. For example, if you select Euler XYZ, the X-axis is used for the roll axis on that bone.

The Rotation Order you select, and thus the roll axis that is used should be an axis that aligns with the bone, as it allows the bone to rotate, or twist on that axis.

TIP It is highly recommended that you select a Rotation Order and thus a roll axis that points down the bone.

You can view the roll axis defined for each bone by turning on the Show DOF Icon property. The DOF rotational sphere also shows you the roll axis.

The following table illustrates the rotation order options you can choose from.

| Rotation Order | Behavior |
|----------------|--|
| Euler XYZ | Rotation on the Z-axis is calculated first, Y second, and X last. This is the default Rotation Order. |
| Euler XZY | Rotation on the Y-axis is calculated first, Z second, and X third. |
| Euler YZX | Rotation on the X-axis is calculated first, Z second, and Y third. |
| Euler YXZ | Rotation on the Z-axis is calculated first, X second, and Y third. |
| Euler ZXY | Rotation on the Y-axis is calculated first, X second, and Z third. |
| Euler ZYX | Rotation on the X-axis is calculated first, Y second, and Z third. |
| Spheric XYZ | You can use this option for joints that have a wide area of rotation such as the shoulders. Only use this rotation order if you need to keep Spheric rotation limits created in earlier versions of MotionBuilder. This option is not recommended. |

NOTE Spheric XYZ calculations are not supported by any other 3D package, and cannot be exported. Using this option is not recommended if you are exporting your scene to other software packages.

Pre Rotation

These values let you offset the rotation sphere orientation before the limits on rotation are calculated. As you adjust the values in these fields, the rotation sphere in the Viewer window gives you visual feedback.

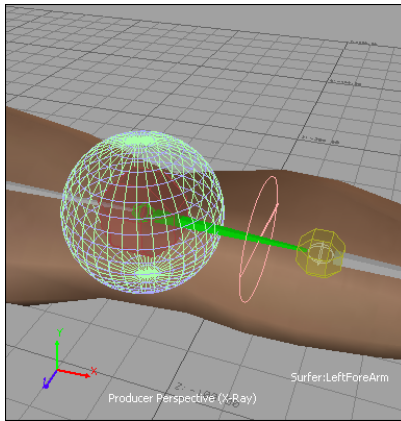
Post Rotation

This option lets you offset the rotation pivot orientation after the limits on rotation are calculated. As you adjust the Post Rotation values, the rotation sphere in the Viewer window gives you visual feedback.

Show DOF Icon

Shows or hides the DOF rotational sphere.

The DOF rotation sphere displays on the selected object in the Viewer window, giving you visual feedback on the limits on rotation you have set, and identifying which is the roll axis for the selected bone.



A DOF Rotation sphere displays on the LeftForeArm bone.

DOF Icon Size

Defines the size of the DOF rotational sphere that appears in the Viewer window to visually represent the rotational DOF properties. The default size is 10.

Enable MB5.5 Limits

Activate this option to make the DOF properties inherit the behavior of limits defined for scenes created in earlier versions of MotionBuilder.

Min R

Contains a set of check boxes and fields that let you enable, disable, and define the minimum rotation values allowed per axis for the selected object. The following table describes the options found in the Min R group of properties.

| Option | Description |
|--------------------|---|
| Enable Min X, Y, Z | Activate and disable the limits on rotation specified for each axis in the Min Freedom fields. |
| Min Freedom | Specifies the minimum value the selected object can rotate to on each individual axis. If an object attempts to rotate past these values, its rotation clamps to the minimum value. |

Max R

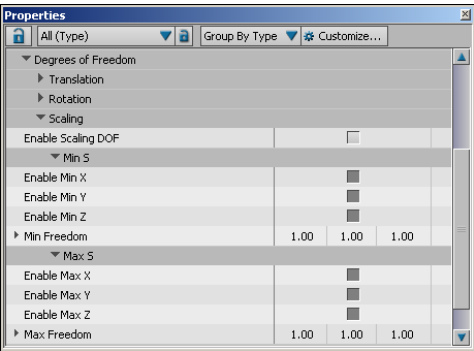
Contains options that let you activate, disable, and define the maximum rotation values allowed per axis for the selected object. The following table illustrates the options found in the Max R group of properties.

| Option | Description |
|--------------------|---|
| Enable Max X, Y, Z | Activate and disable the limits on rotation specified for each axis in the Max Freedom fields. |
| Max Freedom | Specifies the maximum values the selected object can rotate to on each individual axis. If an object attempts to rotate past any of these limits, its rotation clamps to the maximum value. |

- [Degrees of Freedom \(DOF\)](#) on page 555
- [Rules for setting rotation DOF on a character](#) on page 564

DOF Scaling Properties

The DOF Scaling properties let you limit the size of an object. For example, you can define the DOF scaling properties so that a selected object cannot be scaled to a negative value.



Degrees of Freedom Scaling properties

Enable Scaling DOF

Activates or disables the Degrees of Freedom allowed for the scaling of the selected object. When DOF scaling properties are disabled, the Min S and Max S values are ignored and the object can be scaled in any direction.

Min S

Contains a set of check boxes and fields for activating, disabling, and defining the minimum scaling values allowed per axis for the selected object. The following table describes the options found in the Min S group of properties.

| Option | Description |
|--------------------|--|
| Enable Min X, Y, Z | Activate and disable the minimum scaling values specified for each axis in the Min Freedom fields. |
| Min Freedom | Specifies the minimum scaling values the selected object can have on each individual axis. If an object attempts to scale past |

| Option | Description |
|--------|---|
| | these limits, its size is constrained by the minimum value. |

Max S

Contains options that let you activate, disable, and define the maximum scaling values allowed per axis for the selected object. The following table illustrates the options found in the Max S group of properties.

| Option | Description |
|--------------------|---|
| Enable Max X, Y, Z | Activate and disable the limits on scaling for each axis in the Max Freedom fields. |
| Max Freedom | Specifies the maximum scaling values allowed for the selected object on each individual axis. If an object attempts to scale past these limits, its size is constrained by the maximum value. |

- [Degrees of Freedom \(DOF\)](#) on page 555

Rules for setting rotation DOF on a character

When you limit the rotation of a character's bones using Degrees of Freedom (DOF), those limits always have priority and are always respected during solving. However, it is important to note that some DOF settings may prevent a character from reaching its goals.

The following set of rules can help you create a character that reaches its goals even with Degrees of Freedom activated on its bones.

| Bone | Rule |
|-------------------------|--|
| Arms, legs, and fingers | One axis must be aligned with the bone, and this axis should match the roll axis, which is the first axis of the Rotation order you have selected. |

| Bone | Rule |
|------------------|--|
| Hips | <p>DOF set on hip bones do not affect the Reach of the hands and feet. However, setting DOF on hip bones is not recommended since the hips are always animated in global space.</p> <p>DOF can be set on all three axes.</p> |
| Spine | <p>Limiting the DOF on Spine bones does not affect the Reach of the hands, but may prevent Upper Chest Effectors from reaching their goals. This occurs because the first Spine bone is important during IK solving.</p> <p>DOF can be set on all three axes.</p> |
| Clavicle | <p>Setting DOF on clavicle bones does not affect the Reach of the hands.</p> <p>DOF can be set on all three axes.</p> |
| Shoulder or hip | <p>Only the roll axis can have DOF limited, and the other two axes should be free. If you limit the DOF for the roll axis, be sure to have an associated roll bone or expect to have DOF on all three axes for the elbow or knee bones.</p> |
| Elbows and knees | <p>Limiting the DOF for the elbows and knees lets you control the maximum extension angle for the arm or leg.</p> <p>Elbow and knee bones must have at least one axis, other than the roll axis, with no DOF set. It is recommended that the free axis be the last listed in the Rotation Order you have selected, and it should be aligned or close to the natural bending axis of the arm or leg.</p> <p>In addition, if you limit the DOF for the roll axis, be sure to have an associated roll</p> |

| Bone | Rule |
|-------------------|---|
| | bone or have DOF for all three axes limited on the wrist and ankle. |
| Wrists and ankles | DOF can only be set for the roll axis. The other two axes must be free. |
| Roll | All roll bones can have DOF. It is recommended that you completely limit the DOF for the last two axes listed in the Rotation Order you have selected, and set no DOF for the first axis. |
| Fingers and toes | <p>The first bone of each finger and toe should have no DOF on any axis. All other finger and toe bones can have only one axis with no DOF defined.</p> <p>It is recommended that this DOF be the last of the Rotation Order and should be aligned or close to the natural bending axis of the finger or toe.</p> |

■ [DOF Rotation Properties](#) on page 558

Basic Keyframe Animation

The animation process is the method by which an animator simulates movement in a sequence by displaying a series of pictures, or frames. Traditional animation and computer-generated 3D animation are similar, but differ in some fundamental ways.

Keyframing is the recording of a parameter's value at a specific moment in time, advancing the time, then recording the value again. The computer determines what has occurred between the recorded values, and fills in the blanks between keyframes.

Animation simulates movement through a sequence of changing images in a scene. The scene holds all the elements of the animation, and can contain one or multiple objects.

Traditional and computer-generated animation

In traditional animation, animators draw or paint individual pictures for the most important actions in a sequence. The action between these key points is filled in with other pictures. The process of filling in the action between key points is referred to as *in-betweening* or *tweening*.

Once all the pictures are added, they are joined together in a sequence to complete the animation. When the animation plays, the viewer sees continuous movement. This is because the eye does not differentiate between the separate images, and sees only one image creating the illusion of continuous motion.

A simple example of one of the oldest forms of animation is the “flip book”. The flip book consists of a series of pages, each page containing a picture subtly different from the previous picture.

For example, in the following illustration, each star represents a separate picture. Flipping through the pages creates the illusion of the star moving up and down.



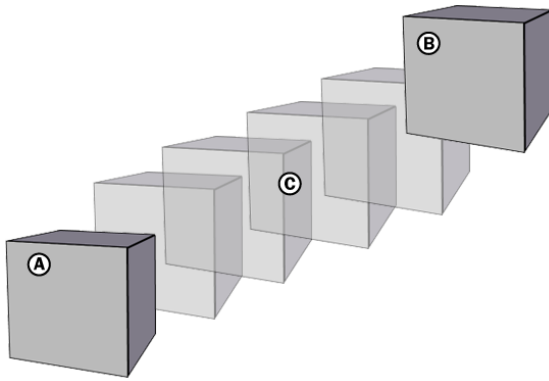
Successive images in a “flip book” animation.

Animators using 3D software also emphasize key action points in a sequence at specific points in time (frames) by setting a mark called a *keyframe*.

However, unlike traditional animation, the computer software simplifies the animation process by automatically filling in the action between the keyframes with in-between frames. This process called *interpolation* is what lets you perceive smooth, continuous motion when you play your animation.

For example, illustrates the interpolation of a simple animation that starts with only two keyframes. The first keyframe marks the cube's position at the beginning of the animation, and the second keyframe marks the location of the cube at the end of the animation.

The computer program adds the additional frames between the two keyframes to provide the illusion of smooth, continuous motion when the animation plays.



Simple animation A. Keyframe on frame 0. B. Keyframe on frame 10. C. Interpolation adds frames between the keyframes.

In MotionBuilder, you can set keyframes manually, or you can use motion capture data. You can also use constraints and devices to create animation.

Animation with constraints

You can use constraints to animate in real-time or to create keyframe animation. Constraints let you link an object that is not animated to an object that is animated in order to animate them both.

For example, in the following image, there is a Parent-Child constraint between the soccer ball and Surfer's hands. The soccer ball does not have keyframe animation, but as the Surfer moves, so does the ball. You can also animate

the constraint itself, so that the ball follows Surfer's hands only at certain times.



The soccer ball is constrained to Surfer's hands.

There are many different types of constraints. You can also constrain models to an animation path, or animate using multiple references. See [Animating with Constraints](#) on page 819.

Animation with devices

You can use devices to animate in real-time or to create keyframe animation.

Devices, such as joysticks and mouse, let you animate objects. For example, in the following image, a Mouse device is constrained to Surfer's eyes to make them rotate.



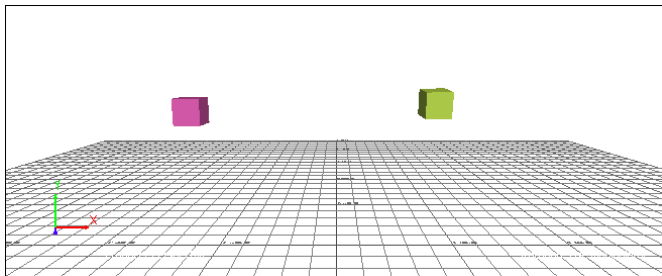
Mouse movements can rotate Surfer's eyes.

You can use many types of devices. See [Animating with Devices](#) on page 1019.

Animating an object

This topic describes the basic steps you can use to animate a simple cube available in the Asset browser. While there are many ways to use MotionBuilder as an animation tool, you can use these steps as a basic guide and introduction to important tools and windows.

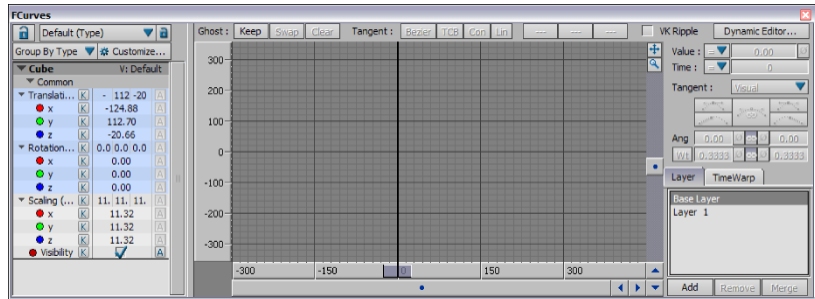
- 1 Drag two cubes from the Elements folder of the Asset browser into the scene, positioning them similar to the cubes in the following picture.



Add two cubes to the scene.

Optional: You can change the color of the two cubes by adding a material to each, then changing the Diffuse property.

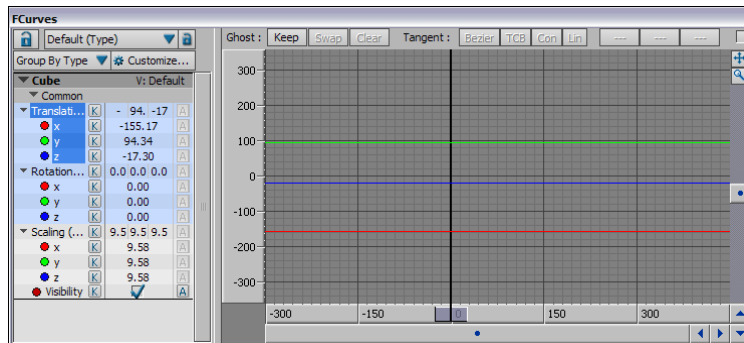
- 2 Select the cube on the left, then open the FCurves window if it is not already open in the current layout.



The FCurves window A. The properties for the selected object in the Properties pane.

The properties of the selected cube display in the FCurves properties pane as well as in the Properties window.

- 3 In the FCurves window Properties pane, click the Translation (Lcl) header to select the cube's Translation properties.



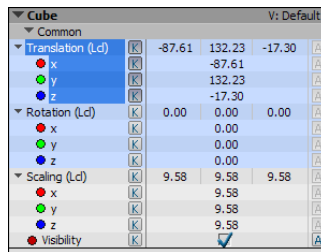
Select the cube's Translation properties to view the function curves.

The cube's translation properties are selected and their representative function curves display. Right now, the function curves are flat because the cube is not yet animated.

The color of the function curves correspond with the color of the axis they represent. By default, the function curve for the X-axis is red, the Y-axis is green, and the Z-axis is blue.

4 With the Translation (Lcl) properties still selected, set a keyframe by doing one of the following:

- In the Properties pane, click the Keyframe (K) button next to the Translation (Lcl) header to set keyframes for the X, Y, and Z translation properties at the same time.
- Press K on your keyboard.
- Click Key in the Key Controls window. If the Key Controls window is not available in your current layout, click Window > Key Controls in the MotionBuilder menu bar.
- Click the Key (K) buttons in the Properties window.



Properties pane A. Click the K button next to Translation (Lcl) to set a keyframe.

One keyframe displays on each function curve. On the Action timeline, one visual keyframe represents all three translation properties.

Now that you've set a keyframe, you can also modify the function curves by manipulating the keyframes on the function curves themselves, or change the time or value in the FCurve Options pane.

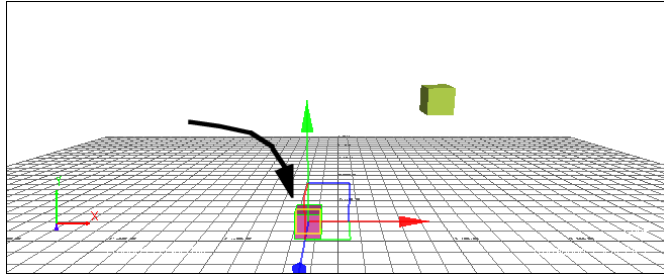
5 Advance the Timeline indicator to frame 15.



Transport Controls window. A. Advance to frame 15.

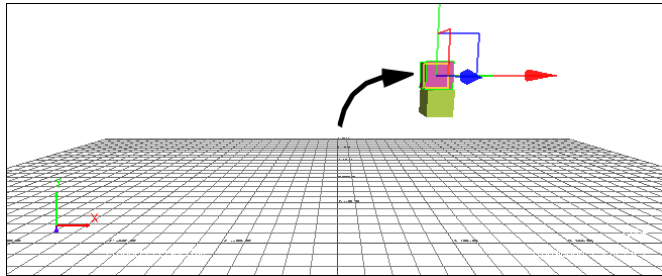
6 Do one of the following to translate the selected cube higher and to the right:

- Click in the Viewer window and press T to activate Translation mode, then translate the selected cube upward on the Y-axis.
- In the FCurves window, drag in the value fields next to a property in the Properties pane.



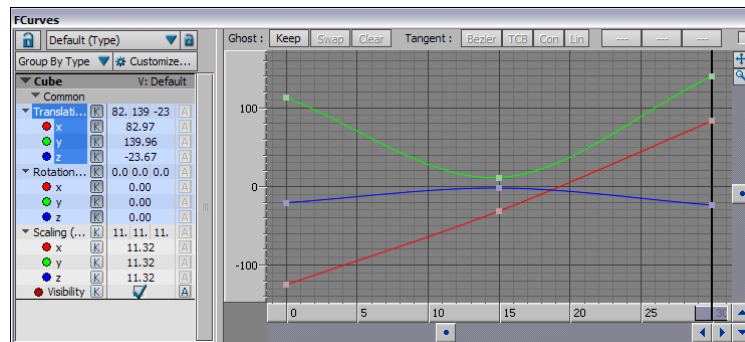
Translate the first cube higher and to the right.

- 7 With the Translation properties still selected in the FCurves window, set a keyframe.
- 8 Go to frame 30 and translate the first cube until it sits on top of the second, then set another keyframe.



Translate the cube until it sits on the second cube.

- 9 Click in the FCurves pane, then press A to frame the function curves.



Press A to frame the function curves.

- 10** Drag around the three keyframes on frame zero to select them.
Tangent handles display on the selected keyframes, and their coordinates display in boxes on the horizontal (time) and vertical (value) axes.
- 11** In the Transport Controls window, drag the right Stretch handle on the Zoom bar to 60.
This zooms on the animation from frame 0 to 60, adjusting the Action timeline to the length specified by the Zoom time codes.
- 12** Play your animation using the Transport Controls. For more information, check out the Playing animation section.

Changing properties

Every object in a MotionBuilder scene has transformable properties. Some objects have translation, rotation, and scaling properties, while others have properties for shape, color, intensity, and so on.

For example, you can use the Properties window to make all your Actors look different, customize Control rigs, and change the Fog intensity and Cone angle of lights.

Modifying the properties of one or more selected objects in the Properties window displays the changes in the Viewer window in real time. You can modify the properties of most objects using a combination of value boxes, lists, and sliders.

The Properties window also lets you select properties for keyframing, and you can animate properties in the Properties window for use in Expressions and Relation constraints.

- [Properties window](#) on page 585
- [Dopesheet window](#) on page 687

Selecting properties for animation

To set keyframes on any property, it must be selected.

To select a property in the Properties window:

- 1 Select the object, such as a light.
- 2 In the Properties window, click the name of the property you want to select and animate.

If the name of the property is highlighted in dark blue, the property is selected and you can animate it. Properties you can animate always have Keyframe (K) and Animate (A) buttons.

If the name of the property is highlighted in dark gray, the property is selected but you cannot animate it.

If a property is highlighted light blue before you click on it, it is already selected for animation and you do not need to click it. See [Keying modes](#) on page 657 for more information.

To select a property in the Navigator window:

- 1 Double-click an object so that it is selected and its settings display in the Navigator window.
- 2 In the Asset Settings area, click the name of the property to select it.
If the name of the property is highlighted blue, the property is selected and you can animate it. Properties you can animate always have Keyframe (K) and Animate (A) buttons.

- [Keyframe \(K\) and Animate \(A\) buttons](#) on page 642
- [Properties window](#) on page 585
- Navigator window

Modifying and animating properties

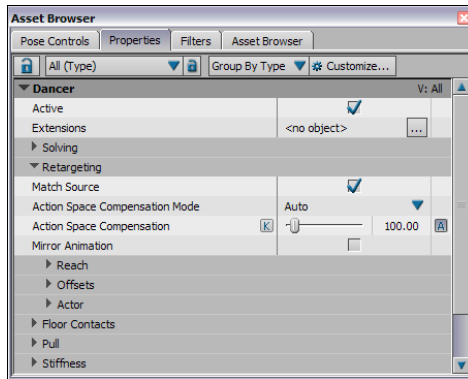
To modify and animate properties:

- 1 Select the object you want to modify in the Viewer window or Scene browser.
- 2 Use the Property settings to change the object's property values.

To modify properties on the same types of objects at the same time:

- 1 In the Properties window, select the Group By Type option in the Group Properties menu.
- 2 Select the object you want to modify in the Viewer window or Scene browser.
- 3 Use the Property settings to change the object's property values.

For example, shows the properties for a selected character, which also appear in the Character settings.



A character's properties display.

To keyframe a property:

- 1 Select the property in the Property list.
- 2 Click its Keyframe button.

To keyframe multiple properties:

- 1 Ctrl-click the properties in the Properties window.
- 2 Press K on the keyboard, or use the Key button in the Key Controls window.

To use a selected property in a constraint without setting a keyframe:

- 1 Click the Animate (A) button for the selected property.

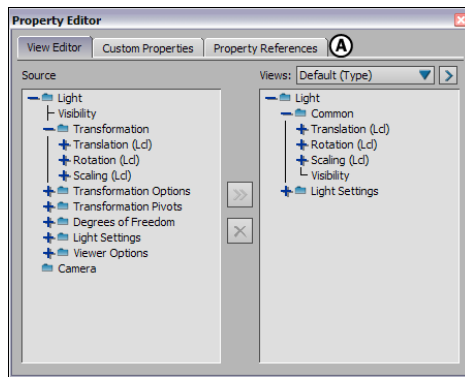
- [Setting keyframes](#) on page 639
- [Keyframe \(K\) and Animate \(A\) buttons](#) on page 642
- Viewer window

Creating a custom view of properties

You can choose which properties display in the Properties window for selected objects.

To create a custom view of properties:

- 1 In the Properties window, click the Customize button.
- 2 In the Properties Editor that appears, select the View Editor pane.
- 3 Click the View Options button, and select Create New View as x from the menu, where x is Local View, Object Type View, or Global View.
 - Select Local View if you want to create a view for the selected object only.
 - Select Object Type View if you want to create a view for all objects of the same type as the selected one.
 - Select Global View if you want to create a view for all objects.



Property Editor A. View Options button

- 4 Click the View Options button again, and select Rename View to give the view a more descriptive name.
- 5 In the Source area on the left, Ctrl-click the properties you want to add to the custom view.
- 6 Click the Add button in the middle of the pane to add the selected properties to the custom view. You can also click the Remove button to remove properties from the custom view.
- 7 When you are done, close the window. The custom view is automatically saved and you can select it from the View menu in the Properties window.

To delete a custom view:

- 1 In the Properties window, click the Customize button and select the View Editor pane in the Properties Editor that appears.
- 2 In the View menu of the Properties Editor, select the property you want to delete.
- 3 Click the View Options button and select Delete View.

Creating custom properties

To create a custom property:

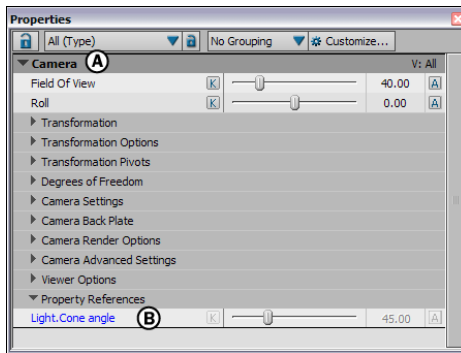
- 1 Select the object to which you want to assign the new property.
- 2 In the Properties window, click the Customize button.
- 3 In the Property Editor that appears, select the Custom Properties pane.
- 4 Drag a property type from the Add Property area onto an object in the Destination area. You can also use the Add button to assign selected property types.
The custom property is assigned to the selected object.
- 5 To rename the custom property, select the custom property in the Destination area, double-click in the Name field, type a new name and press Enter.
- 6 When you close the window, the new property displays in the Properties window.
- 7 In the Properties window, click the custom property's Animate (A) button so that you can use it in constraints.
- 8 Connect the custom property to objects. See [Animating with Constraints](#) on page 819 for more information.

■ [Property Editor](#) on page 595

Property references

You can associate one element's properties with another element, to let you access an element's properties when it is not selected. For example, you can associate a light's Cone Angle property with a cube. When you select the cube, a "Light.Cone angle" property displays after the Cube's properties .

This "Light.Cone angle" property refers to the light's Cone angle property, and so it is called a *property reference*. The original property still displays with the other light properties when you select the light.



Properties window A. Only the cube is selected
B. The "Light.Cone angle" property reference displays in blue.

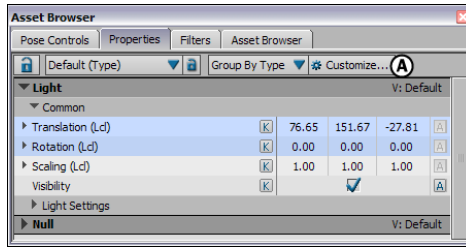
- [Creating a property reference](#) on page 580
- [Deleting a property reference](#) on page 584
- [Property References pane](#) on page 602

Creating a property reference

Create property references using the Property Reference pane or the Viewer window. A null and light are used as an example in the following steps.

To create a property reference with the Property Reference pane:

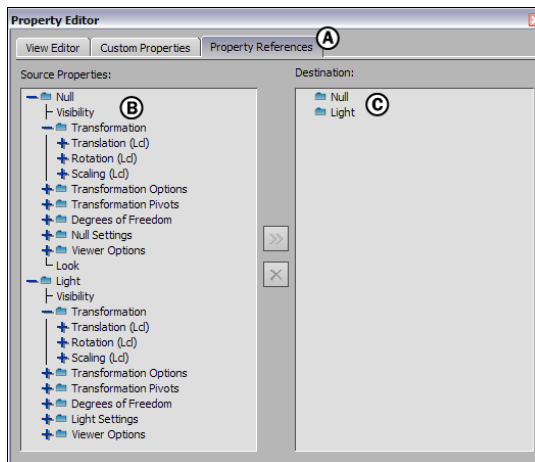
- 1 From the Asset browser, drag a null and a light into the Viewer window, then select both elements.
- 2 In the Properties window, click the Customize button.



Properties window A. Customize button

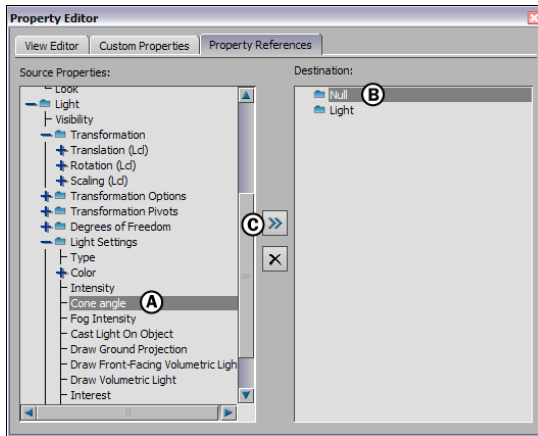
- 3 In the Property Editor window that opens, select the Property References pane.

The selected null and light's properties display in the Source Properties area and the null and light display in the Destination area.



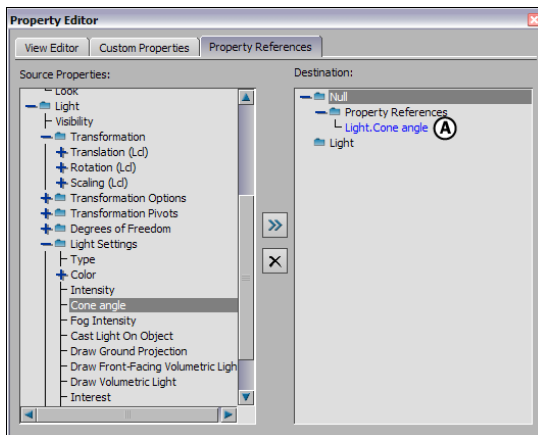
Property Editor A. Property References pane B. The null and light's properties display in the Source Properties area. C. The null and light display in the Destination area.

- 4 In the Source Area, expand the Light Settings folder and select the Cone Angle property, then select the null in the Destination area.



Property References pane A. Select the Light's Cone Angle property. B. Select the null. C. Click the Add button.

- 5 Click the Add button. A Property References folder appears, containing the new property reference.



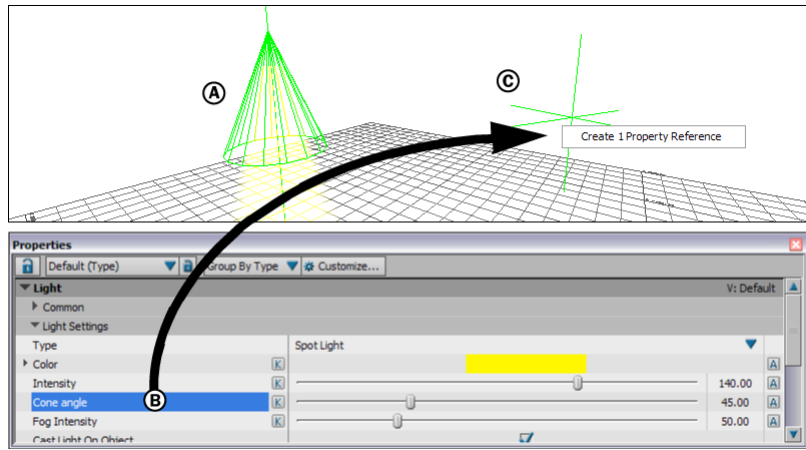
Property References pane A. Light.Cone angle property reference added to the null.

A property reference displays in blue. By default, a property reference name is “x.y”, where x is the source object’s name, and y is the property’s name. In this situation, the property reference is called “Light.Cone angle”.

To create a property reference with the Viewer window:

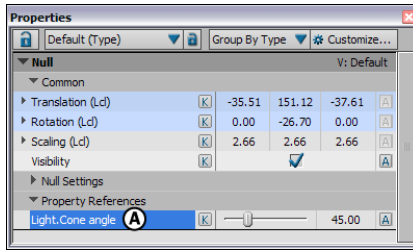
- 1 From the Asset browser, drag a null and a light into the Viewer window, then select the light so that its properties display in the Properties window.
- 2 Drag the Cone angle property from the Properties window and drop it onto the null.

You can drop the property onto the null in the Viewer window, in the Scene browser, or in the Properties window.



Creating a property reference A. Select the Light in the Viewer window. B. Drag the light's Cone angle property onto another object, such as the null. C. Select Create Property References.

- 3 Select Create Property Reference from the menu that appears.
The property you dragged displays in the Properties window when the null is selected. However, to indicate that Cone angle is the Light's property and not the null's, the referenced property displays with the name of its object. In this example, the Cone angle property displays as "Light.Cone angle" when the null is selected.



Properties window A. When the null is selected, the light's Cone angle property displays with the null's properties.

If you select the Light again, its Cone angle property still displays in the Properties window. A referenced property works like a shortcut or an alias for an object.

Deleting a property reference

To delete a property reference:

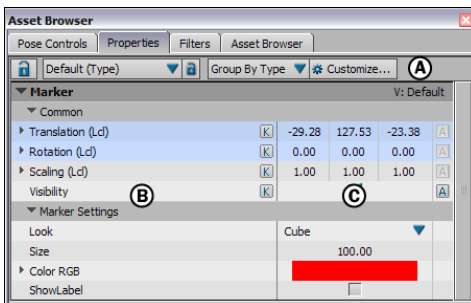
- 1 Right-click the property reference in the Properties window or in the Property Reference pane.
- 2 Select Remove Property Reference from the contextual menu.
- 3 You can also select the property reference in the Property Reference pane and click the Remove button to delete the reference.

Properties window

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The Properties window lets you view, modify, and keyframe the properties of selected objects.

To show the Properties window, select Window > Add Property Editor in the menu bar, or choose a layout that displays the Properties window by default, such as the Editing layout.



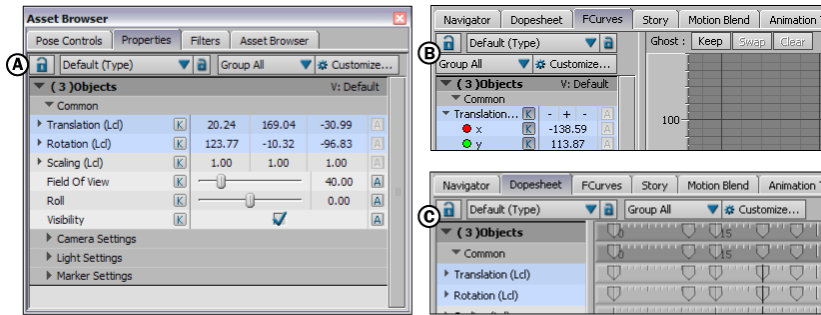
Properties window A. Property options B. Property list C. Property settings

The Properties window consists of the following:

- [Property options](#) on page 585
- [Property list](#) on page 589
- [Property settings](#) on page 592

Property options

The Property options display in the Property, FCurves, and Dopesheet windows.



Property options A. Property options in the Properties window B. FCurves Property options C. Dopesheet Property option

Lock option

Activating the Lock option locks the current object in the Property list. The settings do not change until you disable Lock, regardless of what object you select in the Scene browser or Viewer window.

View menu

The View menu lets you select the custom views you create.

When there are no custom views, the Default (Type) view displays. You can also select the All (Type) view, which includes additional properties of the selected object. When a Character is selected, you can select a number of views specific to Characters, as well as the All (Type) view.

The View menu has a View Lock button that lets you lock the currently selected view. When the Lock View button is activated, the properties for all selected objects display using the locked view, if it is applicable for the selected object. When the Lock View button is disabled, the views change as you select different objects, depending on the last view selected for the object.

For example, if you select a cube and view its properties in the TRS (Type) view, then activate the View Lock button and select a light, the light's properties also display in the TRS (Type) view.

Group Properties menu

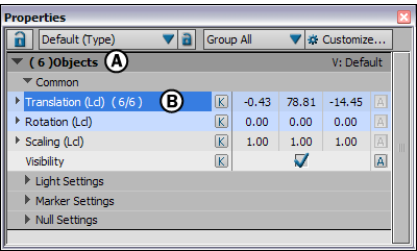
The Group Properties menu lets you group the properties of selected elements. Grouping properties lets you manipulate the properties of many elements at the same time. You can select to group all properties, to group properties by element type, or to keep properties ungrouped.

When elements are grouped, a number in parentheses indicates the number of elements that are grouped under a single label. For example, if six different elements are grouped together, the label would be “(6) Objects”.

Group All

All selected elements are grouped together, letting you modify common properties at the same time for all selected elements.

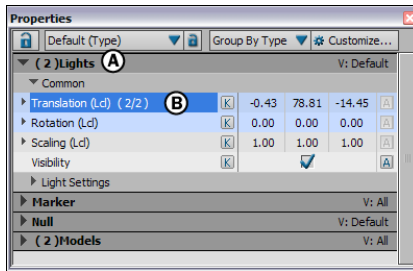
For example, in , six objects are selected. These six objects are all grouped together under the heading “6 Objects” to indicate that their common properties can be edited together.



Properties window A. The properties of six elements are grouped together. B. All six objects can be translated at the same time.

Group By Type

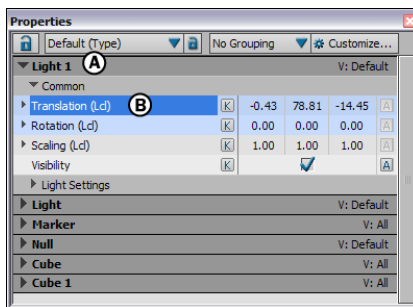
Elements of the same type are grouped together. For example you can modify the properties of all models at the same time, but modify the properties of lights separately from models .



Properties window A. The properties of elements of the same type are grouped together. B. The two selected lights can be translated at the same time.

No Grouping

All elements are listed separately, letting you modify each property individually without affecting other elements. For example, in , all selected objects are listed one after the other.



Properties window A. Each element is listed separately, and their properties are not grouped. B. A selected light can be translated alone.

Customize button

The Customize button opens the Properties Editor. See [Property Editor](#) on page 595 for more information.

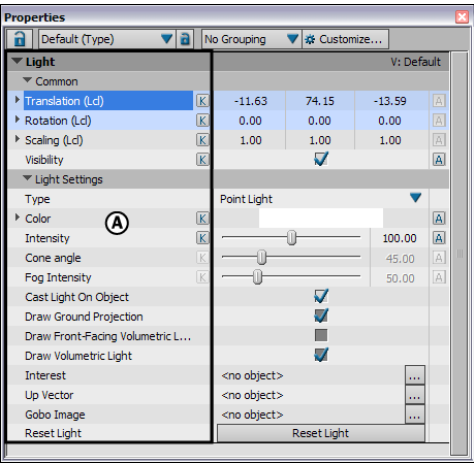
- [Properties window](#) on page 585

Property list

There is a Property list on the left side of the Properties, FCurves, and Dopesheet windows.

The Property list displays the property names of selected objects in a list structure. What displays also depends on which Property options are active and on which view is selected.

For example, displays, the properties of a selected light in the Property list.

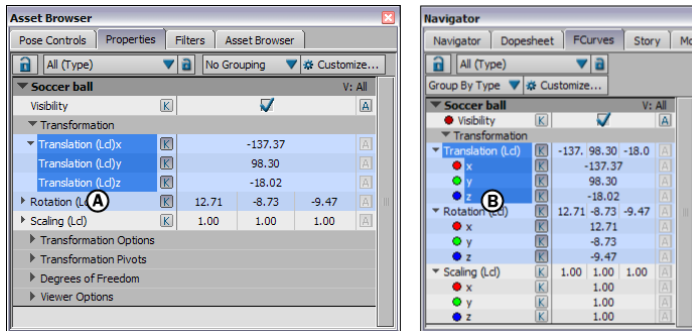


Properties window A. Property list displays a selected light's properties.

- Properties that display in light blue are currently selected in the Key Controls window's Keying Mode menu and can be keyframed.
- Properties that display in dark blue represent properties that you select in the Properties, FCurves, or Dopesheet windows, and can be keyframed.
- Properties that display in dark gray are currently selected but cannot be keyframed.

FCurves Property list

The Property list in the FCurves window displays properties differently than in the Properties window . In the Properties window, a property's name is listed to the left of its settings.



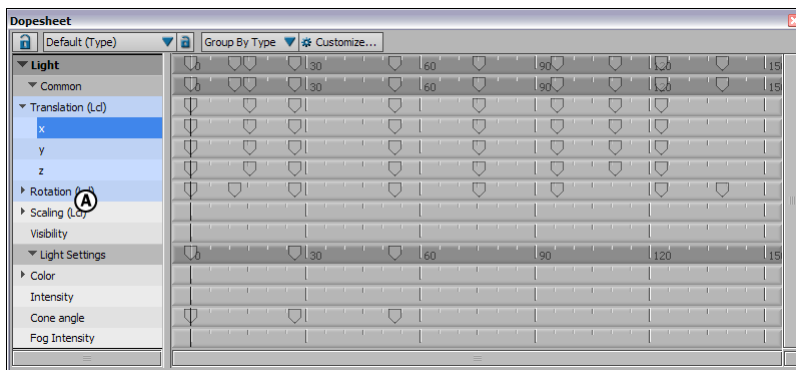
Property lists A. In the Properties window B. In the FCurves window

In the FCurves window, each property with a function curve also has a Color button, which indicates the color of the property's function curve.

Dopesheet Property list

The Dopesheet Property list resembles the Property list in the Properties window.

By default, the properties of an object display beneath the object's name in the list. Only the properties that you can animate display. To hide an object's properties, collapse the list by clicking the arrow next to the object's name.



Dopesheet window A. Dopesheet Property list

When you select an object or property in another window, such as the Properties window, the same object or property is selected in the Dopesheet property list and the FCurves Property list.

Property contextual menu

Right-clicking properties in the Property list opens a contextual menu whose options are as follows:

| | |
|-------------------|---|
| Expand Branches | Expands a selected folder and its child folders. You can also expand individual properties by clicking the arrow next to the property name. |
| Collapse Branches | Collapses a selected folder and its child folders. You can also collapse individual properties by clicking the arrow next to the property name. |
| Expand All | Expands all branches to display all properties. |
| Collapse All | Collapses all branches and displays properties. |
| Select Branch | Selects the entire branch. |
| Deselect Branch | Deselects the entire branch. |
| Select All | Selects all the properties. |
| Deselect All | Deselects all the properties. |
| Remove Object | Removes the selected object from the Properties list. Does not delete the object. |

■ [Properties window](#) on page 585

FCurves Property list Contextual Menu

In the FCurves window, to change your selection, and expand or collapse folders, you can right-click the Property list to use the following contextual menu options.

FCurves Property Color options

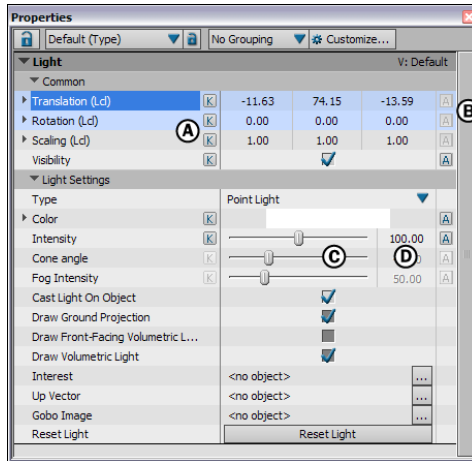
The FCurve Color options in the FCurve property list contextual menu let you change the colors of FCurves so you can identify them.

| Option | Function |
|-------------------------------------|--|
| Edit Curve Color | Opens the Color window so you can choose a new color for the selected FCurve. |
| Edit All Curve Colors of this Type | Opens the Color window so you can choose a new color for the all FCurves of that type. |
| Reset Curve Color | Returns the FCurve color to its default. |
| Reset All Curve Colors of this Type | Returns FCurve colors of that type to their default. |

Property settings

The Property settings let you modify and animate selected object properties. You can modify the properties of any selected object including Actors, Control rigs, lights, cameras, and so on.

Each property that you can animate has a corresponding Keyframe (K) and Animate (A) button, and a Value field.



Property settings A. Keyframe buttons B. Animate buttons C. Sliders D. Value fields

Keyframe (K) button

Click to set a keyframe on the selected property. To remove a keyframe, click the button again. When the K button is gray, the corresponding property does not have a keyframe at the current time.

Animate (A) button

The Animate (A) button lets you animate selected properties and use them in Expressions and Relations constraints.

Value

The Value field displays the current value of a selected property.

To change a value, drag in the property's Value field, or double-click in the field and type a new value. If Key on Edit is active, a keyframe is automatically added at the new value, and the corresponding function curve changes to reflect the new value.

- [Properties window](#) on page 585
- [Keyframe \(K\) and Animate \(A\) buttons](#) on page 642

Property Editor

42

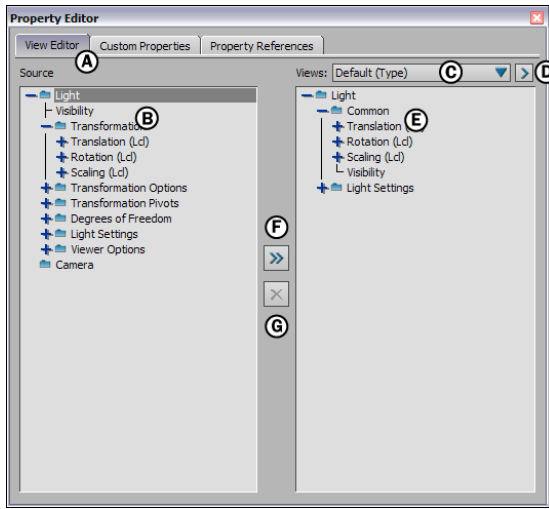
The Property Editor lets you create custom views, custom properties, and property references. You open the Property Editor by clicking the Customize button in the Properties window.

The Property Editor window consists of the following panes:

- [View Editor pane](#) on page 595
- [Custom Properties pane](#) on page 598
- [Property References pane](#) on page 602
- [Properties window](#) on page 585

View Editor pane

The View Editor pane lets you customize the current view for objects in the Properties window, and create multiple custom views of properties for each object type. These views are saved automatically.



Properties Editor A. View Editor pane B. Source area C. View menu D. View Options button E. View area F. Add button G. Remove button

Source area

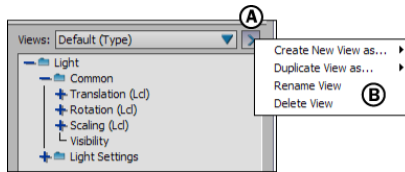
The Source area displays all the properties of selected elements. Properties selected in the Source area can be added to the custom view in the View area, letting you create a custom view.

View menu

The View menu displays the name of the view displayed in the View area and lets you select different views. You use the View menu to select the view you want to modify. When there are no custom views, the default view “x (Type)” displays, where x is the type of object that is selected.

View Options menu

The View Options button opens a menu which contains options that let you create, duplicate, rename, and delete views.



**View Editor pane A. View Options button
B. View Options menu**

Create New View as

Lets you create a new custom view. You can create three kinds of views. The following table describes the three different kinds of views you can create or duplicate:

| | |
|------------------|--|
| Local View | Lets you create or duplicate a custom view only for the selected object. |
| Object Type View | Lets you create or duplicate a custom view for the type of object that is selected. For example, if you create a custom view for a Light1, all lights you select have the same view. |
| Global View | Lets you create or duplicate a custom view for all objects. For example, if you create a custom view for Light1, the same view can be used for a selected cube. |

Duplicate View as

Duplicates the view selected in the View menu.

Rename View

Lets you rename the custom view selected in the View menu.

Delete View

Deletes the custom view selected in the View menu.

View area

The View area displays the view to be modified. To use this area, you must create a view by selecting **Create New View As** option from the View Options menu. If you have more than one custom view, select the one you want to modify in the View menu.

Add button

The Add button lets you add selected properties from the Source area to the custom view in the View area.

Remove button

The Remove button lets you remove selected properties from the custom view in the View area.

- [Property Editor](#) on page 595
- [Properties window](#) on page 585

Custom Properties pane

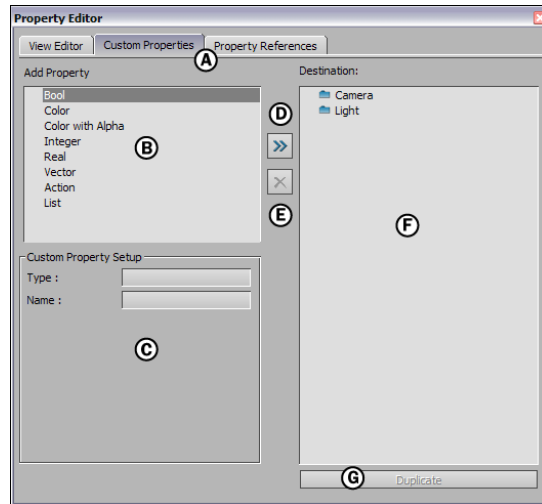
The Custom Properties pane lets you add your own properties to all selected objects in MotionBuilder. You can modify and animate the properties you create just as you would other properties.

For example, you can add check boxes, sliders, and value fields to trigger specific actions, create a custom animation interface, or simply store information you need to export to other software packages. See [Custom Properties pane](#) on page 598 for more information.

The Custom Properties pane consists of the following:

- [Add Property](#) on page 599
- [Custom Properties Setup](#) on page 600
- [Add](#) on page 601
- [Remove](#) on page 601

- [Destination](#) on page 604
- [Duplicate](#) on page 602



Properties Editor A. Custom Properties pane B. Add Property area C. Custom Property Setup area D. Add button E. Remove button F. Destination area G. Duplicate button

Add Property

The Add Property area contains the list of property types you can add to selected elements. Select a property in the Add Property area, then click the Add button to add the property to a selected element in the Destination area.

You can assign the following property types:

| | |
|------------------|---|
| Bool | Creates a check box for the selected object. Use this option to create a property that you can activate or disable. |
| Color | Creates a set of value fields that represent red, green, and blue color values. |
| Color with Alpha | Creates a set of value fields that represent red, green, blue, and alpha values. |

| | |
|---------|---|
| Integer | Creates a slider and a value field that can contain only integer values. Use the Min and Max fields to define the slider for this property. |
| Real | Creates a slider and a value field that can contain any real number. Specify the minimum value and the maximum value for the slider using the Min and Max fields. |
| Vector | Creates a set of value fields that represent a set of X, Y, and Z position values. |
| Action | Creates a button for the selected object. You can use this Action button to trigger scripts Relations and Expressions constraints. |
| List | Creates a menu (drop-down list) for the selected object. You can use this menu to trigger scripts or Relations and Expression constraints. |

Custom Properties Setup

The Custom Property Setup area displays the settings of custom properties you select in the Destination area. The settings that display correspond to the type of property that is selected. These settings include the following:

| | |
|---------------|---|
| Type | Displays the type of property that is selected in the Destination area. This is useful after you have renamed the property. |
| Name | Lets you rename the property selected in the Destination area. |
| Minimum Value | Defines the minimum value that can be set for this property using the slider. By de- |

fault, the minimum value is set to 0. Used for Integer and Real property types.

Maximum Value

Defines the maximum value that can be set for this property using the slider. By default, the maximum value is set to 100. Used for Integer and Real property types.

Text field

Lets you write text for the List property selected in the Destination area.

NOTE The Minimum and Maximum fields define the minimum and maximum number that is indicated by the slider. You can enter any number in the value field itself.

Add

The Add button lets you add selected properties from the Add Property area to the element in the Destination area.

When there are multiple elements in the Destination area, select an element there before clicking the Add button. Otherwise, the custom property may not be added to the element you want.

Remove

The Remove button lets you remove selected custom properties from the Destination area.

Destination

The Destination area lists selected elements, and the custom properties you assign to them. The Destination area also lets you rename, delete, and duplicate properties.

To rename a custom property, right-click it in the Destination area, select Rename Custom Property, type in a new name in the dialog box that appears, and click OK to confirm the change.

To delete a custom property, right-click it in the Destination area and select Remove Custom Property.

You can also copy a custom property selecting it in the Destination area, then clicking the Duplicate button.

Duplicate

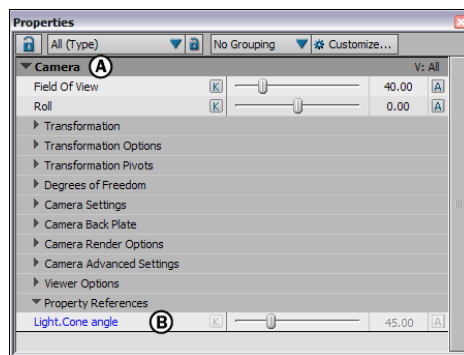
The Duplicate button lets you copy a custom property selected in the Destination area.

- [Property Editor](#) on page 595
- [Properties window](#) on page 585

Property References pane

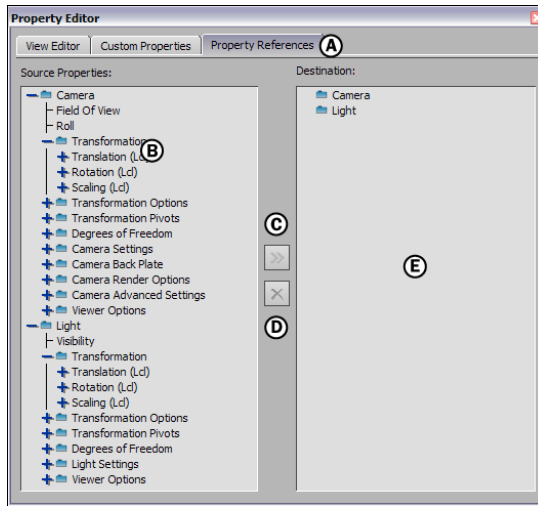
The Property References pane lets you associate one element's properties with another element. For example, you can associate a light's Cone Angle property with a camera. When you select the camera, a “Light.Cone angle” property displays after the camera's properties.

This “Light.Cone angle” property refers to the light's Cone angle property, and so it is called a *property reference*. The original property still displays with the other light properties when you select the light.



Properties window A. Only the camera is selected B. The “Light.Cone angle” property reference displays in blue.

Because property references let you access the properties of any number of objects at once without the need to select each one, they can be especially useful when you animate a complex scene, with many models, submodels, and other elements.



Properties Editor A. **Property References** pane B. **Source Properties** area C. **Add** button D. **Remove** button E. **Destination** area

The Property References pane consists of a Source Properties area, a Destination area, and Add and Remove buttons.

Source Properties

The Source Properties area displays the selected elements and their properties. If you open the Property Editor before selecting elements, you can Alt-drag the elements from the View window into the Source Properties area.

Add

The Add button lets you add properties selected in the Source Properties area to the selected element or elements in the Destination area.

Remove

The Remove button lets you remove custom properties selected in the Destination area.

Destination

The Destination area displays selected elements. You create property references for these properties by adding them from list of properties in the Source Properties area.

If you open the Property Editor before selecting elements, you can Alt-drag the elements from the View window into the Destination area.

There are three ways of creating property references:

- With the Property References pane.
- With the Properties window and the Viewer window.
- With the Properties window and the Scene browser.

The rest of this section shows you how to create a property reference from a light's Cone Angle property using the Property Reference and using the Properties window and the View window. Using the Scene browser to create a property reference is similar to using the View window.

- [Property references](#) on page 580
- [Creating a property reference](#) on page 580
- [Creating a property reference](#) on page 580
- [Deleting a property reference](#) on page 584
- [Property Editor](#) on page 595

Selecting time

In MotionBuilder, a timeline represents the length of your animation using time codes or frame numbers and has a Timeline indicator that marks the current time. Though the Transport Controls window contains the main timeline options, the Dopesheet, FCurves, and Story windows also display this timeline.

MotionBuilder has two timelines; the Action timeline and the Edit timeline. The Action timeline is the main MotionBuilder timeline, where you create and edit animation. All windows with a timeline use the Action timeline. The Edit timeline is used in the Story window to edit the scene with camera shots and time discontinuity.

Current time

The current time is a point in the take, such as a frame or a second, that is currently selected. In most cases, you set keyframes for selected objects at the current time.

The Timecode field displays the current time. A Timeline indicator along a timeline lets you select the current time.



Transport Controls window **A**. Timecode field displays the current time. **B**. The Timeline indicator is at the current time.

- [Timecode field](#) on page 620
- [Timeline indicator](#) on page 606

Timeline indicator

The Timeline indicator indicates the location in the current take and lets you change the current time. When the current take plays, the Timeline indicator moves from left to right along a timeline. You can drag the Timeline indicator along the timeline to change the current time.



Transport Controls A. Timeline indicator

- [Selecting time](#) on page 605
- [Current time](#) on page 605
- [Selecting the current time](#) on page 607
- [Display](#) on page 629

Edit timeline

The Action timeline represents the same time in every window. However, the Story window and Transport Controls window has a second timeline, referred to as the Edit timeline. Use the Edit timeline for setting up camera shots and time discontinuity in the Story window. See “Understanding Story”.

Objects such as models, cameras, lights, materials, and so on, have different types of properties, depending on the type of object. When you select an object, each of its properties are listed in the Properties window, the Dopesheet window, and the FCurves window.

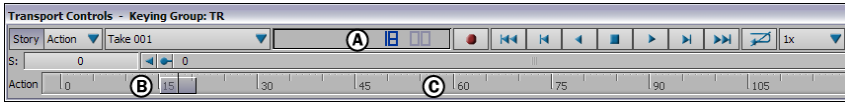
These windows can also list the properties of more than one selected object at a time. A selected object’s properties also appear in the Navigator window’s Asset Settings area. You can use the Properties window and the Navigator window to change a selected object’s values before you set any keyframes.

NOTE If you modify a value of a property without setting a keyframe, the value is not kept if you change the current time.

You can also J-drag left or right in the Viewer window or along any timeline to jog through the animation at varying speeds.

Selecting the current time

In each window with a timeline, a Timeline indicator marks the current time. The current time displays in the Transport Controls window's Timecode field.



Transport Controls (detail) A. Timecode field B. Timeline indicator at frame 20 C. Action timeline

To change the current time, do one of the following:

- Double click the Timecode field, enter a new number, and press Enter.
- Drag in the Timecode field.
- Drag the Timeline indicator along the timeline.
- Ctrl-shift-click on a timeline to move the Timeline indicator to where you click.
- [Current time](#) on page 605

Zooming in on the timeline

In the Transport Controls, the Zoom bar lets you magnify specific segments of the current take's time on the Action timeline, set the zoom length, and stretch and scroll the zoomed area.



Zoom bar A. Zoom Start timecode B. Zoom End timecode C. Stretch handle D. Scroll button

To zoom in on part of the timeline, use one of the following methods:

- Drag one of the stretch handles to shorten the Zoom bar, then drag the whole Zoom bar left or right.
- Double-click the timecode fields (A and B) and enter new start and end values.
- Drag the time codes, then drag the zoom bar left or right.

To move the Zoom bar, do one of the following:

- Drag the Zoom bar left or right.
- Click the left or right Scroll button to move the Zoom bar left or right.

NOTE The Zoom section must be shorter than the total time to move left or right.

To toggle between zoom and current take:

- 1 Double-click the Zoom bar, or press A to change the zoomed view to the current take.
- 2 Double-click the Zoom bar again to return to the last zoomed view.

To resize the Zoom bar to frame keyframes:

- 1 Select the keyframes on which you want to zoom in.
- 2 Press F.

- [Transport Controls](#) on page 619

Selecting a time format

To display time as frames and subframes:

- 1 Right-click the Action timeline in the Transport Controls window.
- 2 Select Time > Show As Frames from the contextual menu.

To display time as a timecode:

- 1 Right-click the Action timeline in the Transport Controls window.
- 2 Select Time > Show As Timecode from the contextual menu.

To display Local time:

- 1 Right-click the Action timeline in the Transport Controls window.
- 2 Select Time > Show Local Time from the contextual menu.

To display System time:

- 1 Right-click the Action timeline in the Transport Controls window.
- 2 Select Time > Show System Time from the contextual menu.

■ [Transport Controls](#) on page 619

Resizing the Timeline indicator

Resizing the Timeline indicator lets you see any keyframes hidden beneath it.

To change the size of the Timeline indicator:

- 1 Right-click the Action timeline in the Transport Controls.
- 2 Select Display > Small Cursor to make the Timeline indicator bigger or smaller.

A smaller Timeline indicator lets you see any keyframes under it more clearly and does not stretch when you resize the Transport Controls window. See [Display](#) on page 629.

■ [Transport Controls](#) on page 619

Custom frame rates

When you use the Custom option in the Time format menu to set a custom frame rate, only the following frame rates are allowed. If you enter a frame rate that is not supported, the closest supported frame rate in this list is selected.

Custom frame rates

| | | | |
|---|----|----|-----|
| 1 | 16 | 75 | 300 |
| 2 | 20 | 80 | 375 |
| 3 | 24 | 85 | 400 |

| | | | |
|------|----|-----|------|
| 4 | 25 | 86 | 500 |
| 5 | 30 | 100 | 600 |
| 6 | 40 | 120 | 750 |
| 8 | 43 | 125 | 1200 |
| 10 | 44 | 150 | 1500 |
| 12 | 48 | 200 | 2000 |
| 12.5 | 50 | 240 | 2000 |
| 15 | 60 | 250 | 6000 |

■ [Selecting a time format](#) on page 608

Selecting takes

43

A take is a level of animation in your scene. A take's start and end determine when the Timeline indicator starts and stops.

In the Transport Controls, the Action timeline can display the current length of a take, or a zoomed section of the current take. The Start and End fields define the current take length, and the Zoom Start and End time codes define parameters for a zoomed section of a take on the Action timeline. You can also use the Takes settings to manage your takes.

- [Takes settings](#) on page 615
- [Selecting the current take](#) on page 611
- [Creating takes](#) on page 613

Selecting the current take

To select the current take, in the Transport Controls window, select a different take from the Current Take menu. See [Current Take menu](#) on page 620 for more information.



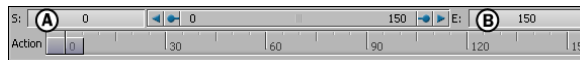
Transport Controls A. The "Half-Gym" take is the current take selected in the Current Take menu.

Resizing takes

The length of a take may be too long or too short compared to the animation it contains. A take may start playing in the middle of the animation or end before the entire edit finishes playing. This happens because the timeline only plays between the Start and End time codes on the Action timeline. To fix this, you can resize the take.

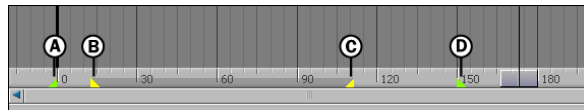
Change the current take's length using one of the following:

- In the Transport Controls, double-click the Start or End fields and type a new frame number.
- In the Transport Controls, drag in the Start or End fields to change the frame number.
- In the Transport Controls, right-click the timeline in the Transport Controls, and select Set Start or Set End to set the start or end time. The start or end of the take changes to match the current time.



Action timeline A. Start field B. End field

- In the Story window, drag the green markers at the bottom of the Action Track list. The green markers indicate the start and end of the take (A and D) and correspond with the Start and End fields in the Transport Controls window.



Time range A. Start of take B. Start of zoom bar C. End of zoom bar D. End of take

- In the Motion Blend window, click Adjust Take Start & End in the Motion Blend Options pane.
- [Edit buttons](#) on page 1513

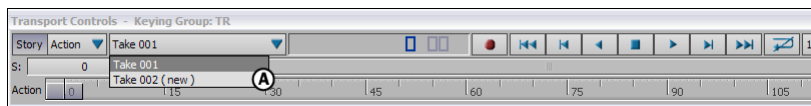
Creating takes

You can select other takes associated with the current scene, or create new takes using the Current take menu.

To create a take:

- 1 In the Transport Controls, select “Take 00n (new)” from the Current Take menu, where n is the number of the new take.

New takes are numbered in sequential order (for example, Take 002, Take 003, and so on).



Transport Controls A. Select Take 00n (new) in the Current Take menu.

Emptying takes

Emptying a take removes all data without deleting the take.

To empty a take:

- 1 In the Scene browser, double-click the Takes root folder to display the Take settings.
- 2 Right-click on the take you want to empty.
- 3 Select Empty from the contextual menu.

All captured and plotted data is removed from the take, but the take is not removed. The take's timecode and duration remain the same.

Deleting takes

You can delete a take to remove the take and all its recorded information.

To delete a take:

- 1 In the Scene browser or Take settings, right-click the take you want to delete.
- 2 Select Delete from the contextual menu.

NOTE You cannot undo the deletion of a take.

Copying takes

Create copies of takes as backups while you apply filtering or adjust keyframes. You can also use duplicate takes in the Motion Blend window to create animation cycles.

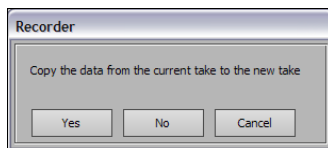
To duplicate a take in the Take settings:

- 1 In the Scene browser, double-click the Takes root folder to display all the takes in the Takes settings.
- 2 Right-click the name of the take you want to duplicate.
- 3 Select Duplicate from the contextual menu.

A new take is created with the same captured data as the original take. The take is given the same name as the original take, plus a numerical extension. For example, if you duplicate Take 001, its copy is named Take 002.

To duplicate a take in the Transport Controls:

- 1 In the Transport Controls window, select Take 002 (New) in the Current Take field.
- 2 Click Yes in the dialog box that appears. You can also click No to create a new empty take. Click Cancel to abort the duplication process.



Click Yes in the dialog box to copy the take.

Insert a take into the Story window

You can transfer keyframe animation from the current take selected in the Transport Controls window to a track in the Story window's Action Track list.

To insert the current take into the Story window:

- 1 In the Transport Controls's Current Take menu, select the take you want to insert into the Story window.
- 2 In the Story window, right-click an Animation, Character, or Camera Animation track.
- 3 Select Insert Current Take from the contextual menu.

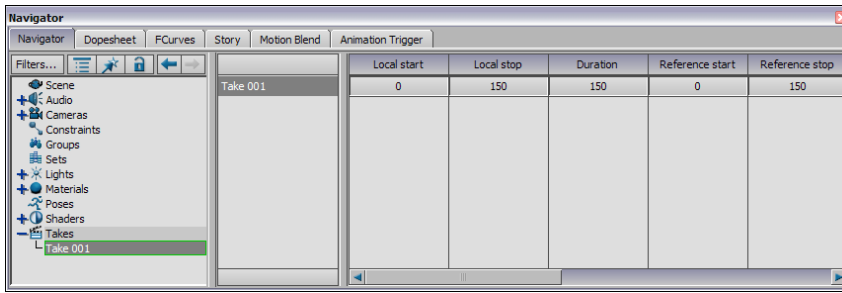
You can also insert the current take using the following steps:

- 1 In the Story window, make sure:
 - there is either an Animation, Character, or Camera Animation track.
 - the track's Animate option is active.
 - the track's content is defined in the Track Content menu.
- 2 Drag a take from the Scene browser into the track in the Story window.

Takes settings

The Takes settings show information about your takes, let you delete and rename them, as well as change their length and the order in which they are listed.

Select the Takes root folder in the Scene browser to display the Takes settings in the Navigator window.



Takes settings

Take list

All of the takes in your scene are listed in the Takes list. There is one row for each take in your scene.

Double-click the name of a take to rename it. You can also right-click on a take's name to duplicate, delete, empty, or move a take. See [Takes contextual menu](#) on page 617.

Local start

Lets you change the start time of the take in local timecode.

Local stop

Lets you change the stop time of the take in local timecode.

Duration

Displays the duration of each take.

Reference start

Lets you change the start time of each take in reference timecode.

Reference stop

Lets you change the stop time of each take in reference timecode.

Comments

Lets you write and save comments such as director's notes for each take. To insert a comment, click the cell and type your comment.

■ [Takes contextual menu](#) on page 617

Takes contextual menu

The Takes contextual menu lets you duplicate, delete, empty, and move takes in your scene.

Duplicate

Create copies of takes as backups while you apply filtering or adjust keyframes. You can also use duplicate takes in the Motion Blend window to create animation cycles.

To duplicate a take, right-click the name of the take you want to duplicate and select Duplicate from the contextual menu.

A new take is created with the same captured data as the original take. The take is given the same name as the original take, plus a numerical extension. For example, if you duplicate Take 001, its copy is named Take 002.

You can also duplicate takes by selecting a new take from the current take field. MotionBuilder asks you if you want to copy the data from the current take to the new take. Click Yes to copy the data or No to create a new empty take. Click Cancel to abort the duplication process.

Delete

You can delete a take to remove the take and all its recorded information. To delete a take, right-click the take you want to delete and select Delete from the contextual menu.

Empty

You can empty a take to remove its data, without deleting the take. To empty a take, right-click on the take you want to empty and select Empty from the contextual menu.

All captured and plotted data is removed from the take, but the take is not removed. The take's timecode and duration remain the same.

Move Down and Move Up

The Move Down and Move Up options let you move a take's row up or down to organize your takes. You can also drag a take up or down in the take list to change the order in which they display.

Transport Controls

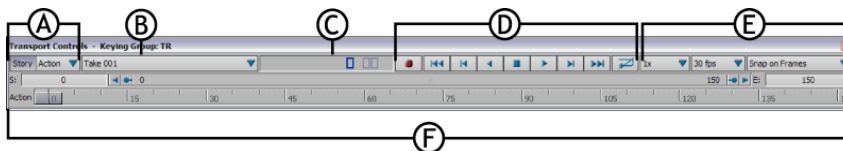
44

The Transport Controls window lets you create and select takes, play and view the time progression of a scene, set timing, play, and view options, change the start and end of a take, select and view audio tracks on the Action timeline, and manipulate visual keyframes.

The Transport Controls window displays by default in every predefined layout. You can also select Window > Transport Controls in the menu bar.

The Transport Controls window consists of the following:

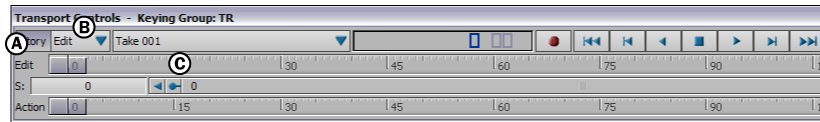
- [Story Mode option and menu](#) on page 619
- [Current Take menu](#) on page 620
- [Timecode field](#) on page 620
- [Play Controls](#) on page 621
- [Timing Controls](#) on page 622
- [Action timeline](#) on page 623
- [Transport Controls contextual menu](#) on page 625



Transport Controls window A. Story Mode option and menu B. Current Take menu C. Timecode field D. Play Controls E. Timing Controls F. Action timeline

Story Mode option and menu

The Story Mode option lets you activate and disable the animation in the Story window. The Story Mode menu lets you select between Action and Edit modes, which determines which part of the scene plays.



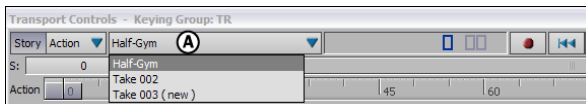
Transport Controls window A. Story Mode option B. Edit is selected in the Story Mode menu. C. The Edit timeline displays.

When Edit is selected in the Story Mode menu, the Edit timeline displays in the Transport Controls window.

The Story Mode menu and option is also in the Story window. See [Story Mode option](#) on page 1512.

Current Take menu

The Current Take menu shows the name of the current take.



Transport Controls A. The “Half-Gym” take is the current take selected in the Current Take menu.

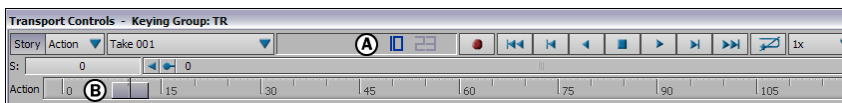
You can select other takes associated with the current scene, or create new takes using the Current take menu.

To create a new take, select “Take 00n (new)” from the menu, where n is the number of the new take. New takes are numbered in sequential order (for example, Take 002, Take 003, and so on).

To rename a take, select and right-click on the take in the Scene browser, choose Rename from the contextual menu, and type a new name.

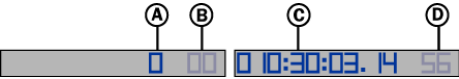
Timecode field

The Timecode field in the Transport Controls shows the take’s current time.



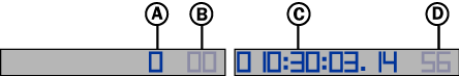
Transport Controls window A. Timecode field displays the current time. B. The Timeline indicator is at the current time.

The current time can display as either Local time or System time. Local time is the time within the current scene, and displays by default. System time provides a reference point based on your computer system.



Timecode field A. Local time display B. Local sub-frames C. System time display D. System sub-frames

The Timecode field can also display time as frames or as time codes.



Timecode field A. Frame number B. Sub-frame number C. System time display D. System sub-frames

To change the time code display, select Show Local Time or Show System Time from the Time menu in the Transport contextual menu (see [Time menu](#) on page 631).



Play Controls








The Play Controls in the Transport Controls window let you play and record your takes. The Play Controls are similar to those of a typical cassette recorder.



Play Controls

The following table describes each Play control button and displays its keyboard shortcut in parentheses:

| Button | Function |
|---|---|
|  | Records a new take or records over the current take. To record, set your Record options, click Record, and then click Play. |
|  | Moves the Timeline indicator to the beginning of the current take (Ctrl-Home). |

| Button | Function |
|---|---|
|  | Moves the Timeline indicator back one frame (Ctrl-Left Arrow). |
|  | Plays the take in reverse (Ctrl-Down arrow). |
|  | Stops playing or recording (Ctrl-Spacebar). |
|  | Plays the take (Ctrl-Spacebar). |
|  | Moves the Timeline indicator forward one frame (Ctrl-Right arrow). |
|  | Moves the Timeline indicator to the end of the current take (Ctrl-End). |
|  | Activates or disables looping when the take is playing. The loop area is the take length. You can set the loop area by changing the Start (S) and End (E) fields, setting a Zoom region using the Zoom Start and End fields, or by using loop marks (see Using marks on page 1684). |

Timing Controls

The Timing Controls in the Transport Controls let you select time-related settings such as the play speed, time format, frame rate, and snapping options.



Timing Controls A. Play Speed menu B. Time Format menu C. Snap menu

The Timing Controls consist of the following menus:

- [Play speed field](#) on page 633
- [Time Format menu](#) on page 635
- [Snap menu](#) on page 636

Action timeline

The Action timeline in the Transport Controls consists of the following:

- [Timeline indicator](#) on page 624
- [Start \(S\) and End \(E\) fields](#) on page 624
- [Zoom Bar](#) on page 624



Action timeline A. Timeline indicator B. Take display C. Audio display D. Visual keyframe

Right-click the Action timeline to access the contextual menu. (see [Transport Controls contextual menu](#) on page 625).

The following table describes the elements found in the Action timeline.for

| Option | Function |
|----------------------------|--|
| Timeline indicator | The Timeline indicator marks the current location in the take along a timeline. See Timeline indicatorfor more information. |
| Start (S) / End (E) fields | The Start (S) and End (E) fields (A and B) reflect the start and end frames of the current take. See Start (S) and End (E) fields for more information. |
| Zoom bar | The Zoom bar lets you magnify specific segments of the current take's time on the Action timeline, set the zoom length, and stretch and scroll the zoomed area. See Zoom Bar for more information. |

Timeline indicator

The Action Timeline Timeline indicator marks the current location in the take along a timeline.

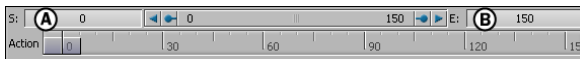
You can change the size of the Timeline indicator using the Small Cursor option (see [Display](#) on page 629). When the Timeline indicator is smaller, it is easier to view and edit visual keyframes.

See [Selecting the current time](#) on page 607 for more information.

Start (S) and End (E) fields

The Action Timeline Start (S) and End (E) fields (A and B) reflect the start and end frames of the current take. When you change the length of the current take, the length of the Action timeline changes to match the current take.

When recording, the Action timeline automatically resizes itself to the length of the recorded take. The Start field reflects where the recorded take begins, and the End field determines where the take ends.



Action timeline A. Start field B. End field

To change the current take's length, double-click the Start or End fields and type a new frame number, or drag in the fields to change the frame number. See [Resizing takes](#) on page 612 for more information.

You can also use the Transport contextual menu to set the start and end time of the current take ([Time menu](#) on page 631), as well as use Start and End fields to set the looping area (see [Using marks](#) on page 1684). See [Story window time range](#) on page 1510 for information on resizing the take in the Story window.

Zoom Bar

The Action Timeline Zoom bar lets you magnify specific segments of the current take's time on the Action timeline, set the zoom length, and stretch and scroll the zoomed area.

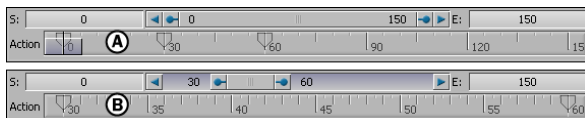


Zoom bar A. Zoom Start time code B. Zoom End time code C. Stretch handle D. Scroll button

The Zoom Start and End time codes (A, B) define the beginning and end of the zoomed segment of the current take on the Action timeline. These fields are distinct from the Start and End fields that define the entire length of the current take on the Action timeline.

For example, shows the Zoom feature active and disabled. When Zoom is disabled, the full length of the take that is defined by the Start and End fields (0 to 150) displays on the Action timeline, and the Zoom bar is at full size.

When Zoom is active, a portion of the current take fills the entire space on the Action timeline (30 to 60), which is defined by the values in the Zoom Start and End fields.



Action timeline A. Zoom is disabled, and the Action timeline reflects the values in the Start and End fields. B. Zoom is active, and the Action timeline reflects the values in the Zoom Start and End fields.

See [Zooming in on the timeline](#) on page 607 for more information.

Transport Controls contextual menu

The Transport Controls contextual menu lets you set various options when working with the Action timeline. To open this menu, right-click the Action timeline.

The options active in the contextual menu may change depending on where you click and what is selected. This section describes all the options in the Transport Controls contextual menu, which consist of the following options:

Cut

Removes a selected visual keyframe and stores it in memory. To cut a keyframe selection, right-click the key or region on the Action timeline and select Cut from the Transport contextual menu. You can also use the keyboard shortcut Ctrl-X to cut selected keyframes.

Cutting a keyframe region makes the keyframes that follow the cut move back to fill empty space.

For example, if you have three keyframes that are set at frame 0, 15, and 30, cutting the keyframe region between frame 0 and 15 causes the third keyframe (originally located at frame 30) to move back to frame 15.

Copy

Copies a keyframe selection and stores it in memory for insertion into another location. To copy a keyframe or keyframe region, right-click the key or region on the Action timeline and select Copy from the contextual menu. You can also use the keyboard shortcut Ctrl-C to copy selected keyframes.

Paste

Inserts a copied or cut selection into another location. To paste a selection, right-click the Action timeline or on an existing keyframe or keyframe region, and select Paste from the contextual menu. You can also use the keyboard shortcut Ctrl-V to paste the copied or cut selection.

Pasting a keyframe on a keyframe region deletes all keys within the region, and replaces the first key of the region with the pasted keyframe. When you paste a keyframe region on a keyframe, the region's first key replaces the original keyframe.

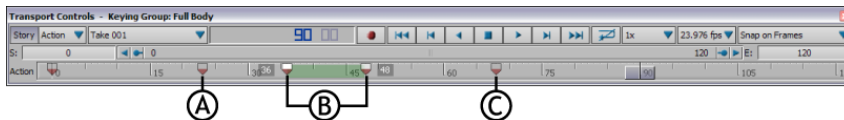
If nothing is selected on the Action timeline when pasting, the selection is pasted at the current time code. To offset keyframes that follow the paste according to the size of the pasted region, activate Paste Ripple.

Paste On Selected IK Objects.

For keyframes on IK effectors, pastes copied Translation values, Rotation values, or both.

Copy Previous Key On Selected IK Objects

For keyframes on IK effectors, copies the Translation values, Rotation values, or both from the previous keyframe to the selected keyframe or keyframe region. See also [Cutting, copying, and pasting keyframes](#) on page 650.



Transport Controls A. Previous keyframe B. Selected keyframes C. Next keyframe

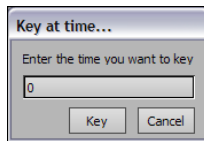
Copy Next Key On Selected IK Objects

For keyframes on IK effectors, copies the Translation values, Rotation values, or both from the next keyframe to the selected keyframe or keyframe region. See [Cutting, copying, and pasting keyframes](#) on page 650.

Key at Time

The Key at Time option opens a Key at Time dialog box, which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can also access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing Ctrl-Shift-K.



Key at Time dialog box

Delete

Deletes keyframe selections. Keyframes following a deleted keyframe selection do not move back to fill empty space.

To delete a selected keyframe or keyframe region, right-click the keyframe or region, and select Delete from the contextual menu. You can also press Delete on the keyboard.

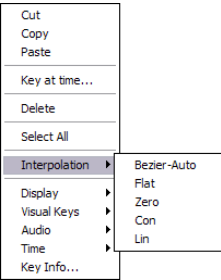
Select All

Choose the Select All option to select all the keyframes on the Action timeline. Selecting more than one keyframe creates a keyframe region.

Interpolation

Changing the interpolation of a selected keyframe affects the shape of the spline between the visual keyframe's associated keys and the next set of keys that follow the selected keyframe. Changing the interpolation of selected keyframes in a region affects the shape of the spline between all keys within the region and the next set of keys that follow the region.

To change the interpolation of a keyframe or keyframe region, right-click the keyframe or region, select Interpolation from the Transport contextual menu, then select an option in the Interpolation menu.



Interpolation menu

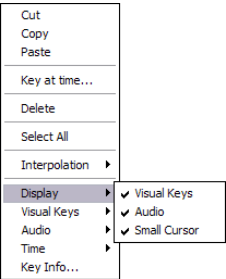
Each option changes the interpolation differently, as described in the following table:

| Option | Function |
|----------------|---|
| Bezier-Auto | Resets selected keyframes so that they use cubic curves. The tangents of the keyframes are recalculated automatically, based on the surrounding keyframes. Tangents are no longer broken or flattened |
| Flat | Flattens the tangent handles of selected keyframes. |
| Zero | Sets the associated keyframe values to 0, and flattens their tangents. |
| Constant (Con) | Maintains a keyframe’s value for each subsequent frame until the next keyframe. There is no slope between keyframes. |
| Linear (Lin) | Joins keyframes using a straight line, in which the slope between keyframes is constant. |

See [Interpolation](#) on page 697 for more information.

Display

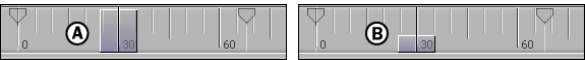
The Display menu contains options for the display of visual keyframes, audio, and the Timeline indicator.



Display menu

The following table describes the Display menu options:

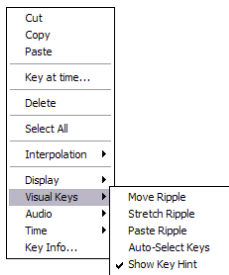
| Option | Function |
|--------------|--|
| Visual Keys | Shows or hides visual keyframes on the Action timeline. Keyframes are shown by default. |
| Audio | Shows or hides audio waveforms on the Action timeline. Audio waveforms are shown by default. |
| Small Cursor | Makes the Timeline indicator smaller and more transparent. This display lets you see keyframes under the Timeline indicator more clearly (see the following figure). |



Timeline indicator A. Large cursor B. Small cursor

Visual Keys

The Visual Keys menu lets you set options for visual keyframes on the Action timeline.



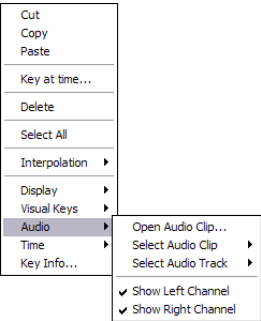
Visual Keys menu

The following table describes the Visual Keys options:

| Option | Function |
|------------------|--|
| Move Ripple | Pushes deselected keys horizontally when offsetting a keyframe or keyframe region. Disable to keep deselected keys anchored when offsetting (default). |
| Stretch Ripple | Moves deselected keys horizontally according to the stretch when stretching a keyframe region. Disable to keep deselected keys anchored when stretching (default). |
| Paste Ripple | Moves deselected keys horizontally when pasting keyframe regions. Disable to keep deselected keys anchored when pasting (default). |
| Auto-Select Keys | When activated, visual keyframes closest to the current time code are automatically selected. |
| Show Key Hint | When activated, keys on the transport controls show a different color according to on what property they are set, for example, full body, body part or selection, extension. |

Audio

The Audio menu lets you select from various audio options for use with .wav files on the Action timeline.



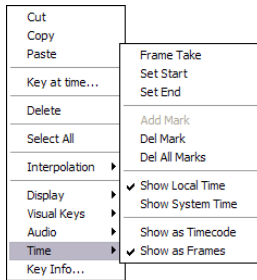
Audio menu

The following table describes the Audio menu options:

| Option | Function |
|--------------------|---|
| Open Audio Clip | Opens a file browser, letting you select a .wav audio file to add to the Action timeline. |
| Select Audio Clip | Lets you select from previously loaded audio clips. |
| Select Audio Track | Lets you select from available audio tracks that are in the Story window. |
| Show Left Channel | Shows the left audio channel. Disable to hide the left channel. Both left and right audio channels are active by default. |
| Show Right Channel | Shows the right audio channel. Disable to hide the right channel. |

Time menu

The Time menu lets you select from various time-related options.



Time menu

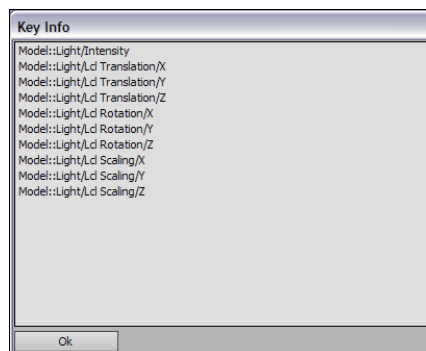
The following table describes the Time menu options:

| Option | Function |
|-----------------|--|
| Frame Take | Frames the start and end of the animation on the current take. You can also use the keyboard shortcut Ctrl-Shift-A. |
| Set Start | Sets the start time of the current take to the position of the Timeline indicator. The Take display updates automatically. |
| Set End | Sets the end time of the current take to the position of the Timeline indicator. The Take display updates automatically. |
| Add Mark | Adds a mark on the Action timeline. Double-click a mark to open the Mark dialog box. The Mark dialog box lets you assign a name, change a mark's location on the timeline, or activate a loop. See Mark options. |
| Del Mark | Deletes the mark on which you right-click. |
| Del All Marks | Deletes all marks from the Action timeline. |
| Show Local Time | Displays the local time code (default). This shows the current time of each take. |

| Option | Function |
|------------------|--|
| Show System Time | Displays the time as a reference time code, which provides a reference point for the local time code. The reference time code is based on the clock time of your computer. |
| Show as Timecode | Changes the display to time code everywhere in MotionBuilder. |
| Show as Frames | Changes the display to frames everywhere in MotionBuilder. |

Key Info

When you right-click a keyframe, the Key Info option displays in the contextual menu and lets you open a Key Info window. The Key Info window displays information about the keyframe you clicked.



Key Info window

■ [Transport Controls](#) on page 619

Play speed field

The Timing Controls Play speed field displays the speed at which your takes play in MotionBuilder. By slowing down the play speed, you can analyze model and camera movements more easily. You can also speed up play or draw every frame.

You can select from the following options in the Play speed pull-down menu:

| Speed | Description |
|--------|--|
| 1/10x | Plays one-tenth slower than real time. |
| 1/5x | Plays one-fifth slower than real time. |
| 1/4x | Plays one-fourth slower than real time. |
| 1/3x | Plays one-third slower than real time. |
| 1/2x | Plays one-half slower than real time. |
| 1x | Plays in real time. |
| All FR | Plays all frames without skipping any frames. The ALL FR option does not play in real time. The play speed is relative to your computer's speed. |
| 2x | Plays two times faster than real time. |
| 3x | Plays three times faster than real time. |
| 4x | Plays four times faster than real time. |
| 5x | Plays five times faster than real time. |
| 10x | Plays ten times faster than real time. |

NOTE To compensate for computer speed, frames may be dropped for playing in real time in all play speeds, excluding the ALL FR option.

See [Timing Controls](#) on page 622 for more information on setting play speeds.

Time Format menu

The Timing ControlsTime Format menu displays the frame rate by which the timeline is divided. You can select frames-per-second (fps), NTSC, or PAL formats.

NOTE For information on changing the time display, see [Selecting a time format](#) on page 608.

By default, the time format displays using a 30 fps time code. You can select other frame rates using the Time Format menu, as follows:

| Time Format | Description |
|-------------|---|
| 120 fps | Displays time with 120 frames in a second. This format is useful when working with motion capture data. |
| 100 fps | Displays time with 100 frames in a second. |
| 60 fps | Displays time with 60 frames in a second. |
| 50 fps | Displays time with 50 frames in a second. |
| 48 fps | Displays time with 48 frames in a second. |
| 30 fps | Displays time with 30 frames in a second (default format). |
| NTSC Drop | Displays time with 30 drop frames in NTSC format. |
| NTSC Full | Displays time with 30 frames in NTSC format. |
| PAL | Displays time with 25 frames in a second, in PAL format. |
| 24 fps | Displays time with 24 frames in a second (film format). |

| Time Format | Description |
|-------------|--|
| 23.976 fps | Displays time with 23.976 frames in a second (video format). |
| Custom | Lets you select a custom frame rate. See Selecting a time format on page 608 for more information. |

When you record data, the data is sampled at a real-time sample rate (in seconds). This means that keyframes can be set between traditional video frames. MotionBuilder sets keyframes between frames to achieve realistic motion.

When you add keyframe animation, keyframes are set at the current time. This can be at a traditional video frame or between frames. The principle behind setting keyframes between frames is the same as capturing data: it results in more realistic data and lets you switch takes between different time formats without affecting the animation.

Changing time formats only changes the unit of measurement that measures the passage of time in MotionBuilder. For example, if you have one second of capture data and you change the time format from 30 fps to 120 fps, you still have one second of capture data.

See [Timing Controls](#) on page 622 for more information.

Snap menu

The Timing Controls Snap menu displays the snap method your take uses. Snapping occurs when keyframes or the Timeline indicator move to specific frames, instead of moving between frames. The following table describes the options in the Snap menu:

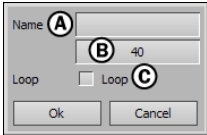
| Option | Function |
|----------------|---|
| No Snap | No snapping is applied. You can drag keyframes and keyframe regions to a time between frames. |
| Snap on Frames | Snaps to an exact frame when the take stops playing. When editing visual keyframes on the Action timeline, the edited |

| Option | Function |
|-------------------------|--|
| | keyframes snap onto exact frames. When offsetting keyframe regions, all keyframes in the region snap to frame. |
| Play on Frames | Plays on exact frames in real time, and does not show any animation in between frames. |
| Snap and Play on Frames | Plays on exact frames, and snaps to an exact frame when the take stops playing and when you edit keyframes. |

See [Timing Controls](#) on page 622 for more information.

Mark dialog box

The Mark dialog box appears when you double-click a mark set on the timeline. See [Time menu](#) on page 631 for about setting marks.



The Mark dialog box appears above a selected mark. A. Name field B. Time code field C. Loop option

The following table describes the settings in the Mark dialog box:

| Setting | Function |
|----------|---|
| Name | Lets you enter a name for the current mark. |
| Timecode | Lets you enter a new time code for the current mark by typing or dragging in the field. |

| Setting | Function |
|---------|---|
| Loop | Loops between the current and previous mark. If there is no previous mark, the Action timeline loops from the beginning of the take to the current mark. When Loop is disabled, the take stops playing at the mark. |
| Ok | Applies the changes in the Mark dialog box to the current mark. |
| Cancel | Closes the dialog box without applying changes. |

Setting keyframes

45

A visual keyframe is a mark on a timeline and represents the time or frame at which you set a key.

When you set a keyframe on a selected property, a visual keyframe displays on the Action timeline in the Transport Controls window at the current timecode, and on the timelines in the Dopesheet window. The Dopesheet window is an expanded view of the Action timeline that lets you edit visual keyframes.

The keyframes that display in the Dopesheet window are associated with selected properties. For example, if you set a keyframe when TRS is selected as the Keying mode in the Key Controls window, one visual keyframe appears on the Action timeline, but three appear on the Dopesheet Timeline area, letting you edit keyframes for translation, rotation, and scaling separately.

You can select and edit visual keyframes and visual keyframe regions on the Action timeline. The keyframes at either side of a keyframe region display in white, and the region displays in green.



Action timeline A. Keyframe region

The keyframes that display on the Action timeline are the keyframes associated with selected properties. When you edit animation by editing the visual keyframes, you also edit the corresponding keys they represent.

For example, if “TRS” is selected in the Keying Mode menu of the Key Controls window, editing a single keyframe on the Action timeline modifies nine different keys simultaneously (the X, Y, and Z values for the selected object’s translation, rotation, and scaling curves).

Therefore, it is important that you choose how you want to alter the animation. You may want to use the FCurves window or the Dopesheet window instead of the visual keyframes on the Action timeline.

NOTE Visual keyframes display on the Action timeline by default. To hide visual keyframes, right-click on the Action timeline and disable Visual Keys in the Display menu.

Types of keyframes

There are different kinds of keyframes you can set, depending on how you intend to use them. They include the following:

- [Key](#) on page 640
- [Zero key](#) on page 640
- [Flat key](#) on page 641
- [Discontinuity key](#) on page 641
- [IK and FK keys](#) on page 642

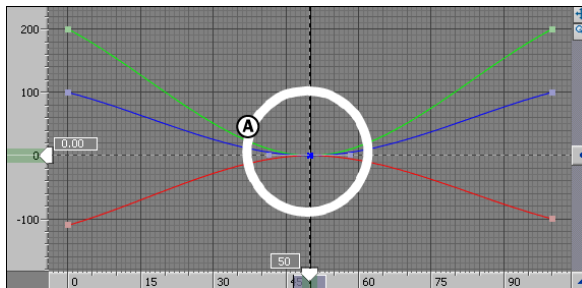
Key

A normal keyframe, often called a *key*, has the interpolation, time, and value that you set for it. It has no additional characteristics.

See [Key button](#) on page 679 for more information.

Zero key

A Zero key is a keyframe with a value of zero. A Zero key can have any type of interpolation.



FCurves pane A. A Zero keyframe with Bezier interpolation and flat tangents.

You can use Zero keyframes to define the start and end of an animation. You can also set the effect of a layer to zero at a given time using zero keyframes.

Zero keyframes work on individual or multiple properties. With multiple animation layers, a Zero keyframe means there is no offset on this frame relative to the previous layer.

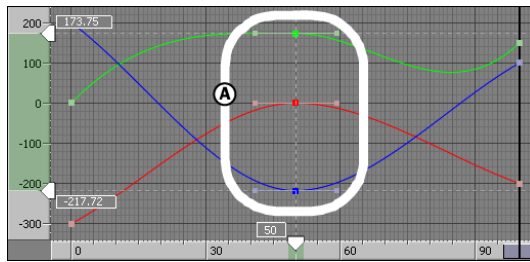
For example, if you have two layers and you do not want the animation from Layer 2 to affect Layer 1, set a Zero keyframe on Layer 2 so that it is not offset from Layer 1.

See [Zero button](#) on page 680 for more information.

Flat key

A Flat key is a keyframe with flat tangents and Bezier-User interpolation. In the FCurves window, you can see that a keyframe's tangents are flat when its tangent handles are horizontal.

If your character's feet go through the floor, setting a Flat keyframe at that point prevents the slope of the original animation from overshooting or undershooting.



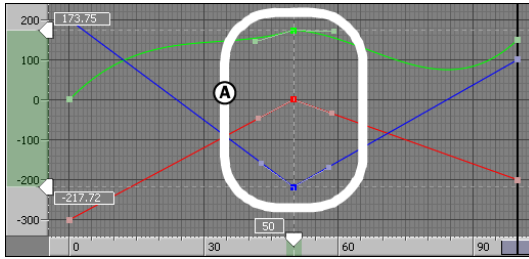
Setting a Flat keyframe A. Keyframes with flat tangent handles.

NOTE You can also set Zero, IK, and FK keys with flat tangents.

See [Flat button](#) on page 681 for more information.

Discontinuity key

A Discontinuity key is a keyframe with discontinuous tangents and Bezier interpolation. A discontinuous tangent points directly towards or away from the next or previous keyframe.



Setting a Discontinuity keyframe A. Discontinuity button B. Keyframes with discontinuous tangent handles.

See [Discontinuity button](#) on page 681 for more information.

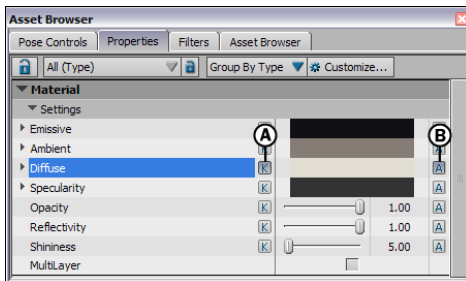
IK and FK keys

When keyframing a Control rig, you can set IK and FK keys. For information on these keys, refer to [FK button](#) on page 683 and [IK button](#) on page 684.

- [Keyframe \(K\) and Animate \(A\) buttons](#) on page 642
- [Setting keyframes](#) on page 639
- [Key Controls window](#) on page 661

Keyframe (K) and Animate (A) buttons

Many windows and asset settings in MotionBuilder display properties with corresponding Keyframe (K) and Animate (A) options. For example, the Keyframe and Animate buttons display in the Properties window .



Properties window A. Keyframe button B. Animate button



Asset Settings area A. Diffuse property is selected B. Keyframe button C. Animate button D. Keyframes of existing Diffuse animation on the Action timeline

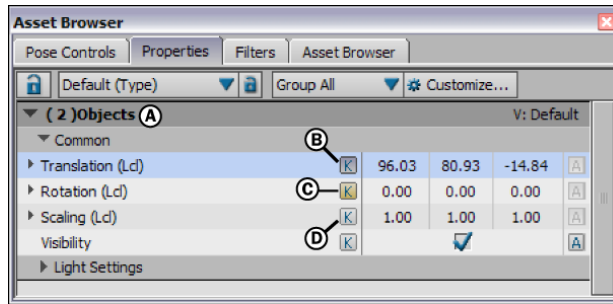
Other places you can find Keyframe and Animate buttons include the FCurves, Dopesheet, and Asset Settings windows, as well as the Character Controls. (See [Animate option](#) on page 1534 for information on the Animate button in the Story window.)

When the Animate button of a selected property is active, you can animate that property or use it in a Relations constraint.

The Keyframe button changes color to give you feedback on what is currently keyed in your scene.

The Keyframe (K) options have three states to give you feedback on what is currently keyed in your scene. When a property is keyed at the current time, the Keyframe button displays dark gray. When the property is not keyed at the current time, the Keyframe button is light gray. Keyframe buttons display in yellow when there is partial keyframing at the current time, indicating one of the following states:

- Several objects are selected, but not all are keyframed at the current time
- Not all properties in a collapsed group of properties are keyed at the current time
- The value of a selected property has changed, but it is not yet keyframed



Properties window A. Two objects are selected B. Translation is keyed on both objects at the current time. C. Only one object has a keyframe for rotation at the current time. D. Neither object has a keyframe for scaling at the current time.

For example, if you are keyframing the Reach properties for a character's left arm and you key the wrist, then add the un-keyed elbow to your selection, the Reach Keyframe buttons display in yellow to indicate that not all selected objects are currently keyed.

Or, if you key only the X and Y Rotation properties for a selected object, then collapse the Rotation group, the main Rotation Keyframe button displays in yellow to indicate not all the Rotation properties are currently keyed.

When you click a yellow Keyframe button, keys are set on all selected properties, and the Keyframe button changes to dark gray.

■ [Setting keyframes](#) on page 639

Setting keyframes

The keyframing process can be broken down into five general steps.

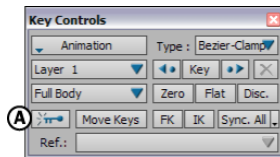
To set a keyframe:

- 1 Select an object.
- 2 Change the value of the object's properties.
- 3 Select the properties you have changed.
- 4 Select the time at which you want to set a keyframe.

- 5 To set a keyframe, do one of the following:
 - Press K.
 - In the Key Controls window, click the Key button.
 - In the Properties window, click the Keyframe (K) button next to the selected property.

To set keyframes automatically:

- 1 Click the Auto Key option (f, A) to activate it.

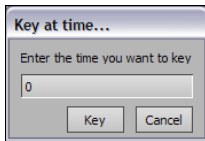


Key Controls window A. Auto Key button

- 2 Change the value of the property you want to animate.
A keyframe is set at the current time.
 - 3 Move the Timeline indicator.
 - 4 Change the value of the property to set a new keyframe.
 - 5 When you are finished setting keyframes, click the Auto Key option to disable it.
- [Key Controls window](#) on page 661
 - [Keyframe \(K\) and Animate \(A\) buttons](#) on page 642
 - [Deleting keyframes and keyframe regions](#) on page 653
 - [Setting many keyframes at once](#) on page 646
 - [Keying modes](#) on page 657

Setting many keyframes at once

While you usually need to set one keyframe at a time at the current time, the Key at Time dialog box lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time. Setting more than one keyframe at once removes the need to copy and paste keyframes to create loops, for example.



Key at Time dialog box

Besides letting you set multiple keyframes at once, Key at Time is especially useful when you have changed the values of selected properties without first changing the current time. Instead of changing the current time and starting over, you can use Key at Time to set a keyframe at a time other than the current one.

To set a keyframe using Key at Time:

- 1 Change the values of selected properties, then open the Key at Time dialog box.
- 2 Enter the frame number at which you want to set a keyframe.
- 3 Click the Key button or press Enter.

To set multiple keyframes using Key at Time:

- 1 Change the values of selected properties, then open the Key at Time dialog box.
- 2 Enter the frame numbers, separating each with a comma (,) or a slash (/). For example, to set three keyframes at frames 0, 10, and 20, you would type the value "0,10,20" or "0/10/20".
- 3 Click the Key button or press Enter.

Selecting and editing keyframes

The following describes methods for selecting, deselecting, and deleting keyframes:

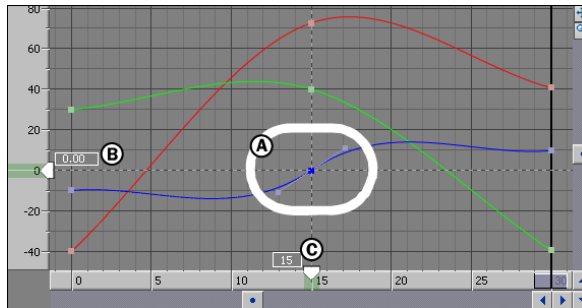
To select keyframes:

- 1 Click a single keyframe, or click-drag over several keyframes to include them in a keyframe region. You can also right-click and select the Select All or Select Keys in Box options in the contextual menu.
- 2 Ctrl-click additional keyframes to create or expand a keyframe region.

To select a keyframe region:

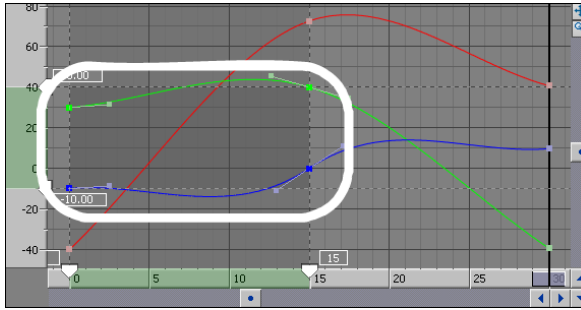
- 1 Shift-click the first and last keyframe to select a keyframe range. To expand a selection region, Ctrl-click additional keyframes.

In the FCurves window, selected keyframes display with tangent handles by default. The Value display shows the value of a selected property on the vertical axis, and its Time display on the horizontal axis.



A. Selected keyframe with tangent handles. B. Value (0.00) of selected keyframe displays in the Value display. C. Time (frame 15) of selected keyframe displays in the Time display.

When multiple keyframes are selected, a gray box outlines the selection area, and four values display, two on the Vertical axis, and two on the Horizontal axis.



Selected region displays as a gray box.

NOTE Selecting and deselecting keyframes on the Dopesheet Timeline area is similar to selecting and deselecting keyframes in the Transport Controls. You can only select one keyframe or keyframe region at a time in the Dopesheet window. When you select a keyframe or keyframe region in the Dopesheet window, it is not selected in the Transport Controls. For example, you can select one keyframe in the Transport Controls window and a separate keyframe region in the Dopesheet window. However, the result of any change to the keyframes on the Dopesheet Timeline area appear on the Action timeline, and vice versa.

To deselect keyframes:

- 1 Double-click an empty space beside the keyframe, either on the Action timeline or in the FCurve pane.

To deselect a keyframe region, Spacebar-click or double-click an empty space on the Action timeline or on another keyframe.

To delete keyframes:

- 1 To delete a keyframe or keyframe region, right-click a selected keyframe or keyframe region and choose Delete from the contextual menu or press the Delete key.

As you can see in the FCurves window, deleting a keyframe removes its associated slope on the function curve and joins the slope between the preceding and following keyframes.

To cut, copy, and paste keyframes:

- 1 Right-click the keyframe selection and choose the appropriate option from the Transport contextual menu or use the appropriate keyboard shortcut (see [Transport Controls contextual menu](#) on page 625).

To navigate between keyframes:

- 1 Use the Back and Forward buttons in the Key Controls window, or the left and right arrows on the keyboard to move between keyframes on the Action timeline.

To offset keyframe selections:

- 1 Drag the region or its Time display to a new location, or double-click the first Time display, type the frame you want the keyframe to move to, and press Enter. To cancel the offset, click outside of the Time display before pressing Enter.

If the Move Ripple option is activated, keyframes surrounding the region are pushed relative to the offset.

To stretch or shrink keyframe regions:

- 1 Drag the region's first or last keyframe or Time display to a new location on the Action timeline, or double-click the region's last Time display and enter the precise frame to which you want the region to stretch, then press Enter.

To cancel the stretch, click outside of the Time display before pressing Enter.

If Stretch Ripple is activated, keyframes surrounding the region are offset according to the stretch.

Manipulating keyframe selections

You can translate and scale entire regions, as well as single keyframes within a selection range.

You can also move visual keyframes on the FCurve timeline to move selected keyframes in that region only. This differs from moving visual keyframes on the Action timeline, which moves all the keyframes in that region.

NOTE When you modify function curves, use the Undo (Ctrl-Z) and Redo (Ctrl-Y) options to cancel the last FCurve operation, such as a deleted keyframe, a change of interpolation, and so on. Redo repeats the last FCurve operation. You can set the default number of undo operations in the menu bar (Settings > Preferences > Undo).

The rest of this section describes methods for manipulating keyframe regions.

Offsetting keyframe selections

Drag the keyframe selection to a new location on the FCurve timeline or in the FCurve pane. Any keyframes that are not selected within the region remain in place when the region moves.

To offset keyframes one frame at a time:

- 1 Drag the first Time display to a new location or
- 2 Double-click the first Time value, enter the frame you want the keyframe to move to, and press Enter.

NOTE To drag a keyframe selection to specific frames, as opposed to between frames, use the options in the Snap menu. See [Snap menu](#) on page 636.

To stretch or shrink keyframe selections:

- 1 Drag the selection's first or last keyframe.

To stretch the region one frame at a time:

- 1 Drag the second Time display to a new location or double-click the second Time value.
- 2 Enter the frame where you want the region to move,
- 3 Press Enter.

Cutting, copying, and pasting keyframes

You can use contextual menu options or keyboard shortcuts to cut, copy, and past selected keyframes.

To quickly copy-paste a keyframe or keyframe region:

- 1 Select a keyframe or keyframe region on the Action timeline in the Transport Controls, FCurves, or Dopesheet windows.
- 2 C-drag the selection along the timeline.
The keyframe selection is copied and pasted at the new location.

To copy a keyframe or keyframe region:

- 1 Select a keyframe or a keyframe region on the Action timeline.
- 2 Right-click the keyframe or region and select Copy from the contextual menu.

The keyframe selection is copied and stored in memory so that you can paste it in a different location.

TIP You can also use the keyboard shortcut Ctrl-C to copy selected keyframes.

To cut a keyframe or keyframe region:

- 1 Select a keyframe or a keyframe region on the Action timeline.
- 2 Right-click the keyframe or region and select Cut from the contextual menu.

The keyframe selection is removed and stored in memory so that you can paste it in a different location.

TIP You can also use the keyboard shortcut Ctrl-X to cut selected keyframes.

To paste a keyframe or keyframe region:

- 1 Right-click a timeline, an existing keyframe, or keyframe region, and select Paste from the contextual menu.

A copied or cut keyframe selection is inserted where you right-clicked.

TIP You can also use the keyboard shortcut Ctrl-V to paste the copied or cut selection.

Pasting a keyframe on a keyframe region deletes all keyframes within the region and replaces the first key of the region with the pasted keyframe. When you paste a keyframe region on a keyframe, the region's first key replaces the original keyframe.

If nothing is selected on the timeline when you paste, the pasted keyframe selection is placed at the current time.

NOTE To push existing keyframes ahead of pasted keyframes, activate Paste Ripple.

- [Copying and pasting values between keyframes on IK effectors](#) on page 652

Copying and pasting values between keyframes on IK effectors

To copy Transformation and Rotation values between keyframes on IK effectors:

- 1 Select a keyframe or a keyframe region in the Action timeline.
- 2 Right-click the keyframe or region and choose where you want to copy values from:
 - To copy values from the previous keyframe, select Copy Previous Key on Selected IK Objects.
 - To copy values from the next keyframe, select Copy Next Key on Selected IK Objects.
- 3 In the menu that appears, select which values you want to copy:
 - To copy Translation values, select T.
 - To copy Rotation values, select R.
 - To copy both Translation and Rotation values, select TR.

The type of values you have chosen to copy are applied to the keyframe or keyframe region you have selected.

To paste Transformation and Rotation values onto keyframes for IK effectors:

- 1 Select the keyframe whose values you want to copy, right-click and select Copy.
- 2 Select a keyframe or keyframe region for an IK effector in the Action timeline.
- 3 Right-click and select Paste on Selected IK Objects.
- 4 In the menu that appears, select which values you want to paste:
 - To paste both Translation and Rotation values, select TR.
 - To paste Translation values, select T.
 - To paste Rotation values, select R.

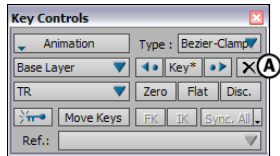
- [Cutting, copying, and pasting keyframes](#) on page 650

- [Copying and pasting values between keyframes on IK effectors](#) on page 652

Deleting keyframes and keyframe regions

To delete keyframes at the current time:

- 1 In the Transport Controls window, move the Timeline indicator to the keyframe you want to delete.
- 2 Click Delete in the Key Controls window.



Keyframe buttons A. Delete

To delete a selected keyframe:

- 1 Click or drag around a keyframe to select it.
- 2 Press Delete to delete the selected keyframe.

TIP You can also right-click the timeline and select Delete from the contextual menu.

To delete keyframe regions:

- 1 Ctrl-click multiple keyframes or drag around a number of keyframes to select them.
- 2 Press Delete to delete the selected keyframe region.

TIP You can also right-click the timeline and select Delete from the contextual menu.

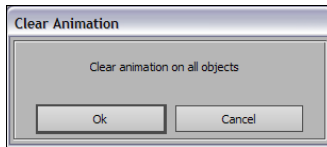
- [Delete button](#) on page 679

Clearing animation

Using a group of options in the Key Controls Animation menu, or the MotionBuilder Animation menu, you can quickly clear all animation from your scene, from selected objects, or from selected properties of selected objects.

To remove animation from all objects:

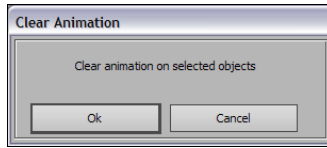
- 1 Do one of the following:
 - In the Key Controls window, select Clear All (All Properties) from the Animation menu.
 - From the MotionBuilder menu bar, select Animation > Clear All (All Properties).
- 2 Click Ok in the Clear Animation dialog box that appears.



Clear animation dialog box when clearing all animation in the scene.

To remove animation from selected objects:

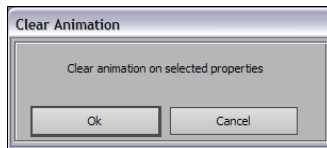
- 1 Select the objects from which you want to remove animation.
- 2 Do one of the following:
 - In the Key Controls, open the Animation menu and select Clear Selected (All Properties).
 - From the MotionBuilder menu bar, select Animation > Clear Selected (All Properties).
- 3 Click Ok in the Clear Animation dialog box that appears.



Clear Animation dialog box when clearing animation from selected objects.

To remove animation from selected properties:

- 1 Select the objects you want to affect, then select the specific properties you want to clear in the Properties window.
- 2 Do one of the following:
 - In the Key Controls, open the Animation menu and select the Clear Selected (Selected Properties) option.
 - From the MotionBuilder menu bar, select Animation > Clear Selected (Selected Properties).
- 3 Click Ok in the Clear Animation dialog box that appears .



Clear Animation dialog box when clearing animation from selected properties of selected objects.

- [Key Controls window](#) on page 661

Visual keyframe feedback

Visual keyframes can display with different colors. They can be completely one color or partly colored.

When keyframes are completely colored, they are related to a clip of the same color in the Story window.

A keyframe with a colored tip indicates that it was set in either the Full Body keying mode, Body Part keying mode, or on a Character Extension. These partly colored keyframes come in three colors, which indicate the following:

| Keyframe tip color | Indicates |
|--------------------|--|
| Red | The keyframe is set in Full Body keying mode. It also indicates that all body parts are keyed at the current time. If you edit a red keyframe, it may turn green. |
| Green | The keyframe is set in Body Part keying mode on one body part or many body parts. A green-tipped keyframe can also indicate that it is set on Character Extensions and body parts. |
| Yellow | The keyframe is set on one Character Extension or multiple Character Extensions. |

In the Transport Controls window, right-click the timeline and select Visual Keys > Show Key Hint to display or hide color feedback on visual keyframes.

- [Showing and hiding visual keyframes](#) on page 656
- [Keyframing a Control rig](#) on page 1067

Showing and hiding visual keyframes

Visual keyframes in the Transport Controls can be displayed or hidden at any time. You can also control whether visual keyframes display color-coded feedback.

To display or hide visual keyframes:

- 1 Select an animated object. Keyframes on objects that are not selected do not display.
- 2 Right-click the Action timeline in the Transport Controls window.
- 3 Select Display > Visual Keys to show or hide visual keyframes on the Action timeline. Keyframes are shown by default.

To show color-coding for visual keyframes:

- 1 In the Transport Controls, right-click the timeline and select Visual Keys > Show Key Hint.

As you set keyframes on a character for example, the tips of the keyframes are now color-coded to indicate what is keyed.

To hide color-coding for visual keyframes:

- 1 In the Transport Controls, right-click the timeline and deselect Visual Keys > Show Key Hint.

All visual keyframes on the timeline now display with no color-coding.

- [Visual keyframe feedback](#) on page 655

Keying modes

Whenever you set a keyframe in MotionBuilder, you set it for at least one property of a selected object. For example, if you want to animate a cube moving across the scene, you set keyframes for the cube's translation property.

There are three ways you can choose the properties to be keyframed:

- Select each property from a list of properties.
- Select keying modes (pre-determined groups of properties) in the Key Controls.
- Select keying modes for character animation.

Selecting individual properties

You can select any property in the Properties window, the FCurves window, and the Dopesheet window. These windows list all properties of selected objects, such as common properties (translation, rotation, and scaling) and object-specific properties (a Light's color or cone angle). See [Property list](#) on page 589.

Selecting keying modes in the Key Controls

Instead of selecting and deselecting frequently used properties one by one, you can select keying modes in the Key Control's Keying Mode menu.

Keying modes are pre-determined groups of properties. Selecting a keying mode selects specific properties. For example, if you select TRS in the Keying Mode menu, keyframes are set for translation, rotation, and scaling properties for the selected object. If you then select the T keying mode, keyframes are set only for the translation property, but not for rotation or scaling.

You can add individual properties to a keying mode selection. For example, if TR is the keying mode selected in the Key Controls, you can select additional properties in the Properties window. See [Selecting keying modes](#) on page 658 for more information.

Selecting keying modes for characters

Keyframing a character's Control rig involves selecting many effectors and their properties. The [Keying Mode area](#) on page 1374 in the Character Controls lets you do all of following at the same time:

- Select all effectors or the group of effectors you want to animate.
- Select a pre-determined group of properties for animating effectors.
- Affect effector manipulation, to control effector movement.
- [Keying Mode area](#) on page 1374
- [Selecting keying modes](#) on page 658

Selecting keying modes

Select keying modes to choose the properties you keyframe.

- 1 Select an object in the scene, such as a light.
- 2 In the Key Controls window, select a keying mode in the Keying Mode menu, such as TR to select translation and rotation properties.

When you set a keyframe, only the properties in the keying mode are selected. If TR is the current keying mode, only translation and rotation can be animated.

NOTE Properties that are selected as part of the current keying mode display light blue in the Properties, FCurves, and Dopesheet windows.

- 3 You can add to the keying mode selection by clicking additional properties in the Properties window.
- For example, you can select a light’s Color property. When TR is the current keying mode and the Color property is also selected, you set keyframes for the light’s translation, rotation, and color.

See [Keying Mode menu](#) on page 673 for more information on the different keying modes.

Keyframing shortcuts

The following table lists keyboard alternatives to using the Keyframe buttons:

| | |
|----------|--|
| Previous | Press the left arrow key on the keyboard to move the Timeline indicator back to the previous keyframe. |
| Next | Press the right arrow key on the keyboard to move the Timeline indicator forward to the next keyframe. |
| Key | Press the K key to set a keyframe. |
| Delete | Press the Delete key to delete a selected keyframe. |
| Zero | Press Shift-K on the keyboard to set a Zero keyframe. |
| Flat | Press Ctrl-K to set a flat keyframe. |

■ [Keyframe buttons](#) on page 677

Key Controls window

46

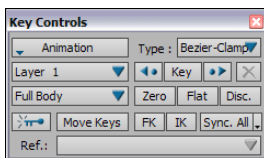
The main window for setting keyframes is the Key Controls window.

The Key Controls display when you select either the Creation, Animation, Editing, or Story layout from the Layout menu.

To open the Key Controls window at any time, you can also select Window > Key Controls from the menu bar.

The Key Controls window includes menus and options that let you do the following:

- select an interpolation mode
- set and delete keyframes
- step through keyframes
- create and select layers
- select take and layer options
- select keying groups
- set tangent and interpolation modes
- plot or clear animation



Key Controls window

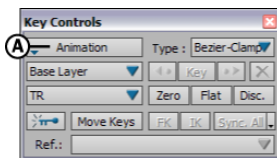
Once you have modified a selected object's properties, the Key Controls window lets you set different types of keyframes manually. You can also activate the Auto Key option to set keyframes automatically every time you change a selected object's properties.

The Key Controls window consists of the following:

- [Animation menu \(Key Controls\)](#) on page 662
- [Type menu](#) on page 670
- [Layer menu](#) on page 672
- [Keying Mode menu](#) on page 673
- [Keyframe buttons](#) on page 677
- [Multi-Referential constraint settings](#) on page 905

Animation menu (Key Controls)

In the Key Controls, the Animation menu lets you set keyframes, as well as plot and remove animation from all or selected properties. You can also choose take and layer options, or create animation paths.



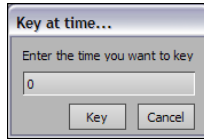
Key Controls window A.
Animation menu

Key At Time option

The Key at Time option opens a Key at Time dialog box, which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing Ctrl-Shift-K. In addition, the Key at Time option is in the contextual menus of the Transport Controls, FCurves, Story, and Dopesheet windows.

See [Setting many keyframes at once](#) on page 646.



Key at Time dialog box

Dynamic Editor option

Opens the Dynamic Editor window which lets you edit interpolation. See [Dynamic Editor](#) on page 713.

Plot All and Plot Selected

Selecting Plot All (All Properties), Plot Selected (All Properties), or Plot Selected (Selected Properties) opens the Plot All or Plot Selected window, which lets you set plotting options for plotting takes to models, specifying the frame rate, and selecting filters when plotting.

See [Plot Properties window](#) on page 1665 and [The plotting process](#) on page 1659 for more information.

Clear All and Clear Selected

Selecting Clear All (All Properties) removes animation from all objects in the scene, Clear Selected (All Properties) removes animation from only selected objects, and Clear Selected (Selected Properties) clears animation from only the selected properties of selected objects. To select specific properties you want to clear, use the Properties window.

See [Clearing animation](#) on page 654.

Take Options

The Take Options menu lets you choose [Normal](#) on page 664 or [Multi Take](#) on page 664 modes.

Normal

Use Normal to set object behavior based on the previous take. When switching from one take to another in Normal mode, the new take acquires the object transformation based on the location of the object in the previous take.

For example, if you have keyframe animation on a cube on Take 1, switching to another take in which the cube is not animated displays the cube at the last position it held in the previous take.

NOTE Normal is the default behavior for all objects, excluding nulls, markers, models, and skeletons.

Multi Take

Use Multi Take when you want to set object behavior for each take. Multi Take works per object transformation, letting you keep an object's transformation on multiple takes without having to set keyframes on each take.

For example, if you are working with multiple takes and you do not want to set keyframes for each take, you can select the object, then choose Multi Take. As you switch between takes, the object always remains where it was placed, with or without a keyframe.

NOTE By default, Multi Take applies to objects such as nulls, markers, models, and skeletons, and excludes cameras and lights.

Layer Options menu

The Layer Options menu lets you choose between [Mono Layer](#) on page 664 or [Multi Layer](#) on page 665 modes.

Mono Layer

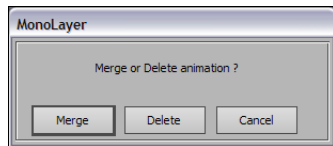
When Mono Layer is active, keyframes are placed on the Base Layer. Mono Layer works per selected object. Most objects are Mono Layer by default excluding IK, FK, and Auxiliary Control rig effectors.

Using Mono Layer helps avoid deleting layers and losing any animation by keeping it on the Base Layer, even if you are currently keying on other layers. When you do not want to keyframe a certain object on a layer, such as a light, select Mono Layer.

Multi Layer

Multi Layer lets you keyframe on multiple layers of animation in a scene. When you are satisfied with your changes, you can merge the layers by clicking Merge in the Layer pane of the FCurves window.

You can also select Mono Layer, then select Merge in the dialog box to merge the animation from all other layers to one layer. Click Delete to delete the animation from all layers, and click Cancel to close the dialog box without merging or deleting animation.



Mono Layer dialog box

NOTE If you load scenes from versions prior to MotionBuilder 4, all objects are in Multi Layer mode by default. You can change the mode by selecting Mono Layer.

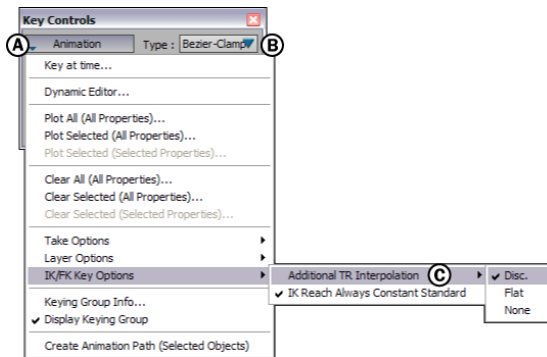
IK/FK Key Options

The IK/FK Key Options menu lets you select preferences pertaining to setting IK and FK keyframes. See [FK button](#) on page 683 and [IK button](#) on page 684 for more information on setting FK and IK keyframes.

Additional TR Interpolation

The Additional TR Interpolation option lets you set IK or FK keyframes with flat or discontinuous tangents for Translation and Rotation properties.

Results depend on the interpolation type selected in the Type menu of the Key Controls.



Key Controls A. Animation menu B. Type menu C. Additional TR Interpolation option

For a description of the results you can achieve with these options when Bezier and TCB interpolation are selected in the Type menu see:

- [Discontinuity \(Disc.\)](#) on page 666
- [Flat](#) on page 667
- [None](#) on page 667

NOTE These options do not affect Constant or Linear interpolation.

Discontinuity (Disc.)

Use the Discontinuity option with:

| Interpolation type | To achieve |
|--------------------|---|
| Bezier-Clamp | Bezier-Clamp interpolation with discontinuous tangents. |
| Bezier-Auto | Bezier-Auto interpolation with discontinuous tangents. |
| Bezier-User | Not supported. |
| TCB | TCB interpolation with Continuity set to a value of -1. |

NOTE These options do not affect Constant or Linear interpolation.

Flat

Use the Flat option with:

| Interpolation type | To achieve |
|--------------------|---|
| All Bezier | Bezier-User interpolation with flat tangents. |
| TCB | TCB interpolation with Tension set to a value of 1. |

NOTE These options do not affect Constant or Linear interpolation.

None

Use the None option with:

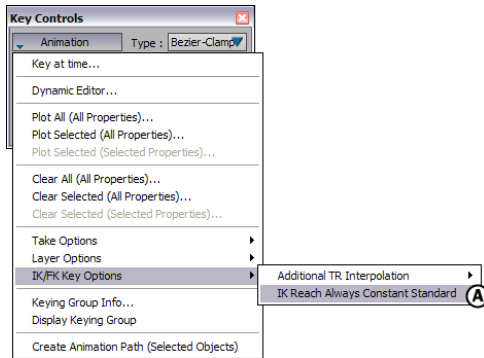
| Interpolation type | To achieve |
|--------------------|---|
| All Bezier and TCB | Interpolation with tangents that are neither flat nor discontinuous. The interpolation reflects what is selected in the Type menu only. |

See [Flat tangents](#) on page 747 and [Discontinuous tangents](#) on page 748 for more information. See [FK button](#) on page 683 and [IK button](#) on page 684.

NOTE These options do not affect Constant or Linear interpolation.

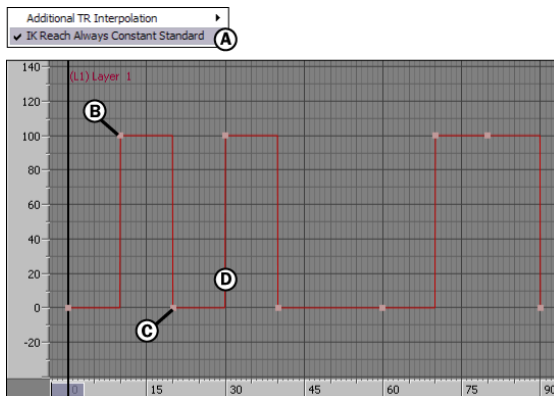
IK Reach Always Constant Standard

When you set an IK or FK keyframe, Translation, Rotation, and Reach properties are keyframed. The interpolation set for Reach is always Constant. The IK Reach Always Constant Standard option lets you choose whether the interpolation is Constant Standard or Constant Next.



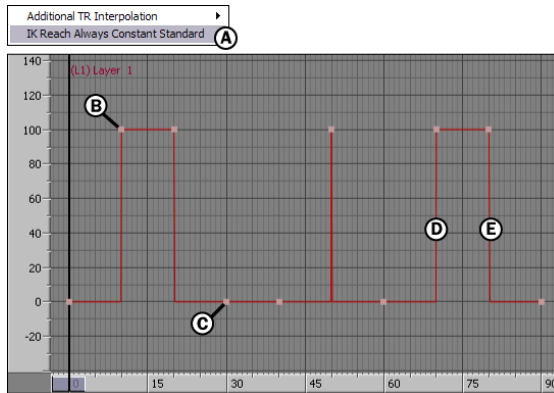
Key Controls A. IK Reach Always Constant Standard

When the IK Reach Always Constant Standard option is active, any IK or FK keyframe you set always has Constant Standard interpolation for Reach properties. This option is active by default.



Function curve for Reach T property in FCurves window
 A. IK Reach Always Constant Standard is active. B. IK keyframes have a value of 100. C. FK keyframes have a value of 0. D. All Constant interpolation is always Constant Standard.

When the IK Reach Always Constant Standard option is disabled, the FK keyframes you set have Constant Standard interpolation for Reach properties, but IK keyframes have Constant Next interpolation.



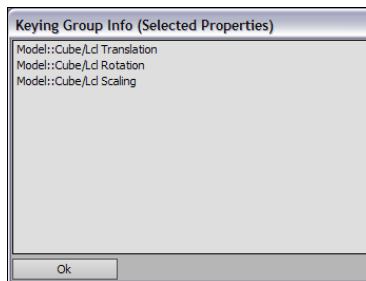
Function curve for Reach T property in FCurves window
 A. IK Reach Always Constant Standard is disabled. B. IK keyframes have a value of 100. C. FK keyframes have a value of 0. D. Interpolation for FK keyframes is Constant Standard E. Interpolation for IK keyframes is Constant Next.

See [FK button](#) on page 683 and [IK button](#) on page 684 and [Constant interpolation](#) on page 706.

NOTE These options do not affect Constant or Linear interpolation.

Keying Group Info

The Keying Group Info option opens the Keying Group Info dialog box, which displays information about the keyframes that are part of the selected keying mode.



Keying Group Info dialog box

Display Keying Group

A group of properties called Keying Group displays in the Properties, Dopesheet, and FCurves windows when you select one of the following:

- Part of a character's control rig.
- The constrained object of a Path constraint.
- The constrained object of a Multi-Referential constraint.
- Character Extensions

For example, when part of a control rig is selected, the Keying Group consist of properties that affect the translation, rotation, and reach of the selected effector or effectors.

TIP In the Dopesheet window, more properties display in the Keying Group for a selected control rig than in the Properties or FCurves windows.

The Display Keying Group option in the Animation menu of the Key Controls window lets you show or hide the Keying Group properties in the Properties, Dopesheet, and FCurves windows. By default, the Display Keying Group option is disabled and the Keying Group properties are not shown.

Create Animation Path

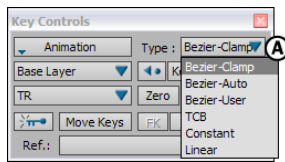
The Create Animation Path option lets you create an editable 3D animation path.

Select an object in the Viewer window, choose Create Animation Path from the Animation menu and set keyframes for it. An editable curve is created as you keyframe, with nodes appearing at every key.

See [Creating an animated path with a 3D Curve](#) on page 915 for more information.

Type menu

The Type menu lets you determine the default interpolation of the new keyframes you set.



Key Controls window A. Type menu

The rest of this section describes the options in the Type menu. Interpolation modes are described in more detail in the [Interpolation](#) on page 697.

| Option | Function |
|--------------|--|
| Bezier-Clamp | Tangents are automatically calculated based on the values of the neighboring keyframes. When you move neighboring keyframes to the same value as a Bezier-Clamp keyframe, the tangents of the Bezier-Clamp keyframe automatically become flat. |
| Bezier-Auto | Tangents are automatically calculated based on the values of the neighboring keyframes. |
| Bezier-User | Tangents are not influenced by the neighboring keyframes. |
| TCB | Joins each keyframe using a Hermite-type curve, but the slope on either side of a tangent handle is changed using the TCB (Tension/Continuity/Bias) values. |
| Constant | Maintains the same keyframe value between keyframes, with no slope between them. |
| Linear | Joins keyframes using straight lines, and a constant slope between keyframes. |

Layer menu

The Layer menu in the Key Controls window lets you select the type of layer to work with, or create new layers. You can select the Base Layer, or any number of separate layers on which to animate.



Key Controls window A.
Layer menu

Base Layer

The Base Layer is the default animation layer. While you can use any number of layers when animating, plotting your animation merges all layers to the Base Layer.

Select Base Layer to animate the object's translation, rotation, scaling, or additional properties. The properties of objects differ depending on the object type. For example, you can animate light properties, such as cone angle and intensity.

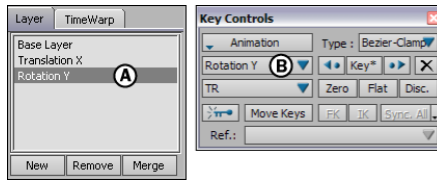
Layer n

Select Layer n to switch between different layers of animation, where “n” is the layer number. Using different layers, you can add keyframes over translation, rotation, scaling, or other properties.

Layer 1 displays in the menu by default. Selecting “(New Layer)” from the menu creates a new layer called Layer 2. Subsequent layers you create are sequential, such as Layer 3, Layer 4, and so on.

NOTE All objects (excluding IK, FK and Auxiliary Control rig effectors) are Mono Layer by default, and cannot be keyframed on layers.

You can also use the Layer pane in the FCurves window to create layers, and to rename, delete, and merge layers. When you select a layer in the Layer pane, the layer displays in the Layer field of the Key Controls window, and vice versa.



Renamed layer A. A layer named “Rotation Y” is selected in the Layer pane (FCurves window). **B.** Selected layer displays in the Layer field.

See [Layers](#) on page 750 for more information about using layers.

- [Adding and renaming layers](#) on page 750
- [Layer pane](#) on page 785

Keying Mode menu

The Keying Modes menu in the Key Controls window determines which properties of selected objects receive keyframes.



Key Controls window A.
Keying Mode menu

For example, selecting the T option in the Keying Mode menu displays the visual keyframes only for a selected object’s translation curves on the Action timeline. This lets you add, edit, or delete keyframes on the object’s translation curves.

The items in the menu may change, depending on what you are doing in MotionBuilder. For example, working with certain windows and settings can influence the keyframing options in the Key Controls (see [Contextual keying modes](#) on page 675).

The following table describes the default Keying modes:

| | |
|---------------------|--|
| TR | Displays keyframes associated with the selected object's translation and rotation curves. Select TR to add a keyframe to the translation and rotation properties at the current timecode. Any change in scale is not keyframed. |
| T, R, or S | Displays keyframes associated with the selected object's translation (T), rotation (R), or scaling (S) curves. Select T, R, or S to add a keyframe to the translation, rotation, or scaling properties at the current timecode. |
| TRS | Displays keyframes associated with the selected object's translation, rotation, and scaling curves. Select TRS to add a keyframe to the translation, rotation, and scaling properties at the current timecode. |
| Current Camera | Adds a keyframe to the current custom camera. The camera does not need to be selected, as long as it is the current camera. Select this mode when you want to create camera animation (such as a walk-through). Keys are set for Translation (T), Rotation (R), Field of View, and Roll. |
| Selected Properties | Adds a keyframe to selected properties only. You can select properties in the Properties, FCurves, and Dopesheet windows, as well as in an object's settings, such as Light settings. |

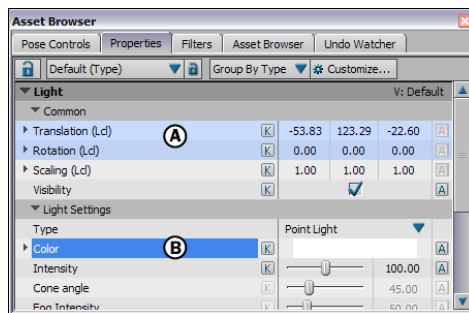
Contextual keying modes

Certain windows and settings influence the keying mode in the Key Controls window. These can be grouped by the degree of influence each has over the Key Controls window.

You can select additional properties on top of other static keying modes such as Full Body, Body Parts, TR, T, R, S, and TRS.

Static keying groups display the properties that they keyframe in light blue. Those properties receive a keyframe when you click the Key button or press the K keyboard shortcut, but they are not selected.

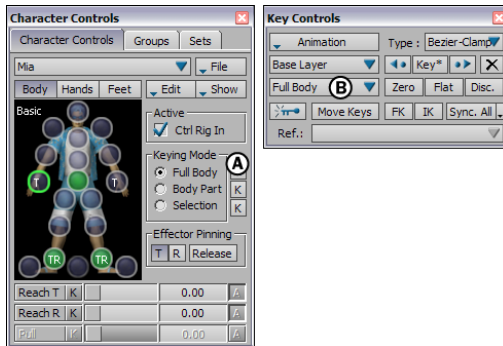
Selected properties display in dark blue. Selected properties are also keyframed when you click Key.



Contextual Keying Modes. *A.* Light-blue properties receive keyframes. *B.* Color property is selected and can also receive keyframes.

Keying modes in the Character Controls

When working with Control rigs, keyframing is relative to the selected keying mode in the Character Controls.



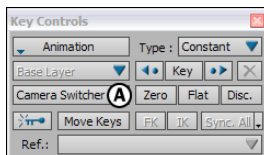
A. Full Body is the Keying mode in the Character Controls window. B. Full Body displays in the Key Controls window.

Depending on the selection, setting a keyframe applies to either the full body (Full Body mode), the selected body part (Body Parts mode), or the selected effector (Selection mode).

In Full Body or Body Parts mode, keyframes are applied to the translation and rotation nodes included in the full body or selected body parts by default.

Camera Switcher

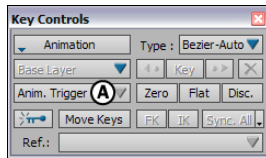
When working with the Camera Switcher, the Key Controls are contextual to the Camera Switcher, letting you keyframe only with the Camera Switcher. See [Camera switcher](#) on page 335.



Key Controls window A. When the Camera Switcher is active, keyframes are placed for the Camera Switcher only.

Motion Blend, Animation Trigger, and Optical Settings

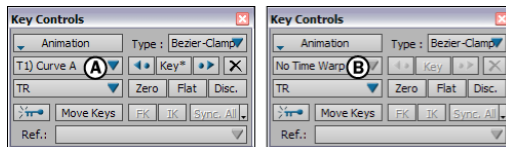
When using the Motion Blend, Animation Trigger, or Optical settings, the name of the window or settings appears in the Keying Mode menu and all the options in the Key Controls are unavailable.



Key Controls window A. When the Animation Trigger window is open, the words “Anim. Trigger” appear in the Keying Mode menu.

TimeWarp Curves

When the TimeWarp pane is active in the FCurves window, TimeWarp is the active Keying mode, and the keying options are contextual to the selected object’s TimeWarp curve.



Key Controls window A. TimeWarp curve name. **B.** TimeWarp is active, but there is no TimeWarp curve.

If the TimeWarp pane is active but no TimeWarp curve exists, No Time Warp displays in the Key Controls window, and the Keyframe buttons are not available.

For more information, see [TimeWarp pane](#) on page 787.

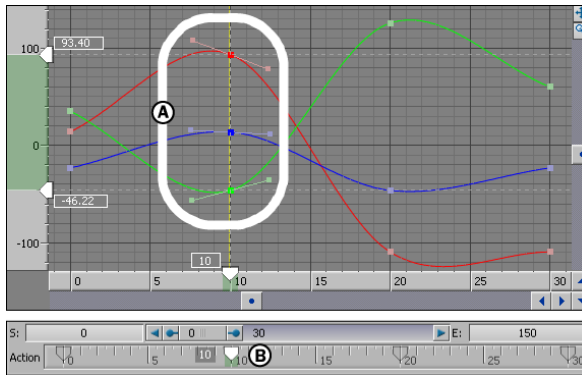
Keyframe buttons

The Keyframe buttons in the Key Controls window let you set, delete, and navigate through different types of keyframes. You can set keyframes on an object’s translation, rotation, and scaling properties, or for other properties such as a light’s cone angle. You can also set keyframes that have zero, flat, or discontinuous values, or keyframes specifically for Control rigs.

When you select an object and set a keyframe, a visual keyframe appears on the Action timeline in the Transport Controls at the current time.

For example, setting a keyframe on a selected cube with “T” as the Keying Mode adds a keyframe to the object’s X, Y, and Z translation curves. If you

delete any keyframes in the FCurves window, the remaining keys are still represented by visual keyframes.



A. In the FCurves window, keyframes are added to the selected object's X, Y, and Z translation curves. B. A single visual keyframe represents the three keys in the Transport Controls.

The keyframe buttons consist of the following:

- [Key button](#) on page 679
- [Previous and Next buttons](#) on page 679
- [Delete button](#) on page 679
- [Zero button](#) on page 680
- [Flat button](#) on page 681
- [Discontinuity button](#) on page 681
- [Auto Key option](#) on page 682
- [Move Keys](#) on page 682
- [FK button](#) on page 683
- [IK button](#) on page 684
- [Sync and Sync All](#) on page 684

Key button

The Key button lets you set a keyframe to the selection at the current timecode. You can also press K to set keyframes. An asterisk indicates a keyframe at the current time.



Keyframe buttons A. Key button, with an asterisk that indicates a key at the current time.

Previous and Next buttons

The Previous and Next buttons let you move between the keyframes that are part of the current keying group.



Key buttons A. Previous button B. Next button

To go back in the current take to previous keyframes, click the Previous button. To move forward to keyframes in the current take, click the Next button.

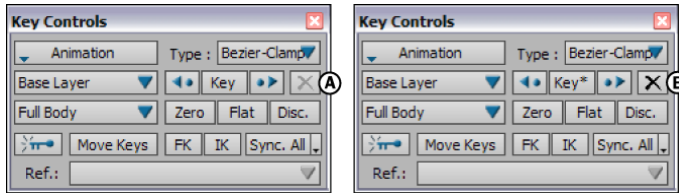
When using the Previous or Next buttons, the Timeline indicator moves to the position of the previous or next keyframe on the Action timeline in the Transport Controls and Dopesheet windows. If there is no animation, Previous and Next are not available.

Delete button

The Delete button removes the keyframe at the current timecode for the selected object, function curve, and property.

For example, if the selected object has a keyframe for the Scale property's X value at the current timecode, clicking Delete with Translation as the Keying Mode deletes a keyframe from the selected object's Translation curve. The keyframe for the Scale property's X value is left untouched.

When there is keyframe animation in a scene but not at the current timecode, Delete is unavailable. If the selected object does not contain a keyframe for the selected curve and property, Delete does nothing.



Keyframe buttons A. Delete is not available since there is no keyframe at the current frame. **B.** You can delete the keyframe set at the current time.

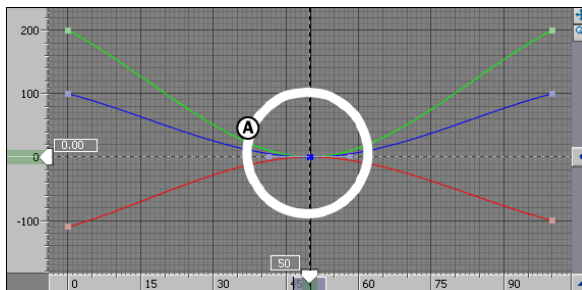
You can also delete keyframes using the Delete option in the Transport Controls contextual menu.

To delete a selected keyframe or keyframe region, right-click the keyframe or region, and select Delete from the contextual menu. You can also press Delete on the keyboard. See [Deleting keyframes and keyframe regions](#) on page 653.

Zero button

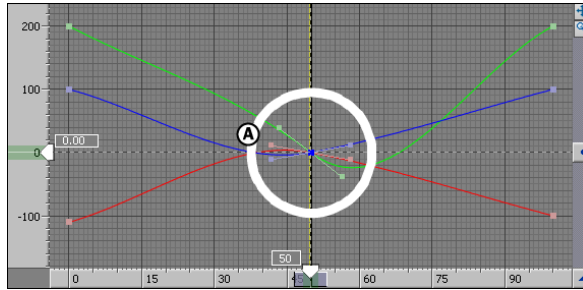
The Zero button lets you set a keyframe with a zero value for selected properties.

Clicking the Zero button sets a keyframe with a zero value and flat tangents for the selected properties.



FCurves pane A. A Zero keyframe with flat tangents.

Right-clicking the Zero button sets a keyframe with a zero value for selected properties, but the tangent is not flattened.

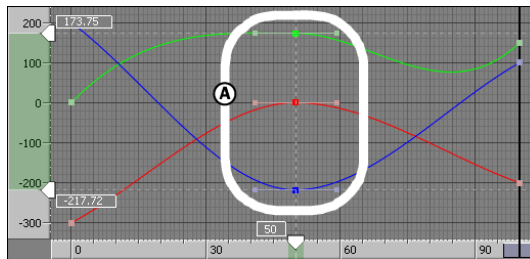


FCurves pane A. Right-click the Zero button to set keyframes with a value of 0 and tangents that are not flat.

Flat button

The Flat button lets you set a keyframe with flat tangents and Bezier-User interpolation. In the FCurves window, you can see that a keyframe's tangents are flat when its tangent handles are horizontal.

If your character's feet go through the floor, setting a Flat keyframe at that point prevents the slope of the original animation from overshooting or undershooting.



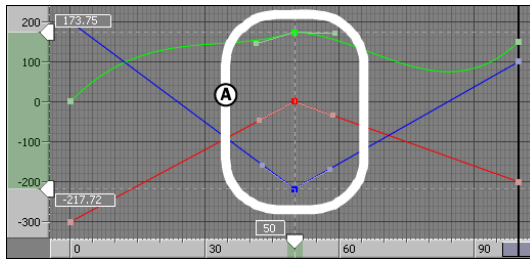
FCurves pane A. Keyframes with flat tangent handles.

You can also set Zero, IK, and FK keyframes with flat tangents. See [Flat key](#) on page 641.

Discontinuity button

The Discontinuity (Disc.) button lets you set a keyframe with discontinuous tangents.

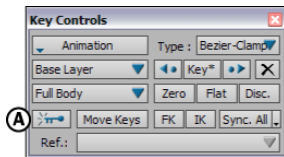
In the FCurves window, you can see that the keyframe's tangent handles point directly at the previous and next keyframes.



FCurves pane A. Keyframes with discontinuous tangent handles.

Auto Key option

The Auto Key option lets you set keyframes automatically when it is active.



Key Controls window A. Auto Key option

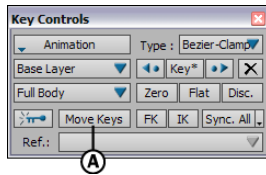
When Auto Key is active, changing a value in the Properties window or transforming in the Viewer window automatically adds a keyframe at the current timecode for the edited value.

When Auto Key is disabled, you can manually add keyframes by changing the value of the selected property and clicking the Keyframe button.

Move Keys

The Move Keys button lets you change the translation and rotation values of keyframes you have already set. For example, you can take a character's walk-cycle in which the character walks in a straight line and change the animation so that the character turns part-way throughout the animation.

The Move Keys button is disabled when the Auto Key option is active (see [Auto Key option](#) on page 682).



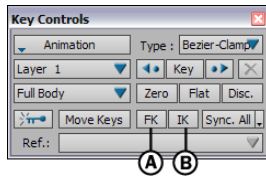
Key Controls window A.
Move Keys button

FK button

When you select a Control rig effector or Auxiliary object, the FK button lets you make many changes and set keyframes with a single click.

NOTE The FK button is only available when a Control rig object is selected.

When you create walk cycles or other character animation, setting keyframes at a single point in time can mean changing Reach values, interpolation, and tangent angles for different effectors to attain the effect you want. Using the FK button lets you make all these changes and set keyframes with a single click.



Key Controls window A. FK
button B. IK button

Generally, the FK button lets you change Reach properties of a body part to a value of 0. Specifically, when part of a Control rig is selected, clicking the FK button does the following:

- Sets the Reach properties to a value of 0 for all effectors and Auxiliary objects within the body part of the selected object. This occurs no matter which keying mode (Full Body or Body Parts) is selected.
- Sets a keyframe with Constant interpolation for Reach properties, no matter what interpolation is selected in the Type menu.
- Sets a keyframe with the type of interpolation selected in the Type menu. If Full Body keying mode is selected, the keyframe is set on every part of the Control rig. If Body Parts keying mode is selected, the keyframe is set

on the body part containing the selected effector, Auxiliary effector, or Auxiliary pivot.

- Sets a keyframe with discontinuous tangents for Translation and Rotation for selected effectors and for any of their Auxiliary objects. You can also choose to set a keyframe with Flat tangents, or no additional tangent behavior. See [IK/FK Key Options](#) on page 665.

IK button

Similar to the FK button, the IK button lets you make a number of changes and set different types of keyframes with one click, simplifying the character animation process.

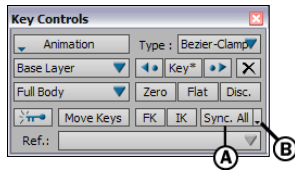
Generally, the IK button lets you determine a Master pivot for body parts in a Control rig. Specifically, when part of a Control rig is selected, clicking the IK button does the following:

- Sets the Reach properties to a value of 100 for a selected effector, Auxiliary effector, or Auxiliary pivot, and sets the Reach properties to a value of 0 for the rest of the select object's body part. This occurs no matter which keying mode (Full Body or Body Parts) is selected.
- Sets a keyframe with Constant interpolation for Reach properties, no matter what interpolation is selected in the Type menu.
- Sets a keyframe with the type of interpolation selected in the Type menu. If Full Body keying mode is selected, the keyframe is set on every part of the Control rig. If Body Parts keying mode is selected, the keyframe is set on the body part containing the selected effector or Auxiliary object.
- Sets a keyframe with discontinuous tangents for Translation and Rotation for selected effectors and for any of their Auxiliary objects. You can also choose to set a keyframe with Flat tangents, or no additional tangent behavior. See [IK/FK Key Options](#) on page 665.

Sync and Sync All

The Sync menu lets you select between Sync and Sync All options. Selecting one of these options changes the behavior of the Sync button.

The Sync button is used for resolving the desynchronization of keyframe animation for both Control rigs and Multi-Referential constraints.



Key Controls window A. Sync button B. Sync menu

When the Sync option is selected in the Sync menu, use the Sync button when a switch between different references in a scene creates “jumps” in the animation.

In situations where there is a reference change, such as from FK to IK solving on a character, or in a scene with a character moving from a car to the street, then to an elevator with a Multi-Referential constraint, “jumps” are created when you change the timing or values of the keys of one of the references.

The Sync button tracks all the reference changes in the animation, correcting any inconsistencies by synchronizing the previous reference to the new one.

When the Sync All option is selected in the Sync menu, use the Sync button to correct any inconsistencies in all keyframes, not just those with different references.

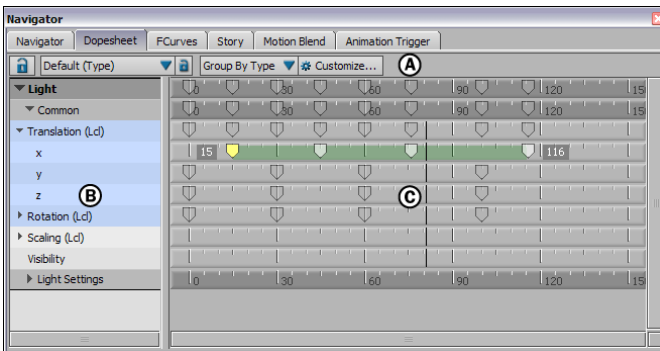
■ [Multi-Referential constraint](#) on page 901

Dopesheet window

47

The Dopesheet window lets you view all keyframe animation for selected objects in the current scene, and edit animation by moving, copying, cutting, and pasting keyframes.

The Dopesheet window is an exploded view of the Action timeline in the Transport Controls, letting you view keyframes for every animated property of selected objects.

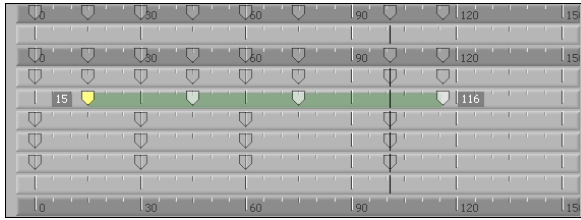


Dopesheet window A. Dopesheet Property options B. Dopesheet Property list C. Dopesheet Timeline area

To open the Dopesheet window, select Window > Dopesheet from the menu bar.

Dopesheet timeline

The Dopesheet Timeline area is an exploded view of the Action timeline in the Transport Controls window. In other words, keyframes set for different properties display separately in the Dopesheet window. When you edit visual keyframes on a Dopesheet timeline, the changes display on the Action timeline.



Dopesheet Timeline area

To zoom or magnify specific segments of the Dopesheet timeline, use the Zoom bar in the Transport Controls. The Zoom bar affects the Dopesheet timeline as well as the Action timeline.



Transport Controls window timeline A. Zoom bar

The Play Controls, Timing Controls, and the Start and End fields of the Transport Controls also affect the Dopesheet.

The Dopesheet Timeline area lets you do:

- Set keyframes
- Select and deselect keyframes and keyframe regions
- Edit keyframes and keyframe regions

Dopesheet contextual menu

The Dopesheet contextual menu is similar to the Transport Controls contextual menu. It lets you cut, copy, and paste keyframes and regions, select all keyframes of a property, and set interpolation and visual key options.

To open this menu, right-click on the part of the Dopesheet timeline you want to affect. For example, if you right-click on the Rotation timeline to paste a keyframe, the keyframe is pasted on that timeline.

Cut

Removes a selected visual keyframe and stores it in memory. To cut a keyframe selection, right-click the key or region and select Cut from the Dopesheet

contextual menu. You can also use the keyboard shortcut Ctrl-X to cut selected keyframes.

Copy

Copies a keyframe selection and stores it in memory so that you can paste it in a different location. To copy a keyframe or keyframe region, right-click the key or region on the Action timeline and select Copy from the contextual menu. You can also use the keyboard shortcut Ctrl-C to copy selected keyframes.

Paste

Inserts a copied or cut selection into another location. To paste a selection, right-click on a property's Dopesheet timeline or on an existing keyframe or keyframe region, and select Paste from the contextual menu. You can also use the keyboard shortcut Ctrl-V to paste the copied or cut selection.

Pasting a keyframe on a keyframe region deletes all keyframes within the region, and replaces the first key of the region with the pasted keyframe. When you paste a keyframe region on a keyframe, the region's first key replaces the original keyframe.

If nothing is selected on the Dopesheet timeline when pasting, the paste is placed at the current time.

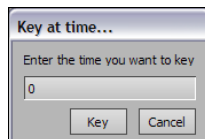
To offset keyframes that follow the paste according to the size of the pasted region, activate Paste Ripple.

Key At Time

The Key at Time option opens a Key at Time dialog box, which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can also access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing Ctrl-Shift-K.

See [Setting many keyframes at once](#) on page 646.



Key at Time dialog box

Delete

Deletes keyframe selections. When you delete a keyframe, the previous and next keyframes do not move to fill the empty space.

To delete a selected keyframe or keyframe region, right-click the keyframe or region, and select Delete from the contextual menu. You can also press Delete on the keyboard.

Select All

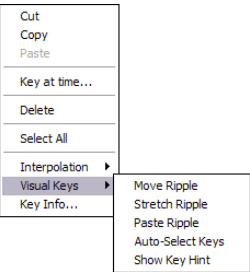
Choose the Select All option to select all the visual keyframes for one property. This creates a keyframe region.

Interpolation

The Interpolation options let you change the interpolation of a selected keyframe or keyframe region. See [Interpolation](#) on page 697, about the same option in the Transport Controls contextual menu. See [Type menu](#) on page 670 for information on selecting interpolation before setting a keyframe.

Visual Keys

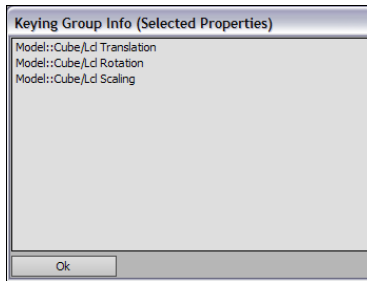
The options in the Visual Keys menu let you set options for visual keyframes on the Dopesheet timeline and the Action timeline.



Visual Keys menu

| Option | Description |
|-------------|--|
| Move Ripple | Pushes deselected keys horizontally when offsetting a keyframe or keyframe region. Disable to keep deselected keys anchored when offsetting (default). |

| Option | Description |
|------------------|--|
| Stretch Ripple | Moves deselected keys horizontally according to the stretch when stretching a keyframe region. Disable to keep deselected keys anchored when stretching (default). |
| Paste Ripple | Moves deselected keys horizontally when pasting keyframe regions. Disable to keep deselected keys anchored when pasting (default). |
| Auto-Select Keys | When activated, visual keyframes closest to the current timecode are automatically selected. |
| Show Key Hint | When activated, certain keyframes display with color. Keyframes set in the Full Body character keying mode display with a red tip. Keyframes set in the Body Part character keying mode display with a green tip. Keyframes set in the Selection character keying mode do not have a color. See Keyframing a Control rig on page 1067. When disabled, all keyframes look the same, except for keyframes set in the Story window. Note: Keyframes that are completely colored are related to clips in the Story window. |
| Key Info | When you right-click a keyframe, the Key Info option displays in the contextual menu, letting you open a Key Info window. The Key Info window displays information about the selected keyframe. |



Key Info window

■ Character keying Groups

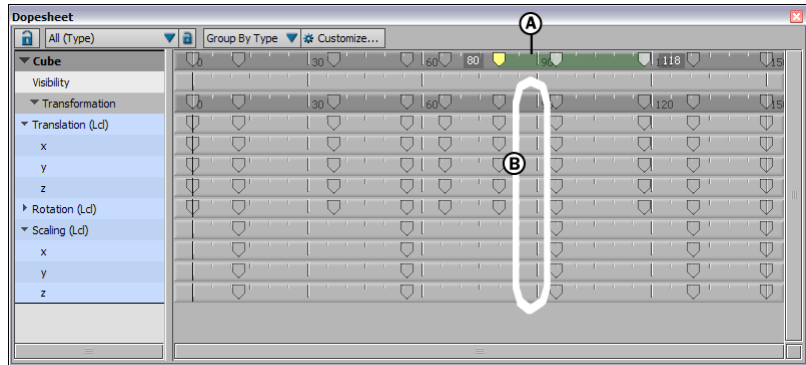
Editing keyframes in the Dopesheet window

The Dopesheet window is an exploded view of the Transport Controls timeline, meaning that you can see and manipulate keyframes for every animated property along multiple timelines. This lets you edit the timing of keyframes without the need to manipulate function curves.

In the Dopesheet window, keyframe manipulation follows the hierarchy of properties as they are displayed in the Properties pane.

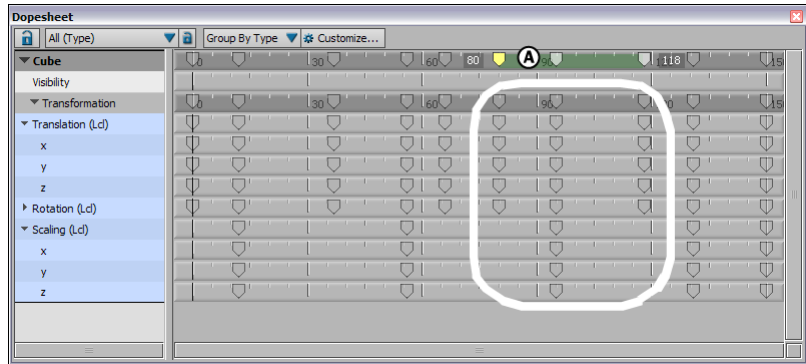
To move many keyframes:

- 1 To move all keyframes set on one frame, drag the topmost keyframe. Keyframes for all animated properties set on the same frame move with it. This is the same as moving one keyframe in the Transport Controls window.



Dopesheet window A. Drag the topmost keyframe. B. All keyframes set at the same frame move with the keyframe you drag.

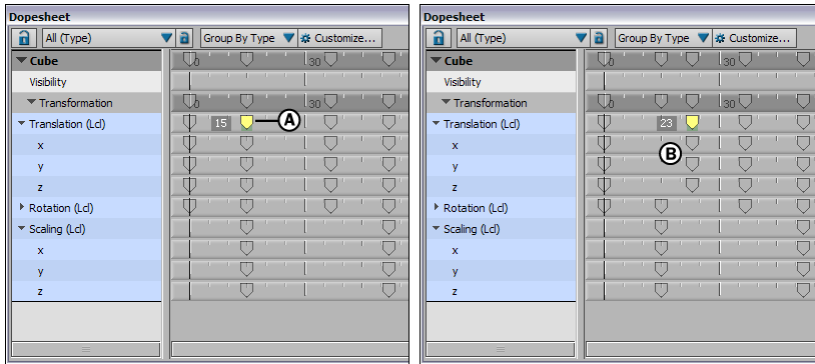
- 2 You can also select a keyframe region to move even more keyframes.



Dopesheet window A. Drag a keyframe region to offset a greater number of keyframes.

To move keyframes for specific properties:

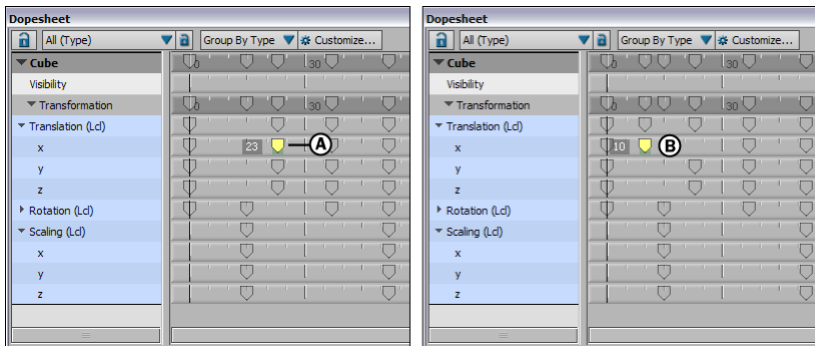
- 1 Drag a keyframe on the timeline corresponding to the property's name.



Dopesheet window A. Drag the keyframe for Translation. B. Only the keyframes for the Translation property move.

This moves all keyframes for that property set on the same frame.

- 2 Drag a keyframe on a timeline corresponding to part of the main property, such as Translation x.



Dopesheet window A. Drag the keyframe for Translation x. B. Only the keyframes for the Translation property move.

Only the timing for the keyframe set on the Translation x property changes.

Refining Animation

Once you have set keyframes or opened a file containing motion capture data, you can continue to refine your animation. You can edit keyframe animation by manipulating function curves and modifying interpolation. You can also use filters to clean, manipulate, and modify animation.

- [Interpolation](#) on page 697
- [Function curves](#) on page 737
- [Filtering](#) on page 805
- [Dynamic Editor](#) on page 713

Interpolation

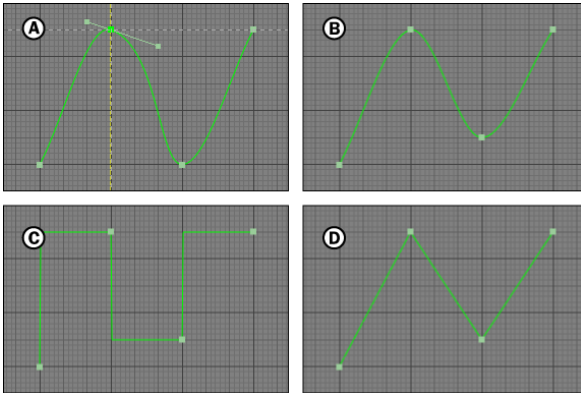
48

When you set multiple keyframes for a property, MotionBuilder automatically interpolates the animation between the keyframes. You can see a graphical representation of this interpolation in the [FCurves window](#) on page 763.

To edit animation, you can create, view, and modify function curves in various ways. For example, you can control the type of interpolation between keyframes, the curve's extrapolation, and the value and time of the function curve.

Each type of interpolation creates different animation. For example, a model animated along the Y axis with Bezier interpolation would move up and down gradually, while the same model animated with Constant interpolation would suddenly appear in different locations at each keyframe.

The following figure shows the graphical representation of each interpolation type.



FCurves window A. Bezier interpolation B. TCB interpolation C. Constant interpolation D. Linear interpolation

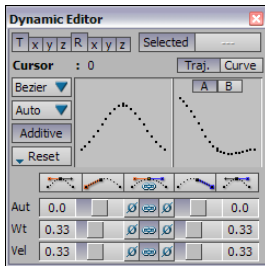
You can set the type of interpolation before you set keyframes in the Key Controls window, or you can change the interpolation for existing keyframes using the FCurves window and the Dynamic Editor.

In the FCurves window, you can select keyframes and change their interpolation type, but you can also manipulate a function curve directly to alter the interpolation.

The slope of a function curve determines the speed at which the values change between keyframes. A steep slope means the value changes quickly, and a gradual slope means the value changes more slowly over a longer period of time.

While the FCurves window lets you modify the function curve of one selected keyframe at a time, the Dynamic Editor lets you simultaneously modify multiple function curves. You can edit the interpolation of selected keyframes or of keyframes at the current time.

The Dynamic Editor also lets you quickly alter the velocity of animation without changing its trajectory through space. See [Dynamic Editor](#) on page 713.



The Dynamic Editor lets you modify many function curves at the same time.

Types of interpolation

MotionBuilder offers four different types of interpolation:

- [Bezier interpolation](#) on page 698
- [TCB interpolation](#) on page 704
- [Constant interpolation](#) on page 706
- [Linear interpolation](#) on page 709

Bezier interpolation

Bezier interpolation is a cubic curve which you can modify using tangent handles or angle and weight settings. When editing Bezier interpolation, you can work in three modes—Clamp, Auto and User (sometimes referred to as Bezier-Clamp, Bezier-Auto, and Bezier-User).

Bezier-Clamp

Bezier-Clamp interpolation is a cubic curve whose tangents are automatically calculated based on the values of the neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-Clamp keyframe change. Tangents of Bezier-Clamp keyframes flatten automatically when you move neighboring keyframes to the same value. Use Bezier-Clamp to avoid overshooting and undershooting interpolation.

See [Type menu](#) on page 670, [Tangent area](#) on page 775, and [Bezier interpolation settings](#) on page 721 for setting keyframes with Bezier-Clamp interpolation.

To edit keyframes in Clamp mode:

- Select the keyframes you want to edit, then click the Bezier and Clamp options at the top of the FCurves window.
When you edit neighboring keyframes so that they have nearly the same value, the tangents of these keyframes in Clamp mode are set to Flat to avoid over- and under-shooting.

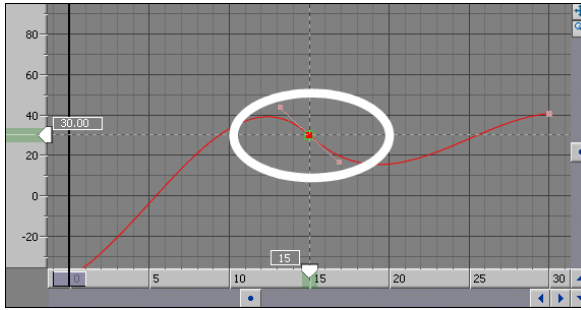
Bezier-Auto

Bezier-Auto interpolation is a cubic curve whose tangents are automatically calculated based on the values of the neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-Auto keyframe change. Unlike Clamp, tangents of Bezier-Auto keyframes do not automatically flatten.

Bezier-User

Bezier-User interpolation is a cubic curve whose tangents are not influenced by neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-User keyframe do not change.

In User mode, moving one tangent handle moves the other tangent equally, as shown in the following figure.



- [Creating Bezier interpolation](#) on page 700
- [Editing Bezier interpolation](#) on page 702

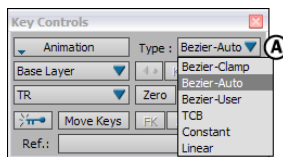
Creating Bezier interpolation

You can set keyframes with Bezier interpolation or change a keyframe's interpolation after the keyframe is already set.

To set keyframes with Bezier interpolation:

- 1 In the Key Controls window, select one of the interpolation types from the Type menu:
 - Bezier-Clamp (the default interpolation type)
 - Bezier-Auto
 - Bezier-User

These options let you set keyframes with Bezier interpolation, each with a different behavior. See [Bezier interpolation](#) on page 698.



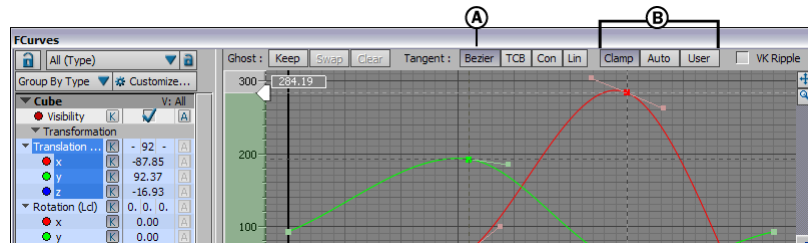
Key Controls A. Type menu

- 2 Set keyframes (see [Setting keyframes](#) on page 639).

NOTE The keyframes you set have the type of Bezier interpolation you selected, until you select different interpolation.

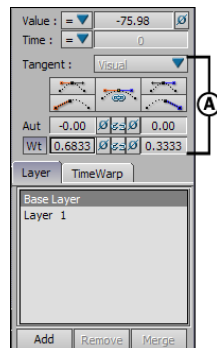
To change the interpolation of a keyframe to Bezier:

- 1 In the FCurves window, select the keyframe or keyframes whose interpolation you want to change.
- 2 In the Tangent options, select Bezier to set the interpolation type.



FCurves window A. Bezier is the selected interpolation type for the keyframe selection. B. Select Clamp, Auto, or User modes.

- 3 Select either Clamp, Auto, or User modes, which affect the way Bezier interpolation behaves when you edit keyframes. See [Bezier interpolation](#) on page 698.
- 4 Edit the interpolation by dragging each tangent handle, or by using the settings in the Tangent area. These settings let you change the behavior, angle, and weight of tangents. See [Tangent area](#) on page 775.



FCurves window A. Tangent area settings

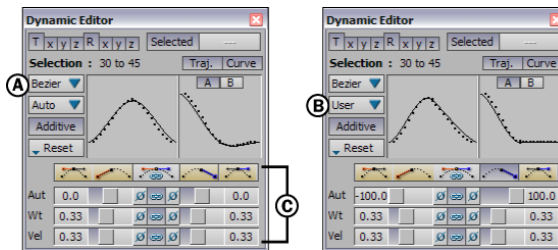
Related topics

- [Dynamic Editor](#) on page 713

Editing Bezier interpolation

To edit Bezier interpolation:

- 1 Move the Timeline indicator to the animation you want to edit or select a range of keyframes.
- 2 In the Dynamic Editor, select Bezier in the Interpolation Mode menu. The selected animation has Bezier interpolation, and the Bezier interpolation settings display in the settings area.



Dynamic Editor A. Interpolation Mode menu B. Interpolation Options menu C. Interpolation settings.

- 3 In the Interpolation Options menu, select either Clamp, Auto, or User. Bezier-Clamp is the default.

NOTE Two options in the FCurve contextual menu affect your use of Clamp, Auto, and User modes during editing.

See [Switch to User on Edit](#) on page 796 and [Reset Tangents on Switch to Auto](#) on page 796.

- 4 Select Flat, Discontinuity, Break, and Link options to affect the behavior of tangents.

See [Bezier interpolation settings](#) on page 721.

- 5 Change the values of the Auto, Weight, and Velocity settings to edit the interpolation.

See [Dynamic Editor](#) on page 713.

Related topics

- [Creating Bezier interpolation](#) on page 700
- [Dynamic Editor](#) on page 713

Editing keyframes in Clamp mode

Everything in this topic needs to go

To edit keyframes in Clamp mode:

- 1 Select the keyframes you want to edit, then click the Bezier and Clamp options at the top of the FCurves window.

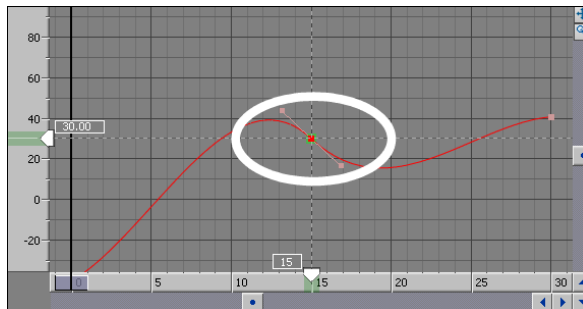
When you edit neighboring keyframes so that they have nearly the same value, the tangents of these keyframes in Clamp mode are set to Flat to avoid over- and under-shooting.

Bezier-Auto

Auto interpolation is a cubic curve whose tangents are automatically calculated based on the values of the neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-Auto keyframe change. Unlike Clamp, tangents of Bezier-Auto keyframes do not automatically flatten.

Bezier-User

User interpolation is a cubic curve whose tangents are not influenced by neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-User keyframe do not change.



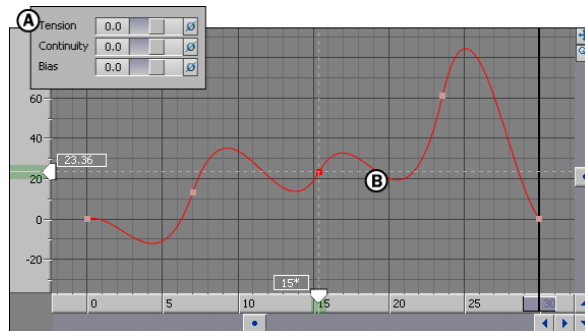
In User mode, moving one tangent handle moves the other tangent handle equally.

- Creating Bezier interpolation
- Editing Bezier interpolation

TCB interpolation

TCB interpolation joins each keyframe using a Hermite-type curve. The slope on either side of a keyframe is changed using the TCB (Tension/Continuity/Bias) values.

To set the slope of a tangent, select TCB and change the values in the TCB fields. Each field in the vector changes a different part of the tangent. The TCB fields are only visible in the FCurve Options pane when a keyframe or keyframes with TCB interpolation are selected.



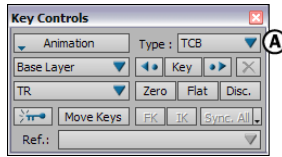
A. The TCB settings in the FCurve Options pane B. TCB curves

Creating TCB interpolation

You can set keyframes with TCB interpolation, or you can change existing keyframes to use TCB interpolation.

To set keyframes with TCB interpolation:

- 1 In the Key Controls window, select TCB from the Type menu.

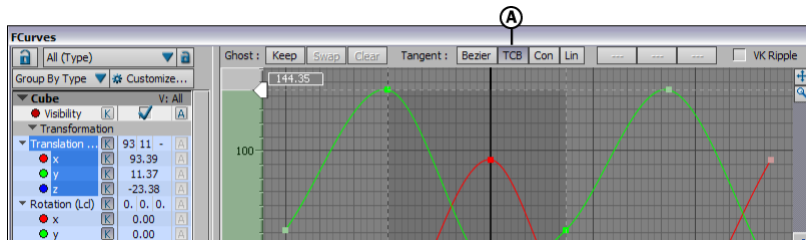


Key Controls A. TCB is selected in the Type menu

- 2 Set keyframes (see [Setting keyframes](#) on page 639). The keyframes you set have TCB interpolation until you select a different type of interpolation.

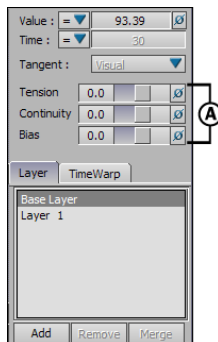
To change the interpolation of a keyframe to TCB:

- 1 In the FCurves window, select the keyframe or keyframes whose interpolation you want to change.
- 2 In the Tangent options, select TCB to set the interpolation type.



FCurves window A. TCB is the selected interpolation type for the keyframe selection.

- 3 Edit the TCB interpolation by changing the value of the settings in the Tangent area. These settings let you change the tension, continuity, and bias of tangents. See [Tangent area](#) on page 775 for more information.



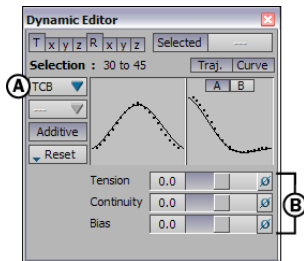
FCurves window A. Use the settings in the Tangent area

- [TCB interpolation](#) on page 704

Editing TCB interpolation

To edit TCB interpolation:

- 1 Move the Timeline indicator to the animation you want to edit or select a range of keyframes.
- 2 In the Dynamic Editor, select TCB in the Interpolation Mode menu. The selected animation has TCB interpolation, and the TCB settings display in the settings area.



Dynamic Editor A. Select TCB in the Interpolation Mode menu. B. TCB interpolation settings

- 3 Change the values of the Tension, Continuity, and Bias settings to edit the interpolation.
See [TCB interpolation](#) on page 704 for more information.

Constant interpolation

The Constant interpolation maintains the same keyframe value between keyframes. There is no slope between keyframes. For example, the curve in has four keyframes with a Constant interpolation method.

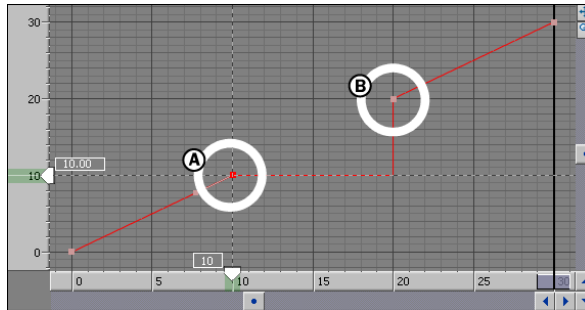
When you click the Constant option in the FCurves window, the Standard and Next options appear .



Tangent options A. Constant option is active. B. Standard option C. Next option

Standard

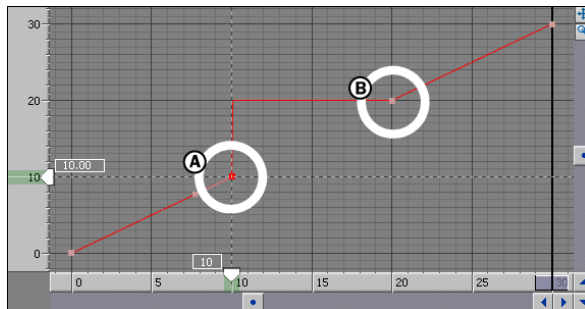
When the Standard option is active, the constant interpolation maintains the selected keyframe's value until the next keyframe .



Standard constant interpolation A. Selected keyframe B. Next keyframe

Next

When the Next option is active, the constant interpolation maintains the next keyframe's value until the next keyframe .



Next constant interpolation A. Selected keyframe. B. Next keyframe

NOTE

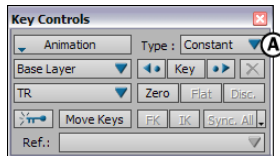
The Constant Next interpolation is useful for marking the end of a referential when using the Multi-Referential constraint.

Creating Constant interpolation

You can set new keyframes with Constant interpolation or change existing keyframes to use Constant interpolation.

To set keyframes with Constant interpolation:

- 1 In the Key Controls window, select Constant from the Type menu.

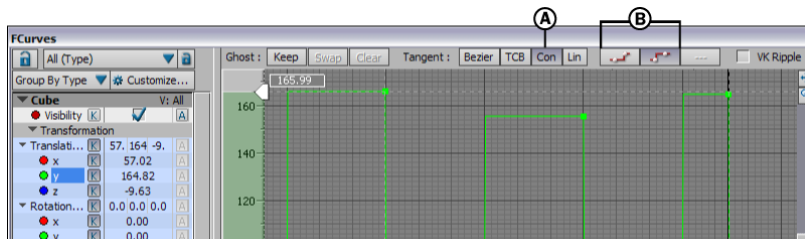


Key Controls A. Constant is selected in the Type menu

- 2 Set keyframes (see [Setting keyframes](#) on page 639). The keyframes you set have Constant Standard interpolation until you select a different type of interpolation.

To change the interpolation of a keyframe to Constant:

- 1 In the FCurves window, select the keyframe or keyframes whose interpolation you want to change.
- 2 In the Tangent options, select Constant to set the interpolation type.



FCurves window A. Constant is the selected interpolation type for the keyframe selection. B. Select either Standard or Next.

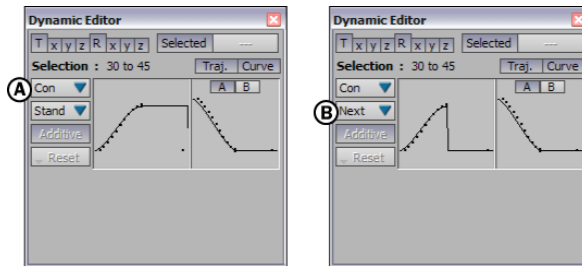
- 3 Select Standard mode or Next mode, which determine whether the interpolation maintains the value of the current or next keyframe. See [Constant interpolation](#) on page 706 for more information.

■ [Constant interpolation](#) on page 706

Editing Constant interpolation

To edit Constant interpolation:

- 1 Move the Timeline indicator to the animation you want to edit or select a range of keyframes.
- 2 In the Dynamic Editor, select Constant in the Interpolation Mode menu. The selected animation has Constant interpolation.



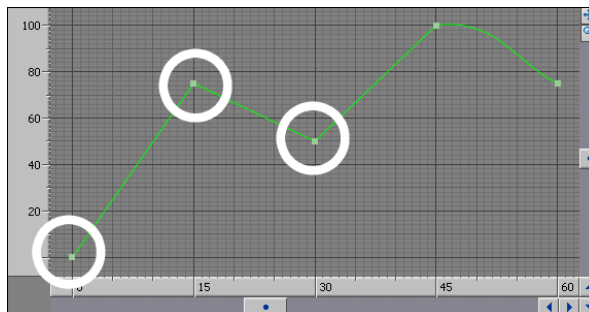
Dynamic Editor A. Select Constant in the Interpolation Mode menu. B. Select Standard or Next in the Interpolation Options menu.

- 3 In the Interpolation Options menu, select either Standard or Next. Constant Standard is the default.

See [Constant interpolation](#) on page 706 for more information.

Linear interpolation

Linear interpolation joins a selected keyframe and the next keyframe with a straight line. The slope between keyframes is constant. For example, the curve in has three keyframes with Linear interpolation.



Three keyframes with linear interpolation.

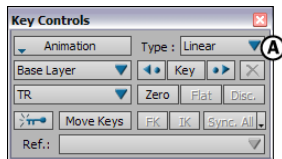
- [Creating Linear interpolation](#) on page 710

Creating Linear interpolation

You can set keyframes with Linear interpolation or change a keyframe's interpolation after the keyframe is already set.

To set keyframes with Constant interpolation:

- 1 In the Key Controls window, select Linear from the Type menu.

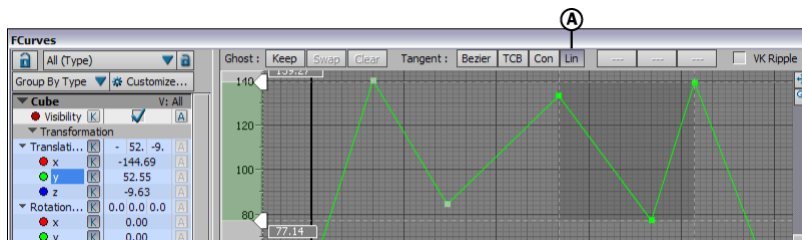


Key Controls A. Linear is selected in the Type menu

- 2 Set keyframes (see [Setting keyframes](#) on page 639). The keyframes you set have Linear interpolation until you select a different type of interpolation.

To change the interpolation of a keyframe to Linear:

- 1 In the FCurves window, select the keyframe or keyframes whose interpolation you want to change.
- 2 In the Tangent options, select Linear to set the interpolation type.



FCurves window A. Linear is the selected interpolation type for the keyframe selection.

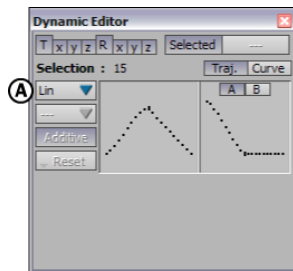
See [Editing Linear interpolation](#) on page 711 for how to edit your interpolations.

Editing Linear interpolation

To edit Linear interpolation:

- 1 Move the Timeline indicator to the animation you want to edit or select a range of keyframes.
- 2 In the Dynamic Editor, select Linear in the Interpolation Mode menu.

The selected animation has Linear interpolation. See [Linear interpolation](#) on page 709 for more information.



Dynamic Editor A. Select Linear in the Interpolation Mode menu.

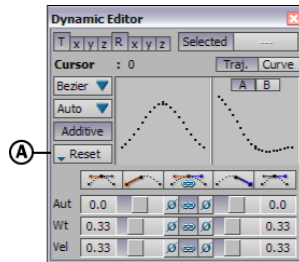
Resetting interpolation

When editing Bezier and TCB interpolation with the Dynamic Editor, you can return settings to their default values using the Reset menu.

To reset Bezier interpolation:

- 1 Move the Timeline indicator to the animation you want to reset.
- 2 In the Dynamic Editor, click Reset to open the menu and select from the following:
 - To reset values in the Auto settings to zero, select Reset Angular Parameters.
 - To reset values in the Weight settings to 0.33, select Reset Weight Parameters.
 - To reset the Velocity settings to 0.33, select Reset Velocity Parameters.

- To reset all values in the Auto settings to zero, and reset the Weight and Velocity settings to 0.33, select Reset All Parameters.



Dynamic Editor A. Reset menu

To reset TCB interpolation:

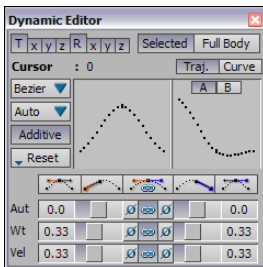
- 1 Move the Timeline indicator to the animation you want to reset.
- 2 In the Dynamic Editor, open the Reset menu and select Reset All.
The Tension, Continuity, and Bias settings are all reset to 0.

- [Bezier interpolation](#) on page 698
- [TCB interpolation](#) on page 704
- [Dynamic Editor](#) on page 713

Dynamic Editor

49

The Dynamic Editor lets you modify the interpolation of multiple keyframes at the same time. You can modify the keyframes at the current time that are not selected, or modify selected keyframes.



Dynamic Editor

Open the Dynamic Editor by selecting Window > Dynamic Editor from the menu bar, or by selecting Animation > Dynamic Editor in the Key Controls. You can also click the Dynamic Editor button in the FCurves window.

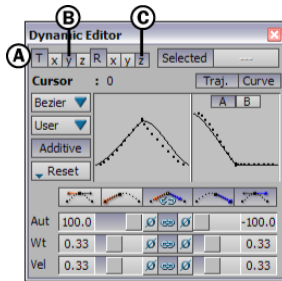
Translation (T) and Rotation (R) options

The Translation (T) and Rotation (R) options let you modify translation or rotation keyframe animation specifically.

When both options are active, you can modify all keyframes for translation and rotation at the current time. When only one of the options is active, you can modify the keyframes of either translation or rotation at the current time, without modifying the other keyframes.

You can also modify the keyframe animation of a specific axis for translation and rotation. For example, shows a situation in which only the keyframe

animation for Translation along the Y axis and Rotation along the Z axis is modified. The other translation and rotation animation is not modified.



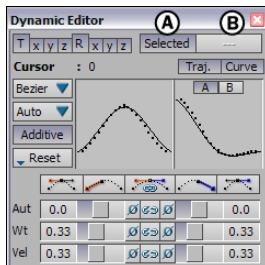
Dynamic Editor A.
Translation and Rotation
options **B.** Keyframe
animation for translation
along the Y axis is
modified. **C.** Keyframe
animation for rotation along
the Z axis is also modified.

The Translation and Rotation options are disabled when keyframes are selected in the FCurves or Dopesheet windows. See [Status indicator](#) on page 716 for more information.

Character Keying Mode options

The Character Keying Mode options let you modify the keyframe animation of selected effectors, all effectors, or effectors in a body part.

When there is no selected effector, only the Selected option is active, indicating that you can modify the keyframe animation of other types of selected objects.

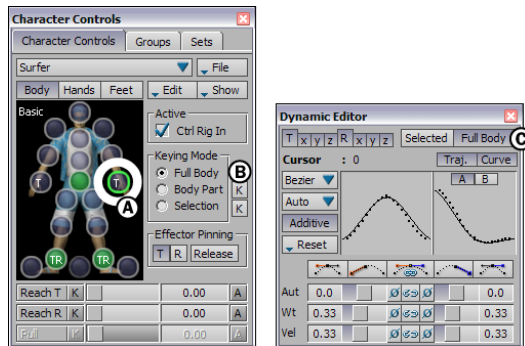


Character Keying Mode
options **A.** Selected option
is active **B.** The other
Character Key Mode option

is disabled when no effector is selected.

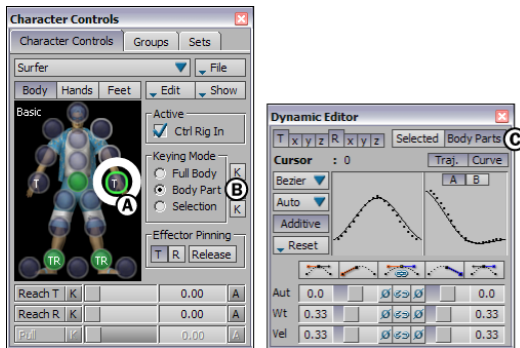
When an effector is selected, you can click the Selected option to modify only the keyframe animation of the selected effector. You can also select either Full Body or Body Parts from the other option when an effector is selected. When there is no selected effector, the second option is not available.

When Full Body is selected in the Character Controls window, the Full Body option is active in the Dynamic Editor. When this option is active, the keyframes on all effectors are modified, even when only one effector is selected. You can also toggle back and forth between the Selected option and the Full Body option when modifying animation.



Character Controls window A. Selected left wrist effector B. Full Body mode C. Full Body option can be selected.

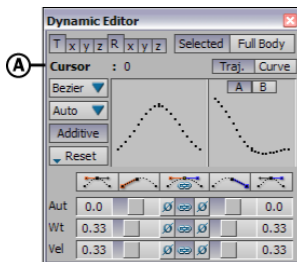
When Body Parts is selected in the Character Controls window, the Body Parts option is active in the Dynamic Editor. When this option is active, the keyframes on all effectors that belong to the body part of the selected effector are modified. You can also toggle back and forth between the Selected option and the Body Parts option when modifying animation.



Character Controls window A. Selected left wrist effector B. Body Parts mode is selected. C. Body Parts option can be selected.

Status indicator

The text in the top left corner of the Dynamic Editor indicates which part of the animation is affected by the changes you make.

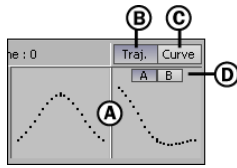


Dynamic Editor A. Text indicating the keyframe or keyframes that can be modified.

Animation representation area

The animation representation area displays the changes you make to animation. The area on the left represents the peak of the trajectory or curve of the animation. The area on the right represents the slopes of the trajectory or curve of the animation. See [A and B options](#) on page 719 for more information.

You can also choose to have representations of the animation display as trajectories, curves, or both.



Animation representation area A.
Animation representations B.
Trajectory option C.
Curve option D. A and B options

Since you can manipulate many different trajectories and curves at once with the Dynamic Editor, the trajectories and curves that display in the window represent the changes you make, not the actual trajectories and curves you are modifying.

To see the changes you make to the trajectory of your animation, look in the Viewer window. To see the exact changes you make to the curves of your animation, look in the FCurves window.

Trajectory (Traj.) option

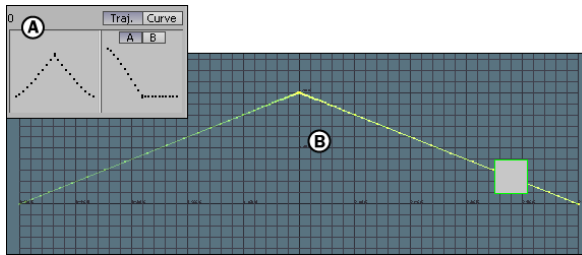
The Trajectory option lets you show or hide the trajectories, which display as dotted lines in the animation representation.



Animation displays as trajectories.

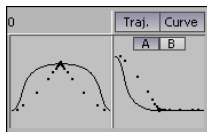
A trajectory is a path of animation through space. For example, in the previous figure, the cube's trajectory in the Viewer window is similar to the trajectory representation in the Dynamic Editor.

The dots represent motion through time, and display close together or far apart depending on the velocity of the animation.



Animation A. Trajectory representation B. The actual trajectory is similar.

The Trajectory option can be active at the same time as the Curve option, so you superimpose curve and trajectory representations.



Trajectories (dotted lines) and curves (solid lines) display together in the animation representation area.

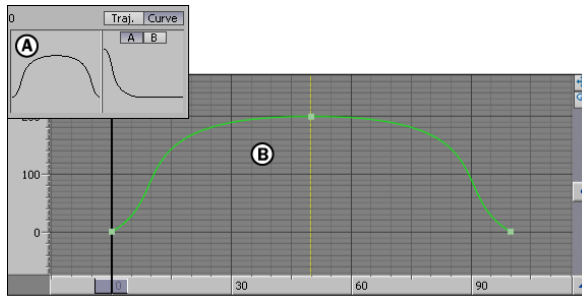
Curve option

The Curve option lets you show or hide the animation curves, which display as solid lines in the animation representation.



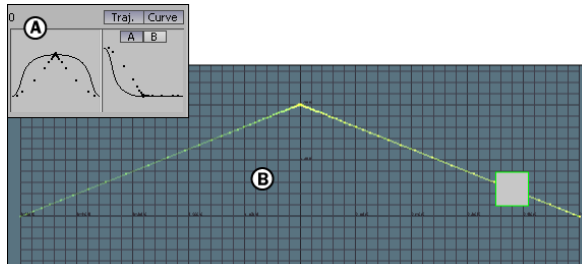
Animation displays as curves.

A curve represents animation through time, similar to what you would see in the FCurves window.



Animation A. Curve representation B. The actual function curve of the animation.

The trajectory of the animation as seen in the Viewer window can be different than its curve.



Animation A. Curve and trajectory representation B. Actual trajectory in the Viewer window

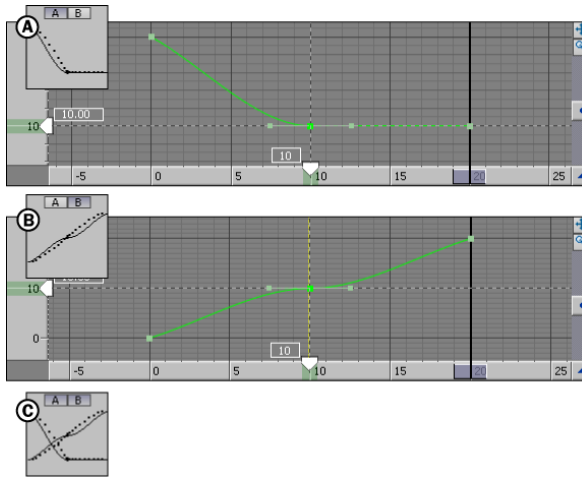
The Curve option can be active at the same time as the Trajectory option, so you can superimpose trajectory and curve representations. See [Trajectory \(Traj.\) option](#) on page 717 for more information.

A and B options

The A and B options let you show or hide different representations of trajectories and curves.

The A option lets you show or hide the representation of a function curve that descends and then plateaus.

The B option lets you show or hide the representation of a function curve with an incremental slope that can have a pause in the middle. Both options can be active at the same time to display both representations.



Animation representation A. The A representation. B. The B representation C. The A and B representations can be superimposed.

- [Function curves](#) on page 737
- [The Dynamic Editor asterisk](#) on page 734
- Status indicator

Interpolation Mode menu

The Interpolation Mode menu lets you select between Bezier, TCB, Constant, and Linear interpolation modes. The interpolation mode you select in this menu determines which settings display in the Interpolation settings area. See [Interpolation settings area](#) on page 721.

Additive option

The Additive option lets you change the values of keyframes starting from the values they already have. Additive works for Bezier and TCB interpolation modes, and is active by default.

Reset menu

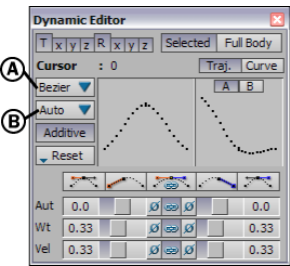
The Reset menu lets you reset Bezier and TCB interpolation settings. The options in the menu depend on which interpolation mode is selected. There are no reset options for Linear and Constant interpolation.

When you select Bezier interpolation, the Reset menu lets you reset the Angular, Weight, and Velocity values. When you select TCB interpolation, you can reset all TCB settings at once.

See [Resetting interpolation](#) on page 711 and for more information.

Interpolation settings area

The options in the Interpolation settings area change depending on which type of interpolation you select in the Interpolation Mode menu.

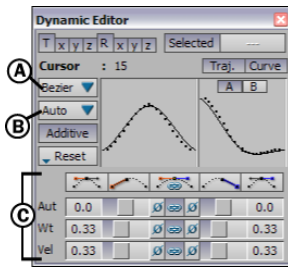


Dynamic Editor A.
Interpolation Mode menu B.
Interpolation Options menu

See [Types of interpolation](#) on page 698 for information on each type of interpolation.

Bezier interpolation settings

When you select Bezier from the Interpolation Mode menu, options and settings that let you manipulate Bezier curves display in the Dynamic Editor.



Dynamic Editor A. Bezier is the selected interpolation mode. B. Auto and User options display in the Interpolation Options menu. C. Bezier settings display in the settings area.

The Bezier settings in the Dynamic Editor consist of the following:

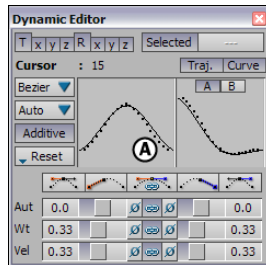
- [Auto and User options](#) on page 722
- [Break](#) on page 723
- [Flat Left and Flat Right](#) on page 723
- [Discontinuity Left and Right](#) on page 723
- [Auto settings](#) on page 724
- [Weight settings](#) on page 726
- [Velocity settings](#) on page 727
- [Reset Left and Right](#) on page 729
- [Link](#) on page 730

Auto and User options

When Bezier is selected in the Interpolation Mode menu, the Interpolation Options menu lets you select Auto or User mode. These options are the same as the options available when Bezier is selected as the interpolation mode in the FCurves window. See [Bezier option](#) on page 768 for information.

Break

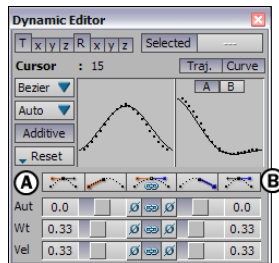
The Break option splits the tangent and lets you manipulate the left and right tangents separately. The Additive option should be active when you use the Break option.



Dynamic Editor A. Break button is disabled.

Flat Left and Flat Right

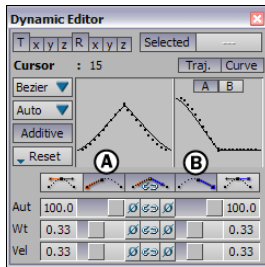
The two Flat buttons (A and B) let you flatten the left and right tangents of current keyframes. The Flat button on the left affects the left tangent, and the Flat button on the right affects the right tangent.



Dynamic Editor A. Flat Left button B. Flat Right button

Discontinuity Left and Right

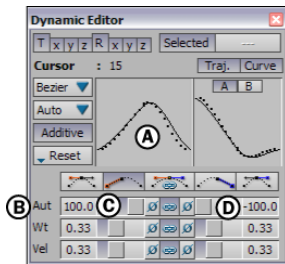
Clicking the left or right Discontinuity button causes the left or right tangent to point to the previous or next keyframe. Clicking the Discontinuity button on the left causes the left tangent to point to the previous keyframe. Similarly, clicking the Discontinuity button on the right causes the right tangent to point to the next keyframe.



Dynamic Editor A.
Discontinuity Right button
B. Discontinuity Left button

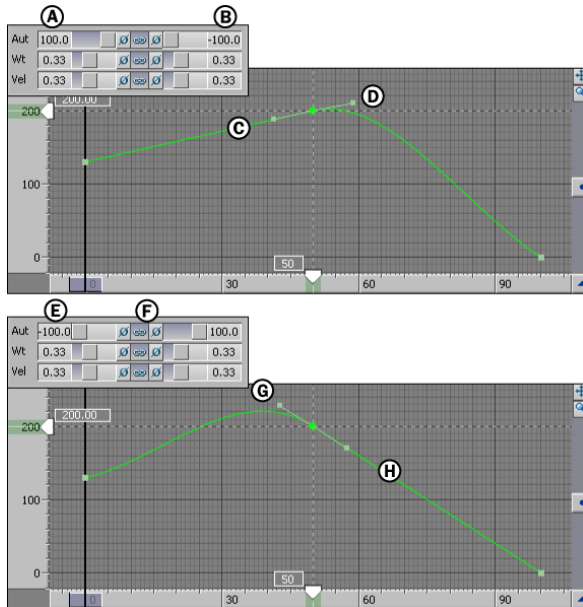
Auto settings

The Auto settings let you change the value of tangents to the left and right of editable keyframes.



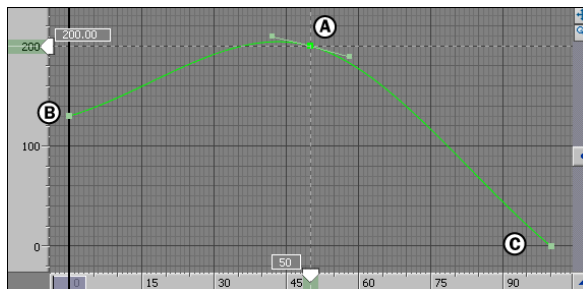
Changing tangent angles A.
Animation representation
shows an angle change. B.
Auto settings C. Field and
slider that affect the left
tangent D. Field and slider
that affect the right tangent

The Auto settings include two fields and sliders (A and B) which let you change the value of the left and right tangents of editable keyframes. The field on the left side affects the left tangent, and the field on the right side affects the right tangent.



Editing tangent angles using Auto settings **A**. The left Auto field is set to 100. **B**. The right Auto field is set to -100. **C**. The left tangent points to the previous keyframe. **D**. The right tangent points away from the previous keyframe. **E**. The left Auto field is set to -100. **F**. The right Auto field is set to 100. **G**. The left tangent points away from the next keyframe. **H**. The right tangent points to the next keyframe.

When you use the Auto settings, the tangents of editable keyframes are automatically calculated based on the values of neighboring keyframes.



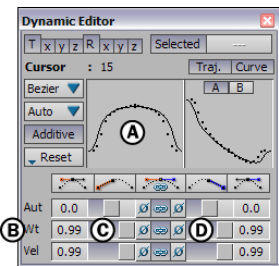
Keyframe with Bezier-Auto interpolation **A**. The tangents for the selected keyframe are the average between the previous and next keyframes. **B**. Previous keyframe **C**. Next keyframe

The values in the left and right Auto fields change the angle of tangents as described in the following table.

| | |
|------|--|
| 0 | At 0, the curve represents the average between the previous and next keyframes. |
| 100 | When the left Auto field is at 100, the left tangent points to the previous keyframe (A and C). When the right Auto field is at 100, the right tangent points to the next keyframe (F and H). |
| -100 | When the left Auto field is at -100, the left tangent points away from the next keyframe (E and G).When the right Auto field is at -100, the right tangent points away from the previous keyframe (B and D). |

Weight settings

The Weight settings let you create curves that you cannot create with unweighted tangents.



Changing weight A. The Animation representation shows the weighting change. B. Weight settings C. Field and slider that affect the left tangent. D. Field and slider that affect the right tangent.

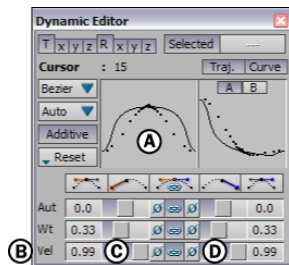
The Weight settings include two fields and sliders (C and D) which let you change the weight of the tangents for the current keyframe. The field and

slider on the left side affect the left tangent, and the field and slider on the right side affect the right tangent.

Velocity settings

The Velocity settings let you speed up or slow down animation on either side of a keyframe without changing the trajectory of the animation. Unlike Auto and Weight settings, Velocity changes the animation in time, but not in space.

In the Dynamic Editor, the trajectories in the animation representation area display velocity changes. The dots of the trajectory, which represent time, move closer together to show an acceleration and move further apart to show deceleration.



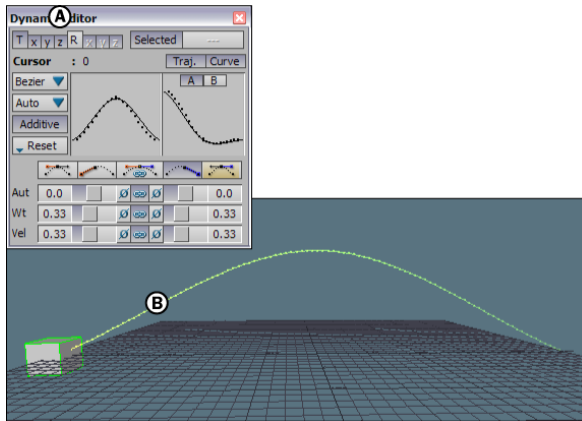
Changing velocity A.
Trajectory representation shows a velocity change. B.
Velocity settings C. Field and slider that affect the left tangent D. Slider and field that affect the right tangent

The Velocity settings include two fields and sliders (C and D) which let you change the animation speed to the left and right of editable keyframes. The field and slider on the left side affect the left tangent, and the field and slider on the right side affect the right tangent.

Velocity settings work when the speed of the animation changes without changing the trajectory of the animation. That is, the trajectory of the animation remains the same but its function curve is weighted.

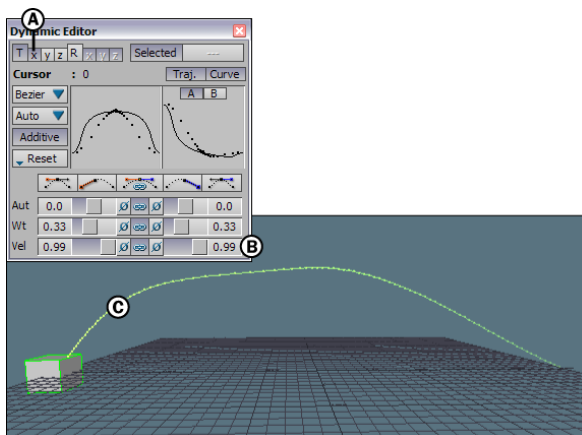
For the Velocity settings to work, you must edit the XYZ values of a property at the same time, or edit the X, Y, or Z values that change during the animation.

For example, in the following figure, keyframes are set for the X, Y, and Z values of a cube's Translation property. However, the cube moves only along the X-axis and Y-axis during the animation, and the Z value remains the same throughout. The cube's trajectory before any changes are made is an arc.



Animation before velocity changes. **A.** The XYZ values of the Translation property are selected. **B.** Though all three XYZ values are keyframed, the cube moves along the X-axis and Y-axis only, in an arced path.

In the following figure, using Velocity does not work, because only the X value is selected and modified. The cube's trajectory is changed as a result.

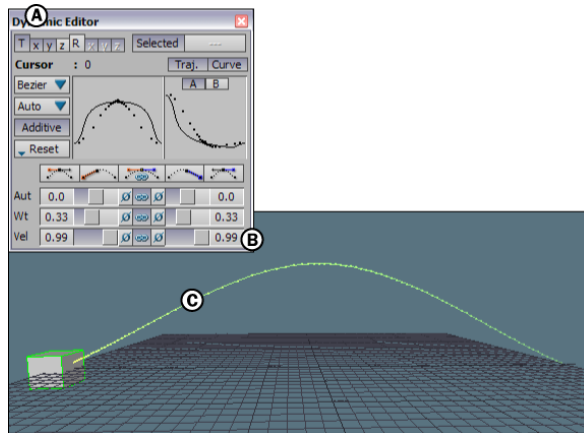


Situation in which using Velocity settings does not work. **A.** Only the X value of the Translation property is selected. **B.** Velocity settings are changed. **C.** The cube's trajectory is changed. This is an undesired result.

This is an undesired result, which also occurs if, for example, only the Y value is selected, or if the X value or Y value is selected as well as the Z value. Selecting only the Z value has no effect at all, because the value does not change during the animation.

For the Velocity settings to work in this situation, both the X value and the Y value must be selected. When the Velocity settings are changed, the cube's trajectory remains the same and the cube speeds up and slows down during the animation.

The Velocity settings would also work in this situation if all three XYZ values were selected. In some situations, selecting all XYZ values for selected keyframed properties can be simpler when using the Velocity settings.

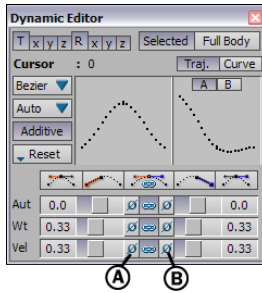


Situation in which using Velocity settings works. A. The X and Y values are selected. B. Velocity settings are changed. C. The cube's trajectory does not change, and the cube speeds up and slows down during the animation.

In addition, while you can easily use the Dynamic Editor and the FCurves window together, you may notice that the FCurves window does not have Velocity settings. In fact, when you use the Velocity settings, you change the angle and weight of tangents in such a way that the speed of the animation is modified without modifying its trajectory. The values of the Angle and Weight settings in the FCurves window reflect this when you use the Velocity settings in the Dynamic Editor.

Reset Left and Right

The Auto, Weight, and Velocity settings each include two reset buttons (A and B), which let you reset left and right parameters.



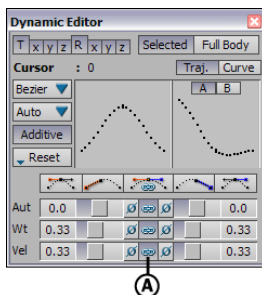
**Dynamic Editor A. Reset button for the left tangent.
B. Reset button for the right tangent.**

The Reset buttons in the Auto settings let you reset the angle of the left and right tangents to zero. The Reset buttons in the Weight settings let you reset the weight of the left and right tangents to 0.33. The Reset buttons in the Velocity setting let you reset the speed of the left and right tangents to 0.33. You can also reset all three parameters at the same time. See [Resetting interpolation](#) on page 711 for more information.

Link

The Auto, Weight, and Velocity settings each include a Link option. When the Link option is active for a particular, you can modify the angle, weight, or velocity of both left and right tangents at the same time, whether or not the tangents are broken or unbroken.

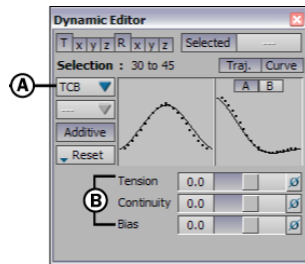
You can modify the angle of each tangent separately when the Link option is disabled and the Break option is active (see [Break](#) on page 723). When the Link option is active, you can modify the angle of each tangent separately if you drag a tangent handle in the FCurves window.



Dynamic Editor A. Link option

TCB interpolation settings

When you select TCB in the Interpolation Mode menu, Tension, Continuity, and Bias settings appear in the settings area. Each of the settings changes a different part of the tangent.

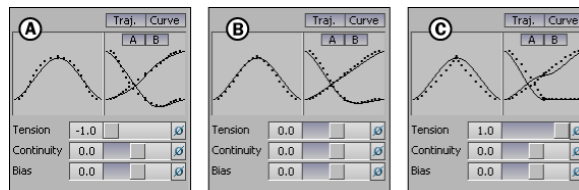


Dynamic Editor A. TCB is selected in the Interpolation Mode menu. B. TCB settings display in the settings area.

Each TCB setting consists of a value field, a slider, and a Reset button. The value field and slider let you edit the function curves of the animation. The Reset button sets the value of each setting to 0.

Tension

The Tension settings let you change the tautness of the function curve. For example, when Tension is set to a value of 1, the result is similar to a selected keyframe with Bezier interpolation with flat tangents.

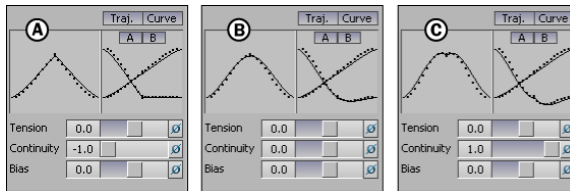


Changing tension A. Tension at -1. B. Tension at 0. C. Tension at 1.

Continuity

The Continuity settings let you create a break in the curve to change that trajectory and speed of the animation.

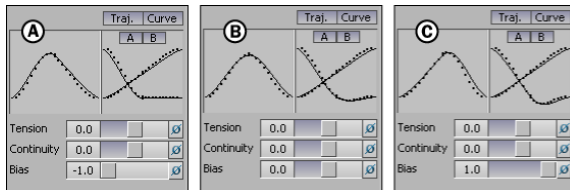
When Continuity is set to a value of -1, the result is similar to using both the Discontinuity Right and Discontinuity Left buttons for a selected keyframe with Bezier interpolation.



Changing continuity A. Continuity at -1. B. Continuity at 0. C. Continuity at 1.

Bias

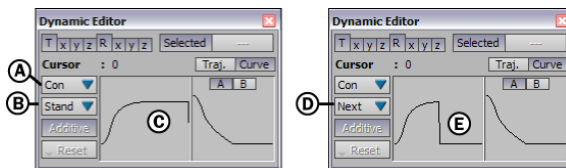
The Bias settings let you change the angle of the trajectories and curves in the animation, making them lean left or right. For example, when Bias is set to a value of -1, the result is similar to using the Discontinuity Right button on a selected keyframe with Bezier interpolation.



Changing bias A. Bias at -1. B. Bias at 0. C. Bias at 1.

Constant interpolation settings

Constant interpolation maintains the same keyframe value between keyframes. There is no slope between keyframes with Constant interpolation.



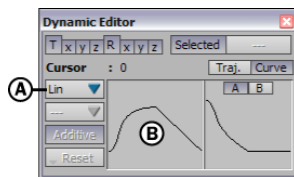
Constant interpolation A. Constant is the selected interpolation mode. B. Standard is the selected interpolation option. C. Constant Standard interpolation.

D. Next is the selected interpolation option. E. Constant Next interpolation.

When Constant (Con) is selected in the Interpolation Mode menu, the Interpolation Options menu lets you select Standard (Stand) or Next. These options are the same as those available when Constant (Con) is selected as the interpolation mode in the FCurves window. See [Standard option](#) on page 769 and [Next option](#) on page 770 for information.

Linear interpolation settings

When Linear (Lin) is selected in the Interpolation Mode menu, there are no additional settings in the Dynamic Editor. For more information on this type of interpolation, see [Linear interpolation](#) on page 709.



Dynamic Editor A. Linear is the selected interpolation mode. B. Linear interpolation

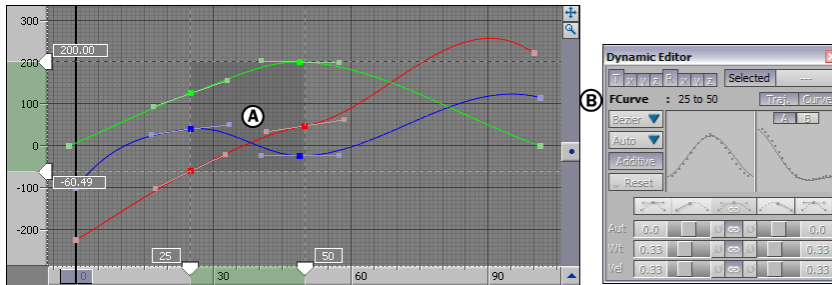
What the Dynamic Editor modifies

The Dynamic Editor lets you modify keyframes at the current time without selecting them, but you can also use it to modify selected keyframes or selected keyframe regions. When no other keyframes are selected, keyframes at the current time are editable.

When you select keyframes in the Transport Controls window, or when no keyframes are selected, the Keying Mode menu of the Key Controls window determines which properties are affected. For example, if the TRS keying mode is selected, animation on translation, rotation, and scaling properties is modified.

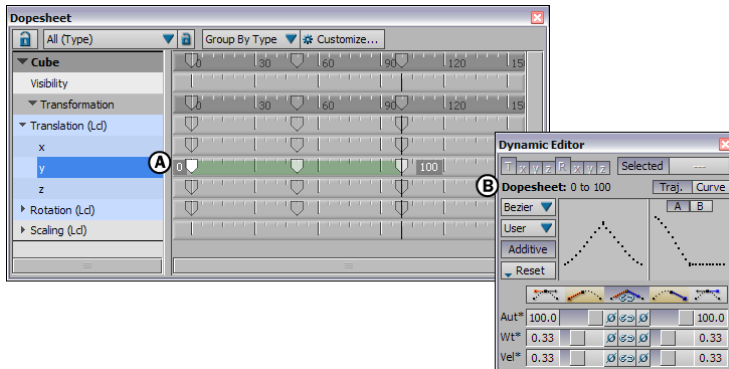
The Dynamic Editor also has options that let you make exceptions to which keyframes are modified. See [Character Keying Mode options](#) on page 714, and [Translation \(T\) and Rotation \(R\) options](#) on page 713 for more information.

If you select one or more keyframes in the FCurves window, the Dynamic Editor indicates this and only the selected keyframes are modified.



Editing keyframes A. Six keyframes are selected in the FCurves window. **B.** The Dynamic Editor indicates that only the keyframes selected in the FCurves window are modified.

The Dynamic Editor also indicates that keyframes are selected in the Dopesheet window and only the selected keyframes are modified.

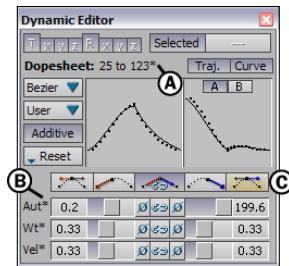


Editing keyframes A. Three keyframes are selected in the Dopesheet window. **B.** The Dynamic Editor indicates that only the keyframes selected in the Dopesheet window are modified.

The Dynamic Editor asterisk

In the Dynamic Editor, an asterisk (*) beside a frame number indicates that the editable keyframe does not snap to a frame.

An asterisk beside one of the Bezier or TCB interpolation settings indicates that at least one of the editable keyframes does not have the same values as the other editable keyframes.



Status A. An asterisk following a frame number. B. An asterisk following a setting name. C. A button that displays yellow.

Flat, Discontinuity, or Break buttons that are yellow also indicate that at least one of the editable keyframes has different values than the others.

For example, in the previous figure, C, the yellow Flat Right button indicates that at least one of the keyframes selected in the FCurves window does not have a flat tangent on the right. Clicking the Flat Right button in this situation flattens the tangent or tangents with a different angle, and the Flat Right button displays dark blue.

Function curves

50

Function curves (FCurves) are a graphical representation of the interpolation between keyframes, showing the value of an animated property over time.

The FCurves window lets you work with function curves to create and modify animation. You can use this window to alter the shape of function curves using tangent handles, change the timing of the animation, filter captured data, and work on multiple layers of animation until you are satisfied with your final result.

- [Interpolation](#) on page 697
- [FCurves window](#) on page 763
- [Tangents](#) on page 746
- [Layers](#) on page 750

Creating function curves

To create function curves in the FCurves window:

- 1 Select an object, such as a model.
- 2 Make sure the properties you want to animate are selected. For example, you can select Translation.
- 3 Select the time at which you want to set a keyframe.
- 4 Set a keyframe.
- 5 Move the timeline indicator, change the selected properties, and set a second keyframe.

Interpolation is automatically created between the two keyframes. This interpolation is represented graphically as function curves in the FCurves window.

- 6 In the FCurves window, select the properties you animated, then click in the FCurves pane and press A to center the function curves.

■ [FCurves window](#) on page 763

Viewing function curves

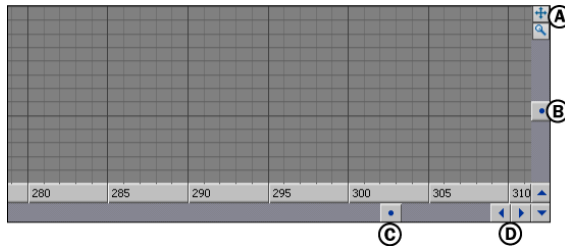
To view function curves in the FCurves window:

- 1 Select an animated object.
- 2 In the FCurves window's Property list, select a property or multiple properties.
Function curves display in the FCurves pane. If they display as flat, uninterrupted lines, the properties you selected are not animated.
If they do not display at all, the function curves may not be centered in the FCurves pane.
- 3 Click in the FCurves pane and press A to center all function curves of selected properties.

■ [FCurves window](#) on page 763

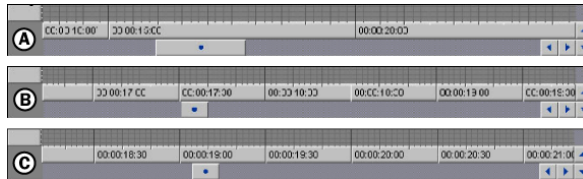
Navigating in the FCurves pane

The scroll bars, arrows, and buttons in the FCurve pane let you change the view in the FCurve pane. You can also change your view using keyboard shortcuts.



FCurve pane A. Pan and Zoom buttons B. Side scroll bar
C. Bottom scroll bar D. Scroll arrows

Where you Ctrl-click is the reference point for scaling your view of the curve. The view scales around this reference point. Dragging from left to right scales the view horizontally, while dragging up and down scales the view vertically.



FCurve timeline A. Original timeline B. Scaled timeline C. Scrolled timeline

Use the following methods to scroll and zoom in the FCurve pane:

| | |
|------------------------|--|
| Changing Direction | Click any of the scroll arrows to move in the direction specified by the arrow. |
| Scrolling Horizontally | Shift-click within the FCurve pane, drag left or right, or drag the Bottom scroll bar left or right. |
| Scrolling Vertically | Shift-click within the FCurve pane, drag up or down, or drag the Side scroll bar up or down. |
| Zooming In and Out | In the FCurve pane, Ctrl-drag left or down to zoom out and Ctrl-drag right or up to zoom in. |

Zooming on Specific Regions

Z-click and drag around the area. Zooming in shows larger increments in the FCurve timeline; zooming out shows smaller increments. Only the size of the time increments on the timeline change, the length or scale of the function curve remains the same.

Pan and Zoom buttons

Click and drag either the Pan or Zoom buttons to pan or zoom respectively.

Editing function curves

Manipulating function curves lets you change not only the time and value of keyframes but also the interpolation between keyframes.

- 1 In the FCurves Property pane, select the animated property whose function curves you want to edit. A function curve displays for each property.
For example, if you select Translation, there is a function curve for Translation *x*, Translation *y*, and Translation *z* properties.
- 2 To see the keyframes function curves clearly, click in the FCurves pane and press A to frame the function curves, if necessary. See [Changing the color of function curves](#) on page 745.
- 3 Select one of the keyframes, which display as small square dots along the function curves.
To select a keyframe on a function curve, click or drag around it. To select a keyframe region, Ctrl-click each keyframe or drag around them.
- 4 Drag the selected keyframe left or right to change its time. You can also enter a frame number in the Time field. Changing the time of a keyframe means that its value occurs sooner or later than when the keyframe was originally set.

TIP When you drag the keyframe in the FCurves pane, dotted lines indicate the previous location of the keyframe.

- 5 Drag the selected keyframe up or down to change its value. You can also enter a value in the Value field. Changing the value of a keyframe is like

changing a property setting. For example, changing the value of a keyframe set for the Translation *y* property of a cube moves the cube up and down in the scene. See [Scaling keys in the FCurve window](#) on page 741.

- 6 When the keyframe uses Bezier interpolation, you can drag its tangents to change the function curve without moving the keyframe. See [Editing Bezier interpolation](#) on page 702 for more information.

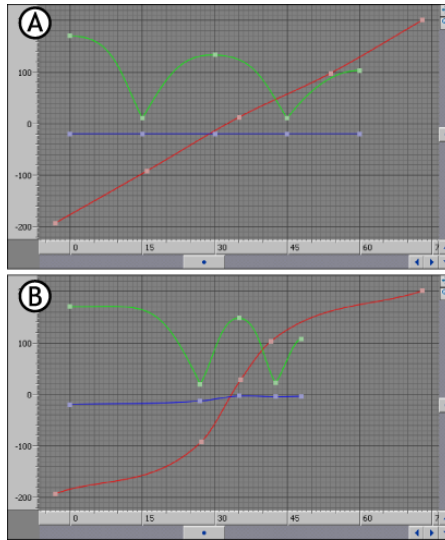
- [Interpolation](#) on page 697
- [Changing the color of function curves](#) on page 745

Scaling keys in the FCurve window

You can scale a group of keys using the selected keyframes as the pivot point of scaling within the FCurve window.

To do this, drag-select a group of keys in the FCurve window and Ctrl-middle-drag them. Dragging the keys inward or outward stretches and scales the keyframes, and affects their relationship with each other. This is useful if you need to tweak or re-purpose existing animation.

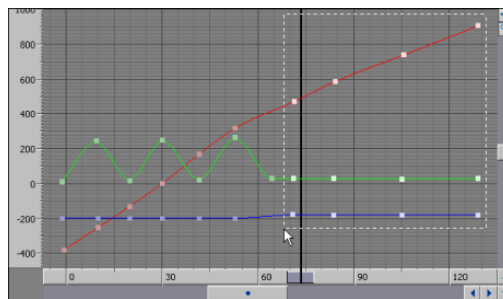
For example, the following illustration shows the FCurve of an animation curve and how you can use FCurve scaling to tighten the selected keyframes.



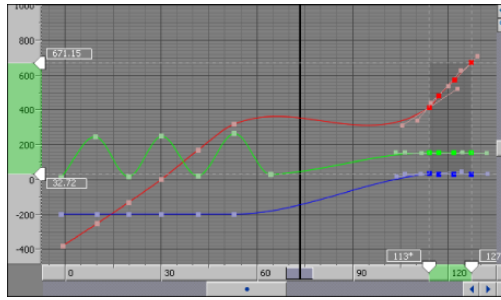
A. Original bouncing ball curve B. Curve scaled to create tighter bounce.

To scale selected keys in the FCurves window:

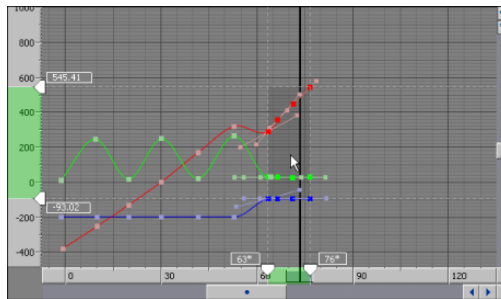
- 1 Drag across a group of keyframes on a curve to select them. In this example, the keys that are on the flat end of all curves are selected.



- 2 Ctrl-Middle-drag them inward to shrink or outward to expand the selected keys on the curve. In the illustration below, the keys are shrunk together on the curve.



- 3 Release Ctrl and drag the selected area closer to the active part of the animation, where the green T-axis curve is wavy.



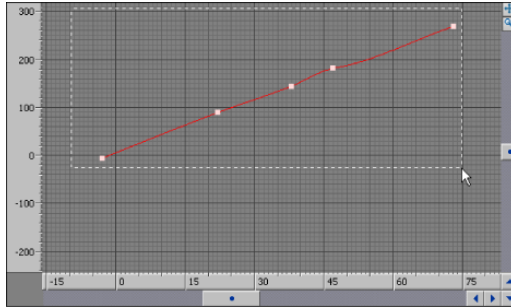
This scales the selected area.

Negative FCurve scaling

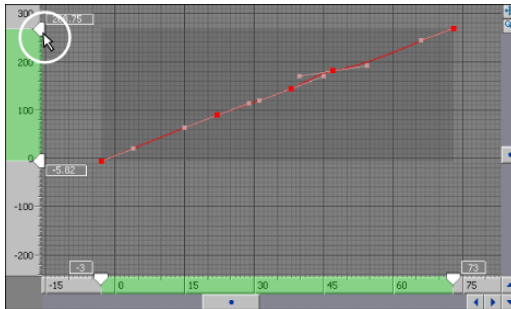
You can drag an FCurve manually to scale a group of keyframes negatively and view the result in the Viewer window. This is useful if you want to mirror or invert certain types of animation.

To negatively scale an FCurve:

- 1 Drag-select a group of keyframes on a FCurve. This illustration show keys on the x-translation curve.

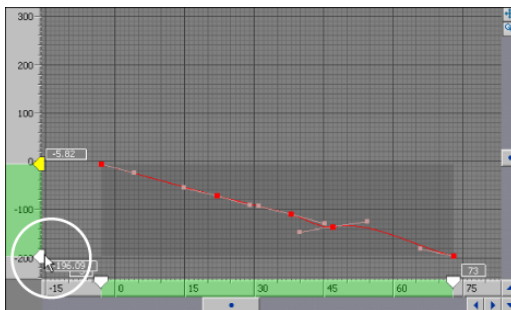


- 2 Select the top white arrow.



- 3 Drag the top white arrow so that it is below the bottom white arrow. This inverts the direction travelled along the x-axis.

NOTE You can also Ctrl-middle-drag to scale about a point, similar to the Autodesk Maya F-Curve editor.

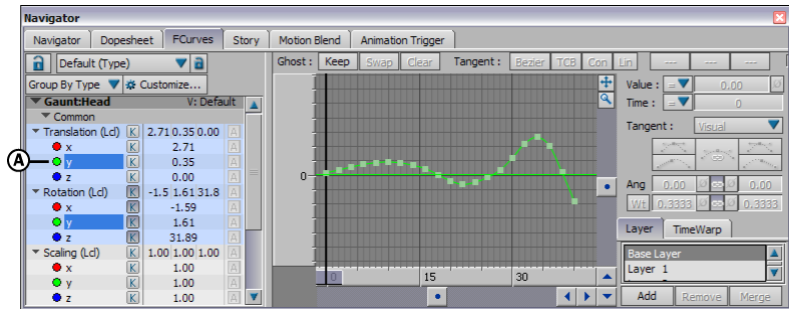


Changing the color of function curves

Using different colors can make it easier to distinguish between different properties. For example, the Y values of translation, rotation, and scaling curves display in the same color by default. Changing the color of the Y translation curve differentiates it from the Y rotation and scaling curves.

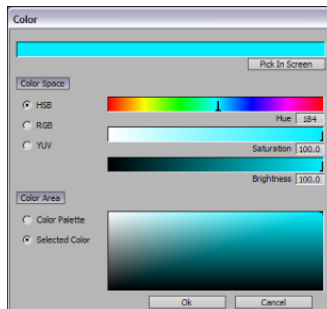
To change a function curve's color:

- 1 In the FCurve Properties pane, double-click the Color indicator next to the property whose function curve color you want to change.



FCurves window A. Color indicator

- 2 In the Color window that opens, define a new color for the function curve of the selected property and click Ok.



Color window

For more information see [Color window](#) on page 4.

The color of the function curve for the selected property is changed in the FCurves pane.

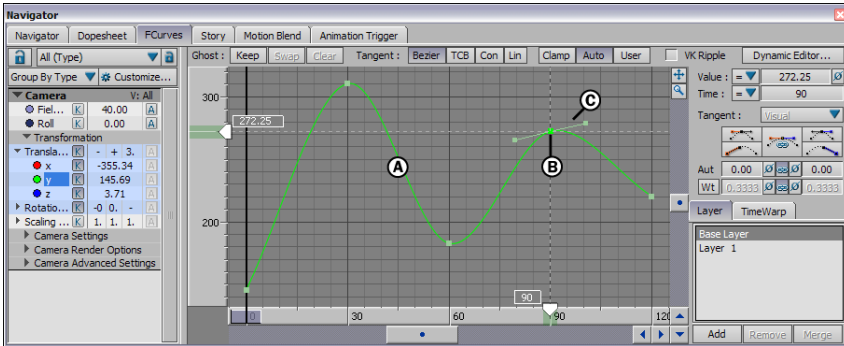
You can also right-click a property in the property tree and select one of the following contextual menu options:

| Option | Function |
|------------------------------------|--|
| Edit Curve Color | Opens the Color window to let you change a function curve's color. |
| Edit All Curve Colors of This Type | Opens the Color window to let you change all curves of the same type to the new color. |
| Reset Curve Color | Restores the selected curve's color to its default colors. |
| Reset All Curve Colors | Restores all curve colors to their default colors. |

■ [FCurve Properties pane](#) on page 764

Tangents

Function curves with Bezier interpolation have tangents that let you change the slope of the curve on either side of a keyframe. The angle and weight of tangents affect interpolation.



FCurves window A. Function curve with Bezier interpolation B. Keyframe C. Tangent

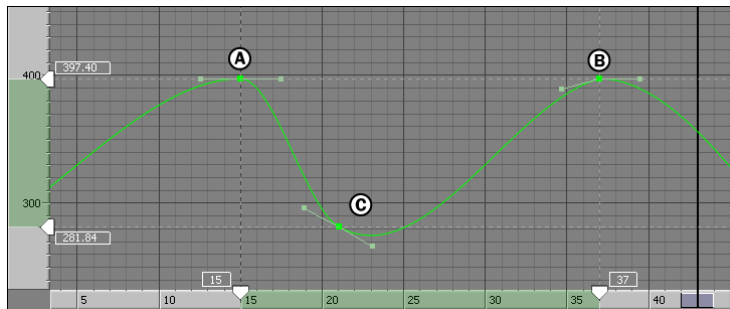
Once you have set keyframes with Bezier interpolation, you can edit their tangents by dragging them in the FCurves window, or by using settings in the Dynamic Editor and FCurves window.

Tangent behavior is the only difference between the three types of Bezier interpolation (Clamp, Auto, and User). See [Bezier interpolation](#) on page 698 for more information.

You can set keyframes with flat or discontinuous tangents. When you manipulate tangents, you can also weight, break, and link them. The rest of this topic discusses these concepts.

Flat tangents

Tangents with an angle of 0 are *flat*. In the FCurves window, flat tangents display as completely horizontal. Flat tangents keep the interpolation from overshooting or undershooting the keyframe.



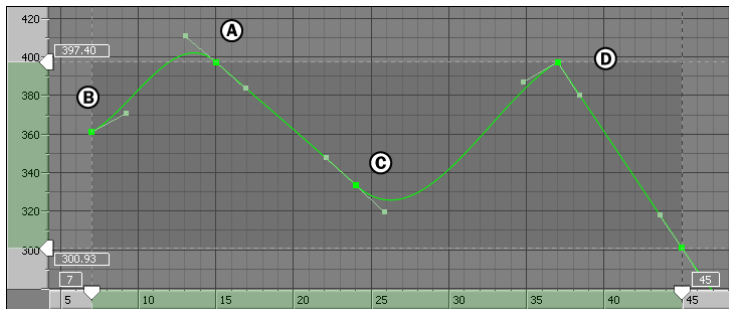
FCurves pane A. A keyframe with flat tangents. B. A keyframe with one flat tangent. C. A keyframe without flat tangents.

While you can always drag tangents so that they are horizontal, you can create flat tangents more quickly. You can set keyframes with flat tangents using the Flat button in the Key Controls window. You can choose to set keyframes using Bezier-Clamp interpolation, which flattens the tangents of keyframes when neighboring keyframes have nearly the same value. You can also select a keyframe, then click one of the Flat buttons in the FCurves window ([Flat buttons](#) on page 777) or the Dynamic Editor ([Flat Left and Flat Right](#) on page 723).

Discontinuous tangents

Discontinuous tangents point directly to the next or previous keyframe.

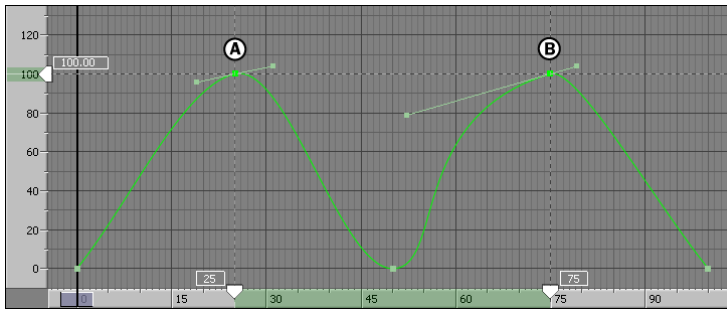
You can set a keyframe with discontinuous tangents by clicking the Discontinuity (Disc.) button in the Key Controls. You can also select a keyframe, then click one of the Discontinuity buttons in the FCurves window ([Discontinuity buttons](#) on page 778) or the Dynamic Editor ([Discontinuity Left and Right](#) on page 723).



FCurves pane A. A keyframe with discontinuous tangents. B. Previous keyframe C. Next keyframe D. A keyframe with broken discontinuous tangents.

Weighted tangents

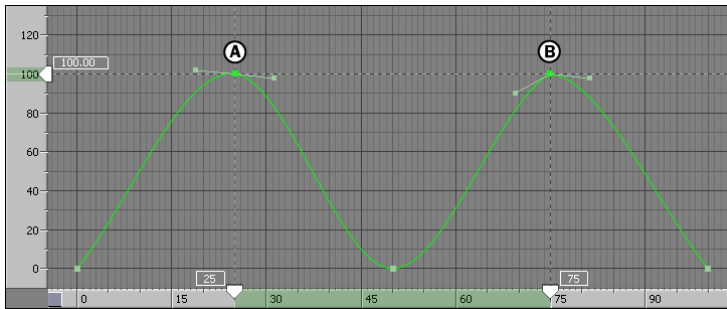
You can alter the arc of a curve by stretching or shortening tangents. This is called *weighting*. Weighting tangents lets you create curves that you cannot create by simply changing the angle of tangents. See [Weight settings](#) on page 726 for more information.



FCurves pane A. Normal tangents B. Weighted tangents

Broken tangents

Each keyframe has a left tangent and a right tangent. When tangents are not broken, the left and right tangents always form a straight line. When tangents are broken, you can manipulate them at different angles.



FCurves pane A. Unbroken tangents B. Broken tangents

Linked tangents

When tangents are linked, you can modify the angle of both left and right tangents at the same time, whether or not the tangents are broken or unbroken (see [Broken tangents](#) on page 749).

When tangents are broken, you can modify each linked tangent separately by dragging a tangent handle. To modify linked tangents together, use the tangent settings in the FCurve Options pane.

- Tangent area
- Tangent options

Layers

In MotionBuilder, a layer is a level of animation in a scene. You can have multiple layers in a scene and make changes to one layer without affecting the others. Layers are especially useful for adjusting motion capture data without altering the original data.

For example, you can add a layer for a cube's translation animation, creating a second level of animation on top of the Base Layer. The data on the Base Layer never changes because the animation is on a separate layer.

The animation on the two layers — the Base Layer animation and the additional layer of Translation animation — combine and apply to the cube in real time. When you are satisfied with your changes, you can merge your layers with the Base Layer.

- [Adding and renaming layers](#) on page 750
- [Base Layer](#) on page 672
- [Layer pane](#) on page 785
- [FCurves window](#) on page 763

Adding and renaming layers

You can add and select layers from the Key Controls or the FCurves window.

To add a new layer, do one of the following:

- In the FCurves window, select New in the Layer pane.
- In the Key Controls select (New Layer) in the Layer menu.

NOTE Only keyframes set on the selected layer display. To see keyframes on a timeline, make sure that the animated object is selected.

To rename layers:

- 1 In the Layer pane, select the layer you want to rename.
- 2 Right-click and select Rename from the contextual menu.
- 3 Type a new name and press Enter to confirm the change.

NOTE You can rename every layer but the Base Layer.

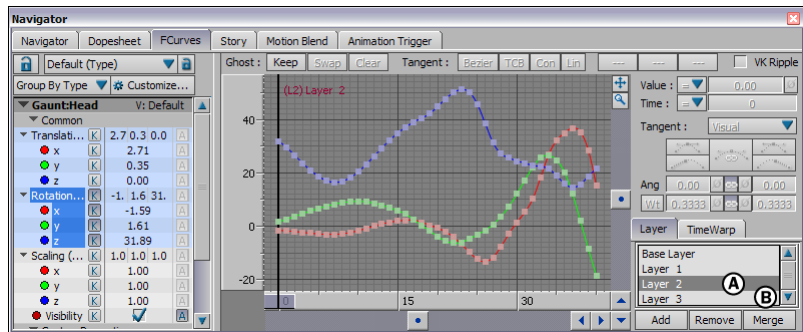
- [Layers](#) on page 750
- [Merging layers](#) on page 751
- [Layer pane](#) on page 785

Merging layers

When you are finished working with animation on multiple layers and you want to keep the final result in a single layer, you can merge all layers onto the Base Layer.

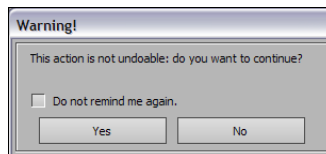
To merge a layer:

- 1 In the Layer pane of the FCurves window, select the Layer you want to merge and click Merge.



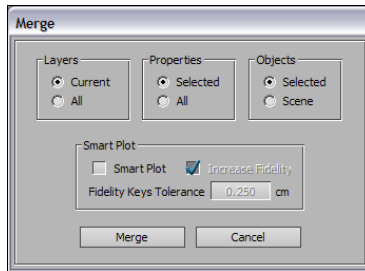
Merging layers in the FCurves window. A. Select a layer. B. Click Merge.

- 2 In the dialog box that appears warning that this action cannot be undone, click Yes.



Undo warning

- 3 In the Merge dialog box that appears, select the options you want to merge with the Base Layer. For information on these options, see [Merge dialog box](#) on page 754.



Merge dialog box

Depending on what you selected in the Merge dialog box, the animation from the selected layer is integrated on the Base Layer. All of the merged properties display with keyframes on the Base Layer.

After you have merged the layer, you can remove it from the scene. See [Deleting layers](#) on page 752.

- [Layers](#) on page 750
- [Base Layer](#) on page 672
- [Layer pane](#) on page 785

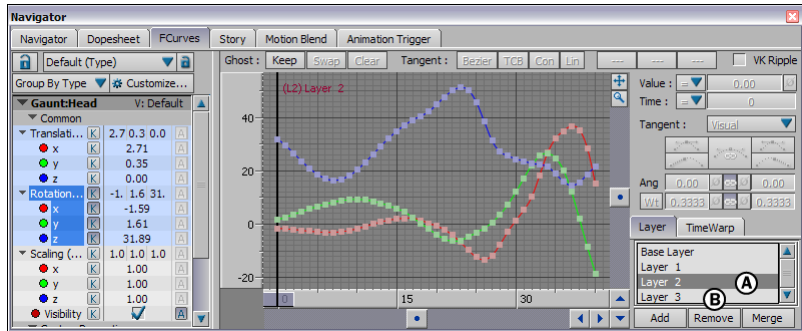
Deleting layers

If you do not want to keep the animation on a particular layer, or if you have merged the animation from a layer and no longer need it, you can delete it.

NOTE You can remove every layer but the Base Layer.

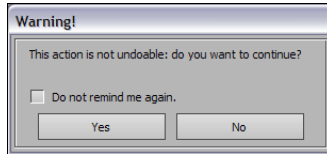
To delete a layer:

- 1 Select the layer you want to delete.
- 2 In the Layer pane of the FCurves window, click Remove.



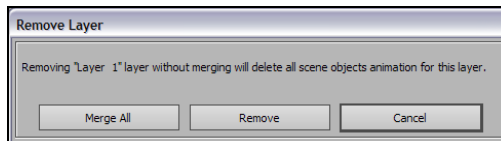
FCurves window A. Select a layer. B. Click Remove.

- 3 Click Ok in the dialog box that appears warning you that this action cannot be undone.



Undo warning

- 4 Click Remove in the Remove Layer dialog box.

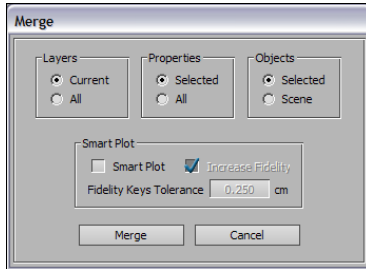


Remove Layer dialog box

- [Layers](#) on page 750
- [Layer pane](#) on page 785

Merge dialog box

This section describes the Merge dialog box that appears when you click Merge in the FCurve window Layers pane.



Merge dialog box

Layers area

Activate the Current option to merge the current layer with the Base Layer. Activate the All option to merge all layers with the Base Layer.

Properties area

Activate the Selected option to merge only selected properties with the Base Layer. Activate the All option to merge all properties with the Base Layer.

Objects area

Activate the Selected option to merge only the selected objects with the Base Layer. Activate the Scene option to merge all objects in the scene to the Base Layer.

Smart Plot area

The Smart Plot option lets you merge layers without adding keyframes. For example, when two function curves with three keyframes each are merged onto one layer using Smart Plot, the resulting function curve has no more than six keyframes. The options in this area are the same as the options in the Plot Properties window.

Merge button

Click to combine the selected layers, properties, and objects with the Base Layer.

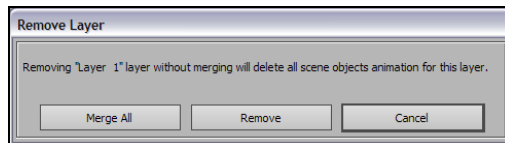
Cancel button

Click to stop the Merge operation.

- [Layers](#) on page 750
- [Merging layers](#) on page 751
- [Layer pane](#) on page 785

Remove Layer dialog box

The Remove Layer dialog box appears when you click Remove in the Layers pane of the FCurves window.



Remove Layer dialog box

This dialog box lets you choose from the following options:

Merge All

Merges everything from the currently selected layer with the Base Layer, then removes the layer.

Remove

Removes the current layer. If the layer has not been merged with the Base Layer, all animation from the current layer is deleted.

Cancel

Cancels the operation.

TIP The Remove and Merge All functions in the Remove Layer dialog box apply to all objects in the scene. To selectively merge objects and properties, use the Merge dialog box.

- [Layers](#) on page 750
- [Deleting layers](#) on page 752
- [Layer pane](#) on page 785

Timewarp curves

By default, a function curve progresses at a constant speed from start to end. A Timewarp curve acts as a speed measurement. Applying a Timewarp curve over a function curve and changing its shape changes the timing of an animation.

You can add additional keyframes and change the shape of the Timewarp curve to slow down, speed up, or reverse the animation.

Timewarp curves are applied as a separate curve over a function curve, so altering a TimeWarp curve does not change the function curve. The modifications you make with a TimeWarp curve only become permanent if you merge them with a function curve.

- [Creating a Timewarp curve](#) on page 756
- [Merging a TimeWarp curve](#) on page 760
- [TimeWarp pane](#) on page 787

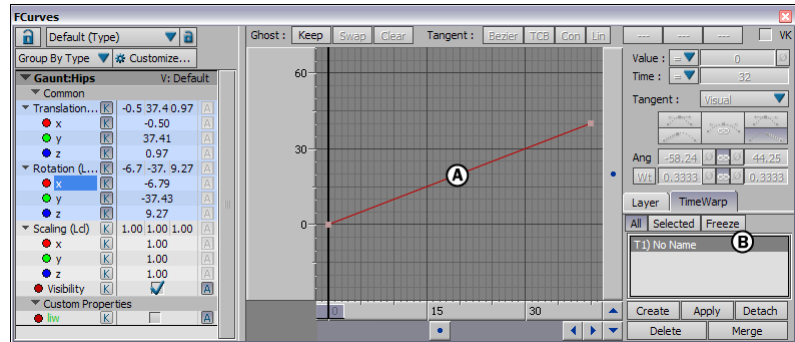
Creating a Timewarp curve

To create a Timewarp curve:

- 1 Select the model with the animation you want to Timewarp.
- 2 In the TimeWarp pane of the FCurves window, click Create.

A new curve called “T1) No Name” displays in the Timewarp list. In the FCurve pane, a linear red TimeWarp curve displays with two keyframes, one at the beginning of the animation, and one at the end. The X and Y

keyframe values are the same and respect the length of the original animation.



FCurves window A. TimeWarp curve B. TimeWarp list

After you have created a TimeWarp curve, you can apply it to the function curve and start editing it.

To rename a Timewarp entry:

- 1 Double-click the item in the Timewarp list, type a new name, and press Enter.

NOTE You can rename the Timewarp curve, but you cannot change its reference number.

- [Timewarp curves](#) on page 756
- [Applying a TimeWarp curve](#) on page 757
- [Editing a TimeWarp curve](#) on page 758
- [TimeWarp pane](#) on page 787

Applying a TimeWarp curve

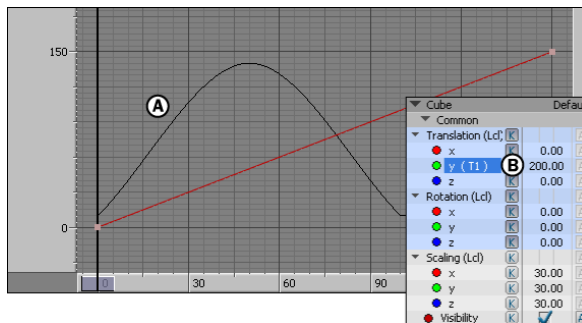
Before you can start modifying a TimeWarp curve, you must apply it to a function curve.

NOTE Applying a TimeWarp curve does not permanently change the function curve.

To apply a Timewarp curve:

- 1 Select the property to Timewarp from the [FCurve Properties](#) pane on page 764.
- 2 Select the Timewarp curve from the Timewarp list, and click Apply.

Once the Timewarp curve is applied, its reference number appears next to the name of the property in the FCurve Properties pane. A black curve shows how the TimeWarp curve affects the function curve for the selected property.



A. The black curve shows the result. B. The reference number of the applied Timewarp (T1) displays.

- [Timewarp curves](#) on page 756
- [Detaching a TimeWarp curve](#) on page 760
- [Merging a TimeWarp curve](#) on page 760
- [TimeWarp pane](#) on page 787

Editing a TimeWarp curve

After you have applied a TimeWarp curve to an animated property, you can edit the TimeWarp curve to change the timing of the animation.

To edit a TimeWarp curve:

- 1 Set, modify, or delete keyframes at different frames on the TimeWarp curve.

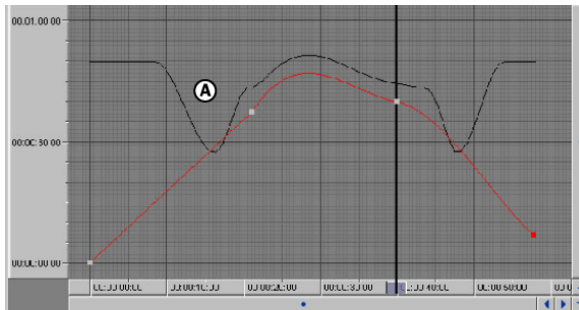
For example, try the following modifications:

- Delete the first keyframe and set a new keyframe on a later frame, removing the beginning of the animation and making the action start later.
- Set a keyframe in the middle of the TimeWarp curve and drag it to a higher value. The animation plays faster because you have increased the slope of the TimeWarp curve.
- Set or select a keyframe and change the interpolation type to Bezier-User. This type of interpolation calculates the slope based on neighboring keyframes.
- Select the last keyframe and click the left Flat option in the Tangent options. The flat tangent causes the action to slow before stopping at the last keyframe.

NOTE Keyframes on the TimeWarp curve display as small pink squares which turn red when selected.

As you edit the Timewarp curve, you can see the effect your TimeWarp modifications have on the black curve in the FCurves pane.

The black curve represents the effect on the Base Layer of animation only.



A. The black curve shows the result of the Timewarp applied to a curve.

To make the modifications permanent and keep the black curve, you can merge the TimeWarp curve and the function curve. To discard the changes you have made, you can detach the TimeWarp curve.

- [Timewarp curves](#) on page 756
- [Merging a TimeWarp curve](#) on page 760
- [Detaching a TimeWarp curve](#) on page 760
- [TimeWarp pane](#) on page 787

Detaching a TimeWarp curve

NOTE You can only detach a Timewarp curve if it has not been merged with its function curve.

To detach a TimeWarp curve:

- 1 In the FCurve property pane, select a property with a TimeWarp curve.
- 2 In the TimeWarp pane, click Detach.
The TimeWarp curve is still listed in the TimeWarp list, but it is no longer applied to a property. The black preview curve no longer displays in the FCurves pane.

- [Timewarp curves](#) on page 756
- [Deleting a TimeWarp curve](#) on page 761
- [TimeWarp pane](#) on page 787

Merging a TimeWarp curve

When you are finished working with at TimeWarp curve, you can merge it with its function curve to make your changes permanent.

To merge a TimeWarp curve:

- 1 In the FCurve Properties pane, select the property whose function curve you want to merge with the TimeWarp curve.

- 2 In the TimeWarp pane, select the TimeWarp curve and click Merge.
- 3 Optional: Switch to the Layer pane, select the Base Layer (if it is not already selected) and view the final function curves for your animation.

After you have merged a TimeWarp curve with the Base Layer, you can delete it from the scene.

- [Timewarp curves](#) on page 756
- [Deleting a TimeWarp curve](#) on page 761
- [TimeWarp pane](#) on page 787

Deleting a TimeWarp curve

In the TimeWarp pane, select a TimeWarp curve from the Timewarp list and click Delete.

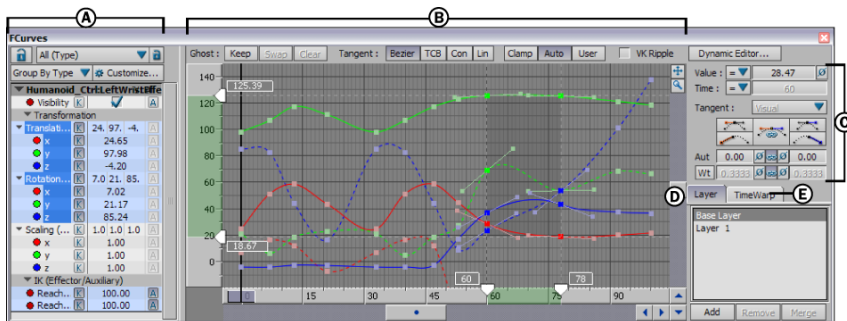
- [Timewarp curves](#) on page 756
- [Detaching a TimeWarp curve](#) on page 760
- [TimeWarp pane](#) on page 787

FCurves window

51

The FCurves window lets you create, view and modify function curves in various ways. For example, you can control the interpolation between keyframes, the extrapolation of a curve, and the value and time of the function curve.

To display the FCurves window, select Window > FCurves in the menu bar. The FCurves window also appears in the Editing layout.



FCurves window A. FCurve Properties pane B. FCurve pane C. FCurve Options pane D. Layer pane E. TimeWarp pane

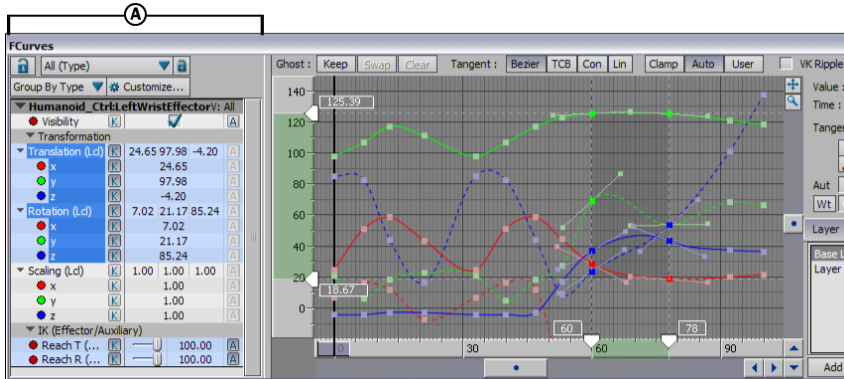
For more about editing FCurves, also see [Scaling keys in the FCurve window](#) on page 741.

The FCurves window consists of the following main areas:

- [FCurve Properties pane](#) on page 764,
- [FCurve pane](#) on page 765,
- [FCurve Options pane](#) on page 773,
- [Layer pane](#) on page 785,
- [TimeWarp pane](#) on page 787,

FCurve Properties pane

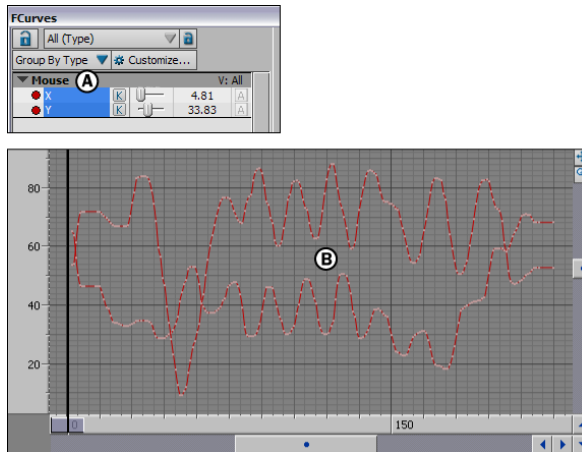
The FCurve Properties pane is simply a representation of the [Properties window](#) on page 585 in the FCurves window. It displays the properties of selected objects, which you can select in order to view curves in the FCurve pane.



FCurves window A. Properties pane

When you select a property in the Properties pane, its function curve appears in the FCurve pane, and the value of each property displays in the Value field at the current time code. If the property is a vector, such as Translation or Rotation, its X, Y, and Z values also display.

For example, shows the captured data of a Mouse device. Two function curves display because both the devices's X and Y properties are selected in the Properties pane. To view only the X or Y data captured to the Mouse device, select only the X or Y property in the Properties pane.



A. The selected Mouse device's properties display in the Properties pane. B. All the data recorded to the device's X- and Y-axes display.

You can hide or show more of the Properties pane by dragging the vertical gray bar between the Properties pane and the FCurve pane.

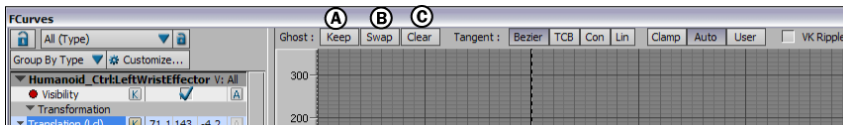
- [Properties window](#) on page 585
- [FCurves window](#) on page 763

FCurve pane

The FCurve pane displays the function curves of selected properties and gives you controls for manipulating the curves. You can edit curves directly by moving a keyframe's tangent handles to change the shape of the curve, and you can also choose different types of interpolation to either smooth the curve or sharpen angles.

Ghost options

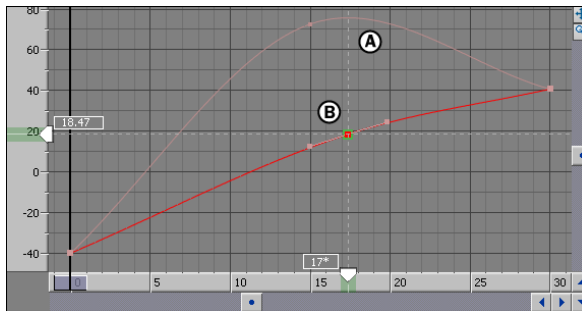
The Ghost options let you edit function curves progressively while using the position of the previous curve as a visual reference. The previous curve is referred to as a Ghost curve.



Ghost options in the FCurves window A. Keep B. Swap C. Clear

As you modify a function curve, its Ghost curve remains static in the background of the FCurves window and displays in the a lighter shade of the same color of the original curve.

For example, shows a Ghost curve behind the function curve that is being modified.



FCurves pane A. Ghost of the original curve displays behind the curve being modified. B. New curve.

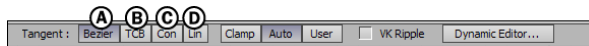
You can move between the current and previous function curves to view the differences as you edit, exchange the current function curve with the previous curve at any time, or keep the modified curve.

| Ghost option | Function |
|--------------|---|
| Keep | Click the Keep button to record the current function curve as the Ghost curve. The Keep button takes a snapshot of state of the current function curve and places it in memory, creating a Ghost curve. To keep the new position of the modified function curve and clear the Keep buffer, click Keep again. The Ghost curve updates based on the current position of the function curve. |

| Ghost option | Function |
|--------------|--|
| Swap | The Swap button exchanges the active curve with the Ghost curve. Click Swap again to swap the two curves once more. |
| Clear | The Clear button deletes any Ghost curves from memory, and from the FCurve pane. Ghost curves will not display on subsequent edits until you click Keep again. You can hide Ghost curves but keep them in memory when you right-click in the FCurve pane, and disable Display > Ghosts in the contextual menu (see Display on page 794). |

Tangent options

By default, MotionBuilder automatically manages the slope, or interpolation, of function curves. The four Tangent options (Bezier, TCB, Con, and Lin) let you select how MotionBuilder interpolates the values between keyframes in order to manually change the interpolation.



Tangent options A. Bezier B. TCB C. Constant D. Linear

To change interpolation, select one or more keyframes, then select an interpolation option. Depending on the option you choose, the interpolation between the selected keyframes changes.

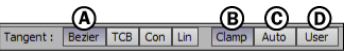
When you change the interpolation of a keyframe region, you affect the shape of the spline between the keys in the region and the next set of keys that follow the region.

Depending on the interpolation option you click, additional options may appear. For example, if you click Bezier, the Clamp, Auto, and User options appear.

For information on changing the mathematical algorithm that calculates the extrapolation of a curve, see [Extrapolation](#) on page 791.

Bezier option

Activates Bezier interpolation mode, which lets you create cubic curves that you can modify using tangent handles or angle and weight settings.



Tangent options A. Bezier option is active. B. Clamp option C. Auto option D. User option

The following table describes the Clamp, Auto, and User modes (B, C, and D in the figure) available when you select Bezier interpolation mode in the FCurves window.

| Mode | Function |
|-------|--|
| Clamp | Creates a cubic curve whose tangents are automatically calculated based on the values of the neighboring keyframes. See Bezier-Clamp on page 699 for more information on this type of interpolation. |
| Auto | <p>Creates a cubic curve whose tangents are automatically calculated based on the values of the neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-Auto keyframe change. Auto is the default mode when keyframing, unless you change the type of interpolation in the Type menu of the Key Controls window.</p> <p>When Auto is selected, Auto and Weight settings display in the Tangent area. See Tangent area on page 775 for more information.</p> |
| User | User mode creates a cubic curve whose tangents are not influenced by neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-User keyframe do not change. |

| Mode | Function |
|------|---|
| | When User is selected, Angle (Ang) and Weight settings display in the Tangent area. See "Tangent" for more information. |

There are two options in the [FCurve contextual menu](#) on page 789 that affect your use of Auto and User modes. See [Switch to User on Edit](#) on page 796 and [Reset Tangents on Switch to Auto](#) on page 796 for more information.

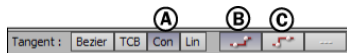
TCB option

Activates TCB interpolation mode, joining each keyframe using a Hermite-type curve. The slope on either side of a keyframe is changed using the TCB (Tension/Continuity/Bias) values.

Constant (Con) option

Activates Constant interpolation mode, maintaining the same keyframe value between keyframes. With Constant interpolation mode active, there is no slope between keyframes.

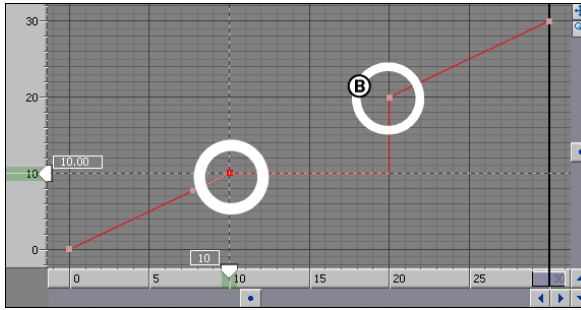
When you click the Constant option in the FCurves window, the Standard and Next options appear (B and C in the figure).



Tangent options A. Constant option is active. B. Standard option C. Next option

Standard option

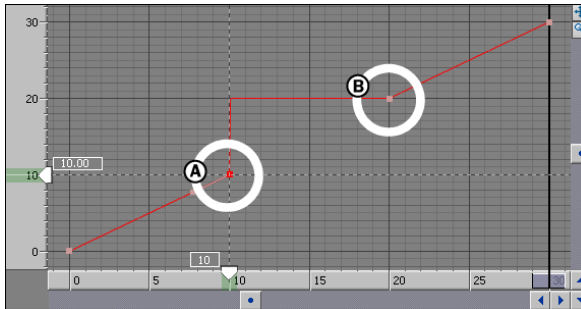
When the Standard option is active, constant interpolation maintains the value of the selected keyframe until the next keyframe.



Standard constant interpolation A. Selected keyframe B. Next keyframe

Next option

When the Next option is active, constant interpolation maintains the value of the next keyframe between the selected and next keyframes.



Next constant interpolation A. Selected keyframe. B. Next keyframe

TIP The Constant Next interpolation is useful for marking the end of a referential when using the Multi-Referential constraint.

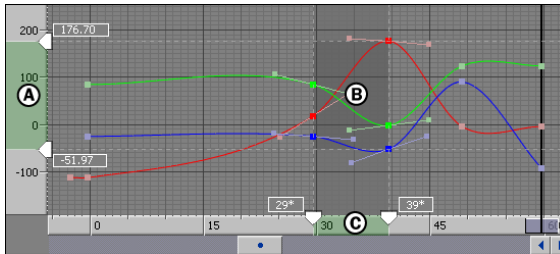
Linear () option

Activates Linear interpolation mode, joining the selected keyframe and the next keyframe with a straight line. The slope between keyframes while this mode is active is constant.

VK Ripple option

As you manipulate keyframe selections using the visual keyframes in the FCurve pane, the VK (Visual Keyframes) Ripple option lets you determine how keyframes move to accommodate your changes.

When VK Ripple is active, and the VK Ripple Options in the contextual menu are also active, dragging keyframe selections using the green bars, pushes other keyframes later in time outside the selected region (A and C in the following figure).



Using VK Ripple A. Green bar along the vertical axis B. Gray box C. Green bar along the horizontal axis

If you use the gray box to drag the keyframe selection, the keyframes move as if VK Ripple is not active.

For example, to push keys forward at the end of a keyframe region, activate VK Ripple and drag the selected region to the right using the visual keyframes on the horizontal or vertical axes.

When VK Ripple is disabled, moving keyframe selections does not change the position of other keyframes, as each keyframe maintains its space.

VK Ripple must be activated if you want to use the VK Ripple options in the FCurve contextual menu and ripple your edits in various ways. See [VK Ripple Options](#) on page 795.

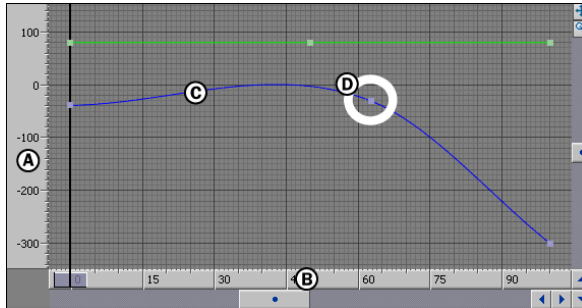
Dynamic Editor button

The Dynamic Editor buttons opens the [Dynamic Editor](#) on page 713 window, which lets you modify keyframes at the current time without selecting them. You can also use the Dynamic Editor window to modify selected keyframes or selected keyframe regions. When no other keyframes are selected, keyframes at the current time are editable.

Horizontal and vertical axes

The value of a property appears along the vertical axis, and its time appears along the horizontal axis.

The slope of the curve determines the speed of the change between each value. For example, a steep slope means the value changes quickly, and a gradual slope means the value changes more slowly over a longer period of time.

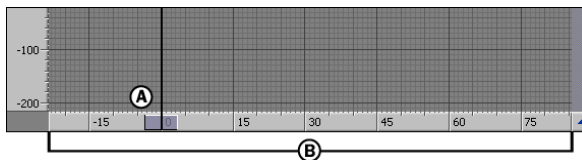


A. Value on vertical axis B. Time on horizontal axis C. Function curve D. Keyframe

NOTE The horizontal and vertical axes change when you edit Timewarp curves (see [TimeWarp pane](#) on page 787).

The FCurve timeline on the horizontal axis shows the progression of time in the FCurves window, and indicates the area of the current function curves relative to the current take. Both axes show selected keyframes and keyframe regions.

The Timeline indicator in the FCurve pane shadows the Timeline indicator on the Action timeline in the Transport Controls window, which also displays the length of the current take. See [Selecting time](#) on page 605.



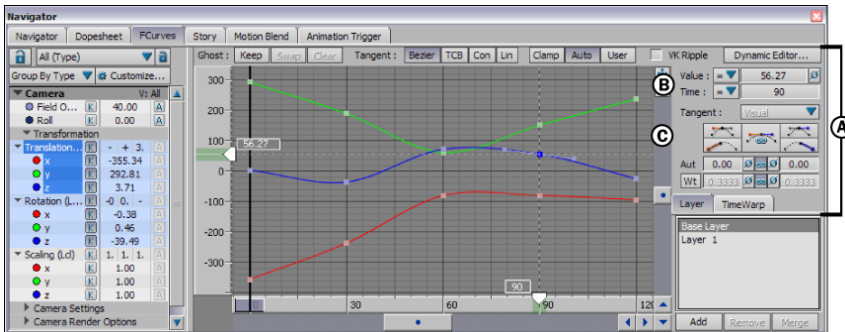
FCurves window A. FCurve Timeline indicator B. FCurve time axis

■ [Changing the color of function curves](#) on page 745

FCurve Options pane

The FCurve Options pane contains options that let you change selected curves and editing modes in the FCurve pane.

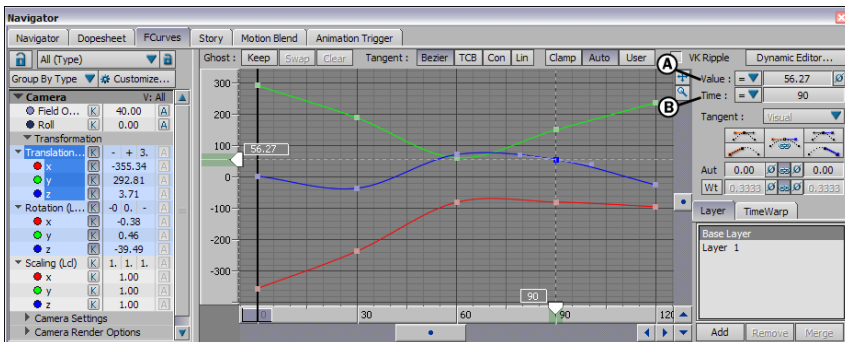
The Value, Time, and Tangent options let you adjust tangent handles and change keyframes based on their time or frame. These options apply to the selected function curves or keyframes.



FCurves window A. FCurves Options pane B. Value and Time settings C. Tangent area

Value and Time settings

The Value and Time settings (A and B in the following figure) let you edit keyframes by adding, subtracting, or multiplying by a specific value or time for offsetting keyframe selections without changing the animation.



FCurves window A. Value settings B. Time settings

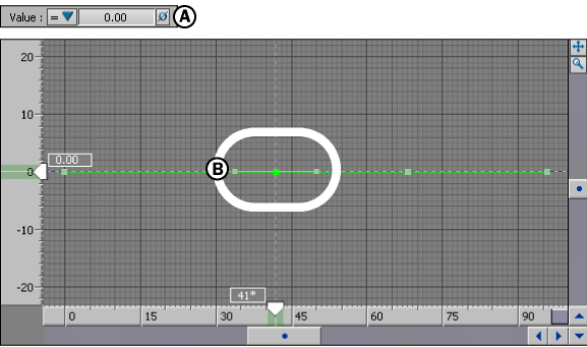
The Value field reflects the value of a selected keyframe in the FCurve pane, and the Value menu lets you edit keyframes by a selected value.

The Time field reflects the time of a selected keyframe in the FCurve pane, and the Time menu lets you edit keyframes by a selected time.

The following table describes the options in the Value and Time menus:

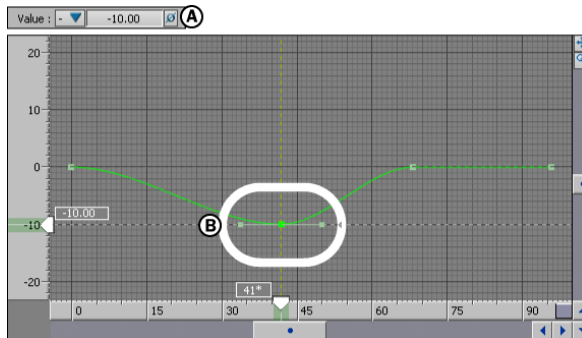
| Option | Description |
|--------|---|
| = | Reflects the actual value. |
| + | Adds the value specified in the Value or Time field. |
| - | Subtracts the value specified in the Value or Time field. |
| * | Multiplies the value specified in the Value field. |

The selected keyframe in has a value of 0.



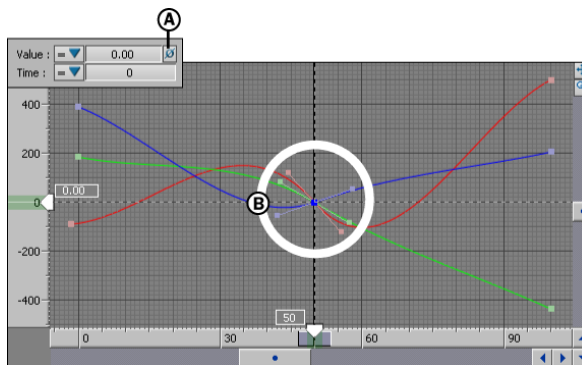
A. Value field reflects selected curve’s value of 0.B. Selected keyframe in the FCurve pane.

In (A), the minus (-) option is selected and 10 is in the Value field. This causes the selected keyframe that originally had a value of 0 to change to a value of -10.



A. Minus is selected in the Value menu. Entering 10 in the Value field becomes -10. B. The Selected keyframe changes to the selected value in the FCurve pane.

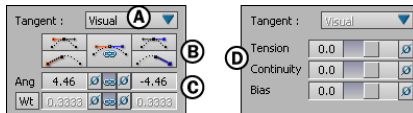
To reset the value of the keyframe to 0, you can click the Reset button for the Value setting.



Resetting values A. Reset button B. Keys are set to 0.

Tangent area

The options in the Tangent area let you set values for the tangents of selected keyframes. The settings in the Tangent area change depending on which tangent option is selected.



Tangent area A. Tangent menu B. Flat, Discontinuity, and Break options C. Angle and Weight settings D. TCB settings

When the TCB tangent option is active, the Tangent area displays the Tension, Continuity, and Bias settings that are the same as those in the Dynamic Editor. See [TCB interpolation settings](#) on page 731.

When the Bezier, Constant, or Linear tangent options are selected, the Tangent area can include the Tangent menu, Tangent buttons, Angle settings, Auto settings, and Weight settings.

Tangent menu

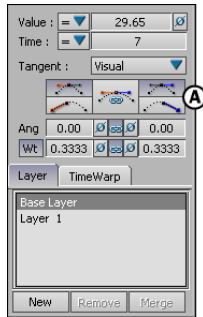
The Tangent menu lets you choose between Visual and Exact options.

| Option | Description |
|--------|---|
| Visual | Lets you intuitively adjust tangents based on the current visual display of the tangents. To adjust tangents, drag or change values in the Left and Right tangent fields. Visual is the default option. |
| Exact | Lets you adjust a tangent using precise degrees. Use this option to paste or reuse exact values independent of the current visual display. |

Tangent buttons

In the FCurves window, the following buttons affect the tangents of selected keyframes:

- [Flat buttons](#) on page 777
- [Discontinuity buttons](#) on page 778
- [Break option](#) on page 779



FCurves Options pane
A. Flat buttons,
Discontinuity
buttons, and Break
option

These buttons display in the FCurves Options pane when certain Tangent options are selected.

Flat buttons

When the Bezier interpolation mode is active, the two Flat buttons let you flatten the left and right tangent handles of selected keyframes. Also, when the Bezier interpolation mode and the Auto interpolation option are active, clicking a Flat button switches the interpolation option from Auto to User.

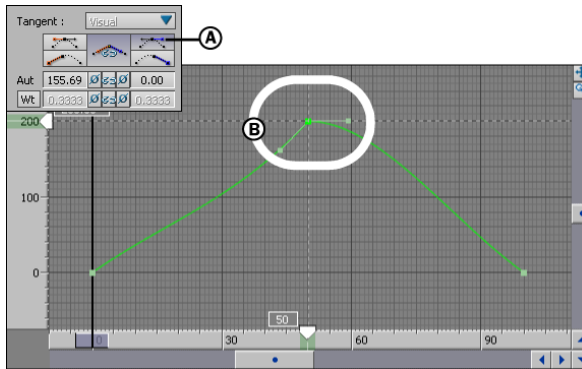


Tangent area A. Flat
Left button B. Flat Right
button

The Flat button on the left affects the interpolation to the left of a keyframe, and the Flat button on the right affects the interpolation to the right of the keyframe.

Also, when the Break option is disabled, clicking one Flat button flattens both left and right tangents. When the Break option is disabled, clicking one Flat button flattens only one tangent.

For example, clicking the right Flat button flattens the right tangent handle horizontally.



using the Flat buttons A. The right Flat button is active.B. The right tangent handle is flattened.

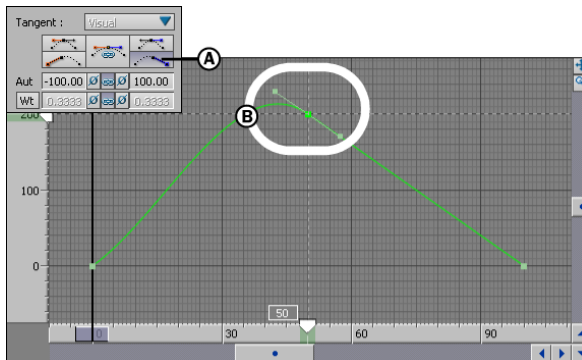
Discontinuity buttons

When the Bezier interpolation mode is active, the two Discontinuity buttons cause the left or right tangents to point at the previous or next keyframes.



Tangent area A.
Discontinuity Left
button B. Discontinuity
Right button

Clicking the Discontinuity button on the right causes the right tangent handle to point to the next keyframe. Similarly, clicking the Discontinuity button on the left causes the left tangent handle to point to the previous keyframe.

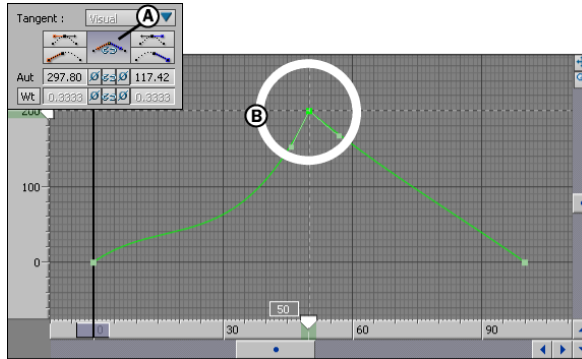


Using Flat buttons A. The right Discontinuity button is active. B. The right tangent handle is points to the next keyframe.

Also, when the Break option is disabled, clicking one Discontinuity button affects both left and right tangents. When the Break option is active, clicking one Discontinuity button affects only one tangent.

Break option

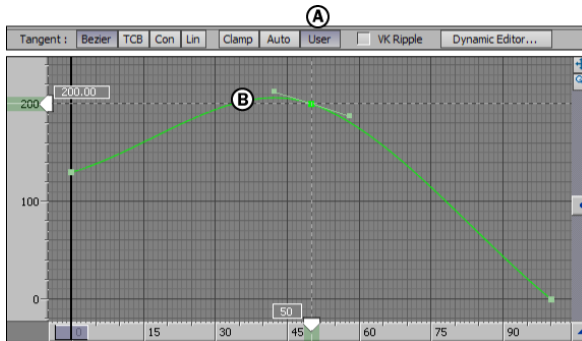
The Break option splits a keyframe's tangent handle into two tangent handles that you can move independently. This lets you change the slope of the function curve on either side of the keyframe or weight left and right tangents differently.



Breaking tangents A. Break option is active. B. Tangent handles of a selected keyframe are broken. Each handle moves independently.

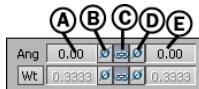
Angle settings

When Bezier and User options are active, the Angle settings let you edit the angles of function curves using degrees, and the angle of left and right tangents are unaffected by previous and next keyframes.



A. The User option for Bezier interpolation is selected. B. The tangent of the selected keyframe is offset by 20 degrees.

The Angle settings consist of fields, Reset buttons, and a Link button.



Angle settings A.
Angle for left
tangent B. Reset left
tangent C. Link
option D. Reset
right tangent E.
Angle for right
tangent

Angle (Ang) fields

Let you change the angle of the tangents for a selected keyframe to specific degrees. The Angle field on the left affects the left tangent, and the Angle field on the right affects the right tangent. The values of these fields depend on whether Visual or Exact is selected in the Tangent menu.

The angle of a selected keyframe's left and right tangents are not affected by neighboring keyframes. Instead, the values in the Angle fields are negative or positive in relation to the selected keyframe, as if the keyframe is at coordinates (0, 0) on a Cartesian plane.

When a tangent is set to 0, it is flat and displays horizontally. When a tangent is set to a positive number, the tangent angle points upwards from the selected keyframe. When a tangent is set to a negative degree, the tangent angle points downwards from the selected keyframe.

Reset

Let you reset the Angle values for the right and left tangents of a selected keyframe to zero (B and D in the figure above). Tangents set to zero are flat, and display horizontally.

Link

When the Link option next to the Angle fields is active, you can modify the angle of both left and right tangents at the same time, whether or not the tangents are broken or unbroken.

When the Break option is active ([Break option](#) on page 779), you can modify the angle of each tangent separately when the Link option is disabled, or by dragging a tangent handle.

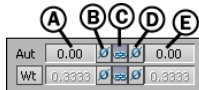
Auto settings

When Bezier and Auto buttons are active, the Auto settings let you edit the angles of function curves parametrically, where the angle of left and right tangents are changed in relation to the previous or next keyframes.



A. The Auto button for Bezier interpolation is selected. B. Selected keyframe's tangents are the average between the previous and next keyframes. C. Previous keyframe D. Next keyframe

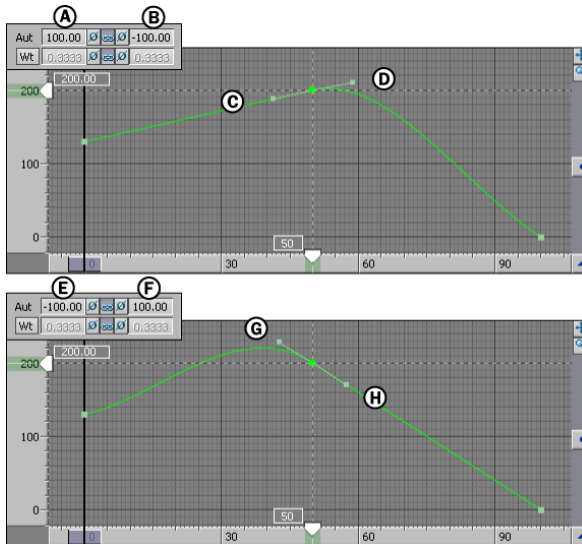
The Auto settings consist of fields, Reset buttons, and a Link button.



Auto settings A.
Value for left
tangent B. Reset left
tangent C. Link
option D. Reset
right tangent E.
Value for right
tangent

Auto (Aut) fields

The Auto settings include two fields (A and E in the following figure) which let you change the angle of a selected keyframes's tangents. The field on the left side affects the left tangent, and the field on the right side affects the right tangent.



Editing tangent angles using Auto settings A. The left Auto field is set to 100. B. The right Auto field is set to -100. C. The left tangent points to the previous keyframe. D. The right tangent points to the previous keyframe. E. The left Auto field is set to -100. F. The right Auto field is set to 100. G. The left tangent points away from the next keyframe. H. The right tangent points to the next keyframe.

When you modify the Auto settings, the tangents behave as described in the following table:

| | |
|------|--|
| 0 | At 0, the curve represents the average between the previous and next keyframes. |
| 100 | When the left Auto field is at 100, the left tangent points to the previous keyframe (A and C in the figure above). When the right Auto field is at 100, the right tangent points to the next keyframe (F and H in the figure above). |
| -100 | When the left Auto field is at -100, the left tangent points away from the next keyframe (E and G in the figure above).When the right Auto field is at -100, the right tangent points away from the previous keyframe (B and D in the figure above). |

Reset

The Reset buttons for the Auto fields (shown as B and D in the figure above) let you reset the right and left tangents to zero. When a left or right tangent is reset to zero, the tangent represents the average between the previous and next keyframes.

Link

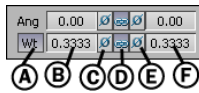
When the Link option for the Auto fields is active, you can modify the angle of both left and right tangents at the same time, whether or not the tangents are broken or unbroken.

When the Break option is active ([Break option](#) on page 779), you can modify the angle of each tangent separately when the Link option is disabled, or by dragging a tangent handle.

Weight settings

The Weight settings let you change the weight of tangents. When you stretch or shorten the handle of a weighted tangent, the interpolation curve is affected

by a third point, represented by the end of the tangent handle. You can stretch a weighted tangent without affecting its angle.



Weight settings A.
Weight Selection
option B. Value for
left tangent C. Reset
left tangent D. Link
option E. Reset right
tangent F. Value for
right tangent

Weight Selection

The Weight Selection option lets you weight the left and right tangents selected keyframes at the same time. The Weight settings are available only when this option is active.

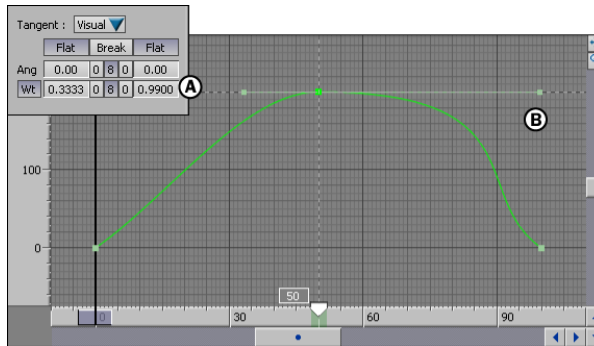
This option is similar to the Weight Selection option in the contextual menu. See [Weight Selection](#) on page 793 for more information.

Disabling the Weight Selection option removes weighting from both tangents of selected keyframes. See [Reset](#) on page 785 to reset tangents separately.

Weight (Wt) fields

The Weight settings include two fields (B and F in the previous figure,) that let you change the weight of the tangents for a selected keyframe.

To change the value in a field, drag in the field, or double-click in the field and type a value. You can also drag the tangent handles themselves. The Weight field on the left affects the left tangent, and the field on the right affects the right tangent.



Changing the weight of a curve A. The Weight settings are at 0.333 and 0.990. B. The weight of the tangent on the right is changed.

Reset

The Reset buttons for the Weight fields (C and E in the figure,) let you reset the right or left tangents of selected keyframes to 0.3333, removing the weight from either tangent.

Link

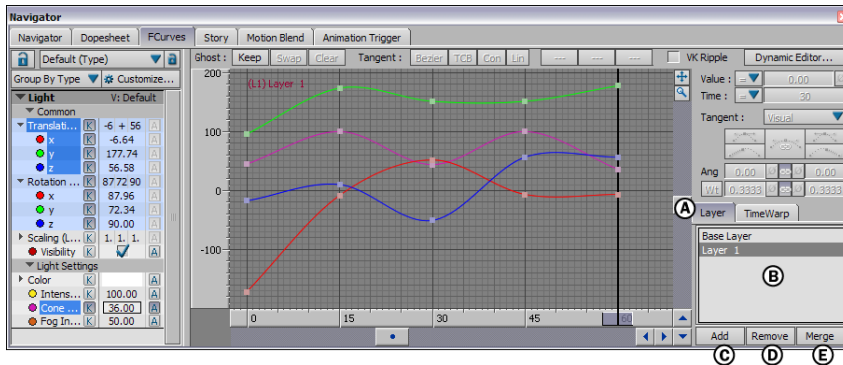
When the Link option for the Weight fields is active, you can modify the weight of both left and right tangents at the same time, whether or not the tangents are broken.

When the Break option is active (see [Break option](#) on page 779), you can modify the weight of each tangent separately when the Link option is disabled, or by dragging a weighted tangent handle.

- [Tangents](#) on page 746
- [FCurves window](#) on page 763

Layer pane

In the FCurves window, the Layer pane lets you create additional layers of animation in the current scene, or adjust captured data without altering the original data.



FCurves window A. Layer pane B. Layers list C. Add D. Remove E. Merge

When a layer is selected in the Layer pane, all changes apply to that layer and not to the original function curve data. When working on a layer, the current layer number displays in the upper left corner of the FCurve pane, next to selected properties in the Properties pane, and in the Key Controls window.

NOTE To keyframe objects on layers, set the object to Multi Layer in the Key Controls window.

The Layer pane includes the following buttons:

Add button

The Add button creates a new layer and adds it to the Layer pane at the end of the list. By default, the Layer pane displays the Base Layer and Layer 1. You can create unlimited numbers of layers. New layers are numbered sequentially, for example, Layer 2, Layer 3, and so on.

Remove button

The Remove button lets you remove a selected layer in the Layer pane.

When you select a layer and click Remove, the Remove Layer dialog box appears. See [Remove Layer dialog box](#) on page 755.

Merge button

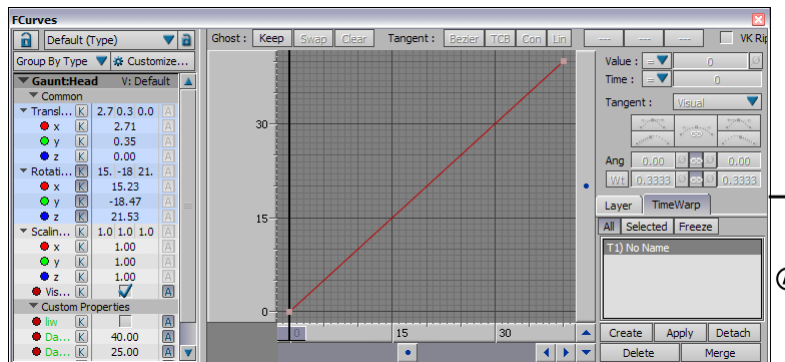
The Merge button lets you select what you want to merge in the Base Layer.

Clicking the Merge button opens the Merge dialog box. See [Merge dialog box](#) on page 754.

- [Layers](#) on page 750
- [Adding and renaming layers](#) on page 750
- [Merging layers](#) on page 751
- [Deleting layers](#) on page 752

TimeWarp pane

When the TimeWarp pane in the FCurves window is active, all changes such as editing, selecting, keyframing, and other actions apply to the selected function curve's Timewarp curve.



FCurve window A. TimeWarp pane

The TimeWarp pane includes the following options and buttons:

All option

Displays all Timewarp curves in the scene.

Selected option

Displays Timewarp curves for selected properties in the FCurve Properties pane.

Freeze option

Freezes the current Timewarp list until you choose All or Selected.

Timewarp list

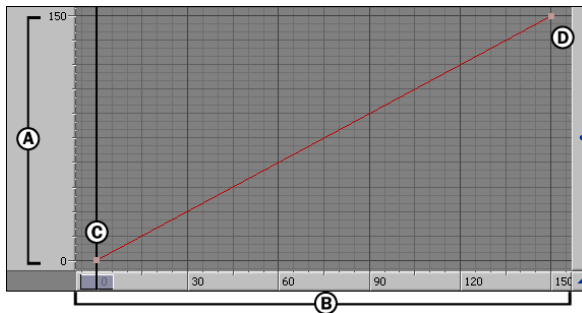
The Timewarp list is empty by default until you create a new Timewarp curve (see [Creating a Timewarp curve](#) on page 756).

Curves are listed in the Timewarp pane and numbered “Tn”, where n is a reference number for the Timewarp curve. The name is based on the object last selected in the FCurve pane. If nothing is selected, the curve is numbered and called “No Name”.

Create button

Click to create a new Timewarp curve. See [Creating a Timewarp curve](#) on page 756.

In Timewarp mode, the original time code is graphed by Timewarp time code. The vertical axis shows the time values for the original animation, and the horizontal axis shows the time values for the Timewarp animation.



A. Original animation values on Y-axis. B. TimeWarp animation values on X-axis. C. Beginning of time D. End of time

Apply button

Click to apply a Timewarp curve to its selected property. See [Applying a TimeWarp curve](#) on page 757.

Detach button

Click to detach a selected Timewarp curve from its function curve, and returns to the original motion data. See [Detaching a TimeWarp curve](#) on page 760.

Delete button

Click to delete a selected Timewarp curve. See [Deleting a TimeWarp curve](#) on page 761.

Merge button

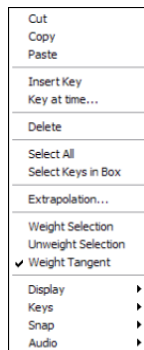
Click to merge a Timewarp curve with its function curve and make the curve permanent. See [Merging a TimeWarp curve](#) on page 760.

■ [Timewarp curves](#) on page 756

FCurve contextual menu

The FCurve contextual menu lets you set display and additional options for keyframes and function curves.

To display this menu, right-click anywhere in the FCurve pane. The menu options may change depending on what is selected, or on the previous editing operation.



FCurve contextual menu

Cut

Removes selected keyframes and stores them in memory. To cut a selection, right-click in the FCurve pane and choose Cut from the contextual menu. You can also use the keyboard shortcut Ctrl-X to cut selections.

Copy

Copies selected keyframes and stores them in memory for inserting into another location. To copy a selection, right-click in the FCurve pane and choose Copy from the contextual menu. You can also use the keyboard shortcut Ctrl-C to copy selections.

Paste

Pastes a copied or cut selection into a selected area. If nothing is selected, the selection is pasted at the current time.

To paste a selection, right-click in the FCurve pane and select Paste from the contextual menu. You can also use the keyboard shortcut Ctrl-V to paste selections.

The first keyframe of the copied or cut curve is pasted at the current timecode. All selected keyframes are pasted, preserving the shape of the copied or cut curve.

Replacing an existing keyframe or keyframe region with a pasted selection deletes all keys within the region, and replaces the first key of the region with the pasted keyframe. When pasting a keyframe region on a keyframe, the region's first key replaces the original keyframe.

You can also cut, copy, and paste multiple function curves at the same time. This means that you can select an object's X, Y, and Z function curves, then copy and paste these curves to another object.

NOTE Activating the Paste Ripple option offsets keyframes that follow the paste according to the size of the pasted region (See [Snap](#) on page 797).

Insert Key

The Insert Key option lets you add a keyframe at the position of the Timeline indicator to selected properties associated with the selected element or model.

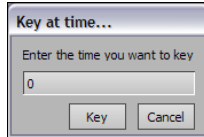
This option is the same as pressing K on the keyboard, or the Key button in the Key Controls window.

Key At Time

The Key at Time option opens a Key at Time dialog box which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can also access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing Ctrl-Shift-K.

See [Setting many keyframes at once](#) on page 646 for more information.



Key at Time dialog box

Delete

The Delete option deletes selected keyframes and regions. Deleted keyframes and keyframe regions are not stored in memory.

To delete a keyframe selection, right-click in the FCurve pane and select Delete. You can also press Delete on the keyboard to delete selections.

Select All

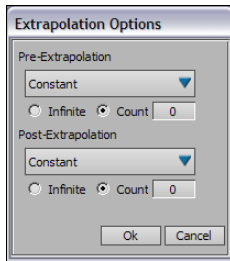
The Select All option selects every keyframe on the function curve of the current property. Some operations require that you select all of a curve's keyframes, such as when you translate an entire function curve or set a curve's interpolation.

Select Keys in Box

The Select Keys in Box option selects every keyframe within a selected region. To select a region, click-drag in the FCurve pane.

Extrapolation

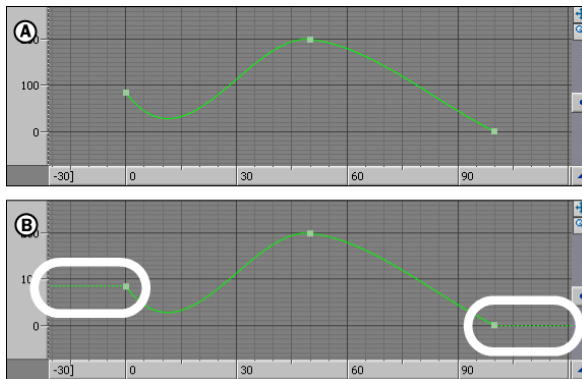
Opens the Extrapolation Options dialog box, letting you set pre- and post-extrapolation modes.



Extrapolation Options dialog box

Extrapolation determines the state of a curve before the first keyframe (pre-extrapolation) and after the last keyframe (post-extrapolation).

Once you set the pre- or post-extrapolation modes, the selected function curves display with the extrapolation settings.



Extrapolation A. Function curve without extrapolation. B. The function curve after extrapolation, with both extrapolation modes set to Constant. The extrapolated regions appear as dotted lines (circled).

To change a curve's extrapolation, select one of the following extrapolation modes in the Pre-Extrapolation or Post-Extrapolation fields.

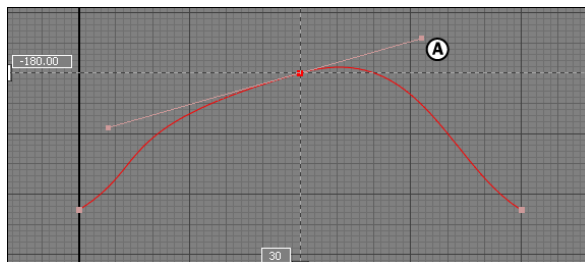
| Extrapolation mode | Description |
|--------------------|---|
| Constant | Flattens the slope of a curve before the first and after the last keyframe. |

| Extrapolation mode | Description |
|--------------------|---|
| Repetition | Duplicates a curve, then places it before the first or after the last keyframe. The Count option repeats the curve a set number of times, and the Infinity option repeats the curve continuously. |
| Mirror Repetition | Duplicates and mirrors a curve, then places it before the first, or after the last keyframe. Count mirrors the curve and repeats it a set number of times, and Infinity repeats the curve continuously. |
| Keep Slope | Extends the slope of the curve past the last or before the first keyframe. |

Weight Selection

The Weight Selection option lets you weight both tangents of selected keyframes.

By stretching the weighted tangent handle, you can create curves that you cannot create with unweighted tangents.



A. Weighted tangents.

Unweight Selection

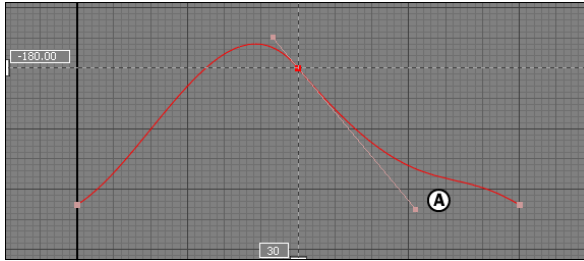
The Unweight Selection option lets you remove the weighting from weighted tangents of selected keyframes.

Weighted Tangent

Selecting the Weighted Tangent option lets you weight selected keyframes. When you right-click the tip of a tangent handle, Weighted Tangent lets you weight that single tangent.

By stretching the weighted tangent handle, you can create curves that you cannot create with unweighted tangents.

Clicking a weighted tangent handle and selecting Weighted Tangent from the menu lets you remove the weight settings from a single tangent.



A. A single weighted tangent.

Display

This section describes the options in the Display menu.

| Option | Description |
|-------------|---|
| Visual Keys | Activate to display visual keyframes on the FCurve timeline. Disable to hide visual keyframes. |
| Ghost | Activate to display the Ghost curves in the FCurve pane. Disable to hide Ghost curves. The Ghost option is active by default. |
| Tangents | Activate to show all keyframe tangents. Disable to hide tangents. The Tangents option is active by default. |

| Option | Description |
|--------|---|
| Audio | Activate to display audio on the FCurve timeline. Disable to hide audio. The Audio option is active by default. |

Keys

The options in the Keys menu let you select how your visual keyframes behave relative to your manipulations in the FCurve pane.

Paste Ripple

When pasting a keyframe region, activate Paste Ripple to make keys that follow the pasted selection move according to the size of the pasted region. Disable to keep other keys anchored when pasting a keyframe region.

VK Ripple

When manipulating keyframe selections, VK Ripple lets you set how keyframes behave relative to your edits. The VK Ripple option is the same as the VK Ripple option in the FCurve pane. To change the behavior of the keyframes when VK Ripple is active, see [VK Ripple Options](#) on page 795.

VK Ripple Options

This section describes the options in the VK Ripple menu.

| Option | Description |
|------------------|---|
| Move Ripple X | When offsetting a selection, activate to push deselected keys horizontally according to the offset. Disable to keep deselected keys anchored when offsetting. Disabled by default. |
| Stretch Ripple X | When stretching a selection, activate Stretch Ripple X to move deselected keys horizontally according to the stretch. Disable to keep keys that are not selected anchored when stretching. Disabled by default. |

| Option | Description |
|------------------|---|
| Move Ripple Y | When offsetting a selection, activate Move Ripple Y to push deselected keys vertically according to the offset. Disable to keep keys that are not selected anchored when offsetting. Disabled by default. |
| Stretch Ripple Y | When stretching a selection, activate Stretch Ripple Y to move deselected keys vertically according to the stretch. Disable to keep keys that are not selected anchored when stretching. Disabled by default. |
| Ripple All Y | When moving a region, activate Ripple All Y to ripple all keys vertically outside the selected region. |

Switch to User on Edit

When Switch to User on Edit is active, editing a Bezier keyframe by dragging its tangents in the FCurve pane switches its interpolation from Bezier-Auto to Bezier-User. Switch to User on Edit is active by default.

When Switch to User on Edit is disabled, editing a keyframe does not switch its interpolation from Bezier-Auto to Bezier-User. The interpolation option also does not change if you edit a keyframe using the Tangent settings in the FCurve Options pane. See [Tangent area](#) on page 775.

Reset Tangents on Switch to Auto

When Reset Tangents on Switch to Auto is active, switching from Bezier-User or Bezier-Clamp to Bezier-Auto resets the selected keyframe's tangents, so that they are the average of the previous and next keyframes. This option is active by default.

When Reset Tangents on Switch to Auto is disabled and you switch a keyframe from Bezier-User or Bezier-Clamp to Bezier-Auto, the tangents of the selected keyframe are not reset and retain their offset. See [Tangent area](#) on page 775.

Snap

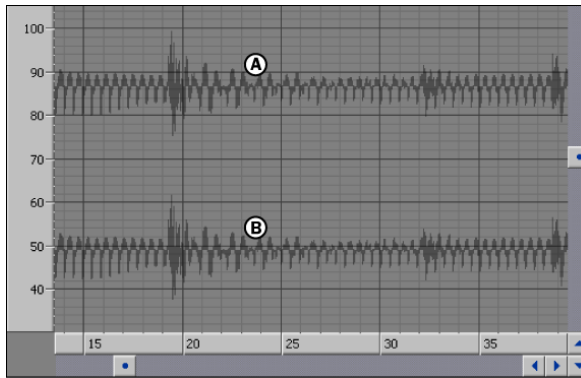
This section describes the options in the Snap menu.

| Option | Description |
|-----------------------|--|
| Grid Snap X | When dragging a keyframe selection, activate Grid Snap X to snap the selected region to the closest X grid lines, and to lock the value of the selected region. |
| Grid Snap Y | When dragging a keyframe selection, activate Grid Snap Y to snap the selected region to the closest Y grid lines, and to lock the time of the selected region. |
| Box Snap | When dragging a selection, activate Box Snap to snap the selected region to the original lines of the region. These lines represent the original values before snapping was performed. |
| Filtering Region Snap | When filtering data, activate this option to snap the selection to the closest keyframes within the selected region. |

Audio

The Audio options let you add audio clips in the .wav format in the FCurves window, and select mono or stereo display.

To add an audio clip, choose Audio > Open Audio Clip, from the contextual menu, and select a .wav file. The audio clip displays in the FCurve pane as waveforms, and shows both left and right channels by default.



**Audio clip displays in the FCurves window. A. Right channel
B. Left channel**

The rest of this section describes the Audio options.

| Option | Description |
|--------------------|--|
| Open Audio Clip | Opens a file browser, which lets you select a .wav audio file to add to the FCurve pane. |
| Select Audio Clip | Lets you select previously loaded audio clips. |
| Select Audio Track | Lets you select from available audio tracks that were created in the Story settings. |
| Show Left Channel | Shows the left channel when activated, and hides the left channel when disabled. Both left and right audio channels are active by default. |
| Show Right Channel | Shows the right channel when activated, and hides the right channel when disabled. |

Filters window

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The Filters window lets you modify your animation data using filters. You can filter function curves and optical data.

Select Windows > Filters to open the Filters window.

Properties menu

The Properties menu lets you choose which animated properties are filtered. You can filter all properties, specific properties, or properties you select.

The Properties menu is contextual to the object that is selected. Any object that is animated has properties that can be filtered, but when you select certain objects, such as lights, object-specific options appear in the Properties menu. For example, if the Cone angle property for a light is animated, a Cone angle option appears in the Properties menu letting you filter only that property.

The Properties menu consists of the following common options:

- [Selected Properties](#) on page 800
- [All](#) on page 800
- [Lcl Translation](#) on page 800
- [Lcl Rotation](#) on page 800
- [Lcl Scaling](#) on page 800
- [Optical](#) on page 800

Selected Properties

When the Selected Properties option is active, the Filters menu displays filters based on the type of properties that are selected. This option is automatically selected when you select one or more animated properties in the FCurves, Properties, or Dopesheet window.

When this option is selected and you filter animation, the filter is applied only to the selected properties.

All

When you select the All option, every filter displays in the Filters menu. This option is automatically selected when you deselect every animated property, or when the FCurves, Properties, and Dopesheet windows are closed.

When you filter animation, the filter is applied to all properties.

Lcl Translation

When you select the Lcl Translation option, the Filters menu displays only the filters that can be applied on translation data. When you filter animation, only Translation properties are filtered.

Lcl Rotation

When you select the Lcl Rotation option, the Filters menu displays only the filters that can be applied on rotation data. When you filter animation, only Rotation properties are filtered.

Lcl Scaling

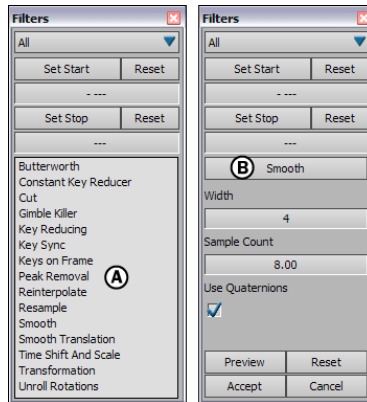
When you select the Lcl Scaling option, the Filters menu displays only the filters that can be applied on scaling data. When you filter animation, only scaling properties are filtered.

Optical

When you work in the Optical settings, the Optical option is automatically selected in the Properties menu and a list of filters that can be applied only to optical data (translation) display.

Filters menu

The Filters menu lists the available filters based on what you select to filter. Selecting a filter changes the layout to reflect the selected filter .



Filters window A. Filters menu displaying all filters B. Smooth is the selected filter in the Filters menu.

The following describes all the available filters in MotionBuilder:

- [Butterworth filter](#) on page 806
- [Constant Key Reducer filter](#) on page 806
- [Cut filter](#) on page 807
- [Gimbal Killer filter](#) on page 808
- [Key Reducing filter](#) on page 809
- [Key Sync filter](#) on page 809
- [Keys on Frame filter](#) on page 810
- [Peak Removal filter](#) on page 811
- [Reinterpolate filter](#) on page 811
- [Resample filter](#) on page 812
- [Smooth filter](#) on page 813
- [Smooth Translation filter](#) on page 814

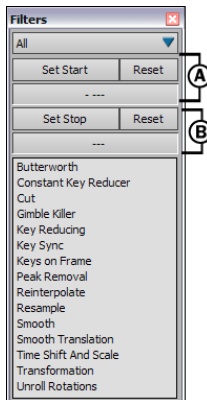
- [Time Shift and Scale filter](#) on page 815
- [Transformation filter](#) on page 816
- [Unroll Rotations filter](#) on page 816

Filter options

Depending on what you select to filter, different filters and options appear in the Filters window. The Start and Stop areas and the group of buttons (Preview, Reset, Accept, and Cancel) at the bottom of the Filters window are common to all filters.

Start and Stop

The Start and Stop areas (, A, B) in the Filters window let you define the region for filtering.



Filters window A. Start area B. Stop area

Set Start and Set Stop

The Set Start button sets the start of the filtering region to the current time, and the Set Stop button sets the end of the filtering region to the current time.

For example, if the Start value is 15 and the Stop value is 30, clicking the Set Start button when the current time is 0 changes the filtering region to begin

at 0 and end at 30. The Start value displays in the Start field, and the Stop value displays in the Stop field.



A. The Start field defines the start of the filtering region.

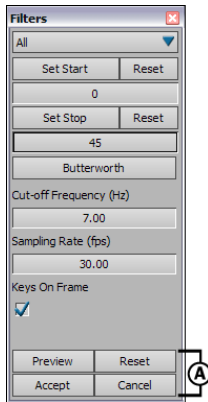
B. The Stop field defines the end of the filtering region.

Reset

The Reset button clears the Start or Stop field. When no values display in the Start or Stop fields, applying a filter affects the entire function curve.

Preview, Reset, Accept, and Cancel buttons

When you select any filter, the Preview, Reset, Accept, and Cancel buttons appear at the bottom of the Filters window. Use these buttons after defining the filtering area, selecting the filter, and, if necessary, selecting the properties to filter.



Filters window A. The Preview, Reset, Accept, and Cancel buttons

| Button | Function |
|---------|---|
| Preview | Lets you see the effects of a filter before you accept the filter. |
| Reset | Returns the animation to its original state without changing the Filter settings. |
| Accept | Lets you apply the filter to the animation. |
| Cancel | Aborts the filtering operation without changing anything. |

Filtering is often used to clean, manipulate, or modify motion capture data. For example, magnetic capture systems might generate noisy samples or localized distortions that require you to tweak the captured data. You can use filters and filtering options to manipulate captured data according to your own specifications.

To filter animation data, select the properties of the object you want to filter and the region or function curve you want to change in the FCurves window or Optical settings, then select and apply a filter.

- [Filters window](#) on page 799
- [Defining filter parameters](#) on page 805

Defining filter parameters

Most filters let you select which properties and regions you want to filter. You can also apply filters to entire function curves.

If you want to define a filtering region, enter a value in the Start and Stop fields of the [Filters window](#) on page 799, or drag in the Start and Stop fields to modify a value. You can also Spacebar-drag in the [FCurve pane](#) on page 765 to select a region. The start and end frames automatically display in the Start and Stop fields when a selection is made.

To apply a filter to an entire function curve, click Reset in the Start and Stop areas, or double-click an empty space in the FCurve or Optical panes to remove the current selection.

When both the Start and Stop fields are empty, applying a filter affects the entire function curve in the FCurve or Optical panes.

Butterworth filter

Averages all keyframes using intelligent low-pass smoothing. The Butterworth is a frequency filter that works best on curves affected by noise.

Unlike the Smooth filter (see [Smooth filter](#) on page 813), the Butterworth filter removes noise from data without affecting the FCurve's minimum or maximum values. In this way, the Butterworth filter avoids the “over-averaging” problems that can happen when filtering motion capture data.

When you select the Butterworth filter in the Filters window, you can set the following parameters:

Cut-Off Frequency

Lets you establish a limit frequency value, in Hertz (Hz). All frequencies higher than this value are cut. The lower the value, the more frequencies are removed, resulting in a much smoother curve.

Removing too many frequencies changes the shape of the curve.

Sampling rate

Lets you specify the sampling rate at which keyframes are added to the filtered curve. The default value is 30.

Keys on Frame

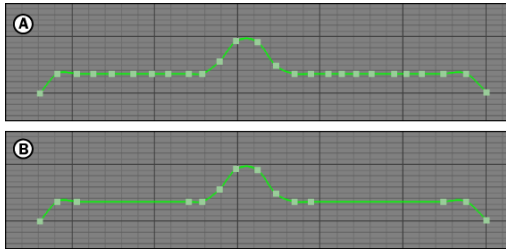
Snaps all keyframes to the nearest frame (see [Keys on Frame filter](#) on page 810).

■ [Filters window](#) on page 799

Constant Key Reducer filter

Reduces the number of keyframes by eliminating redundant keyframes.

For example, a function curve before applying the Constant Key Reducer filter has many keyframes. After applying the Constant Key Reducer filter, the number of redundant keyframes used by the function curve is reduced.



Key Synchronizing A. Original curve B. Constant Key Reducer filter applied

When you select the Constant Key Reducer filter in the Filters window, you can set the following parameters:

Keep At Least One Keyframe option

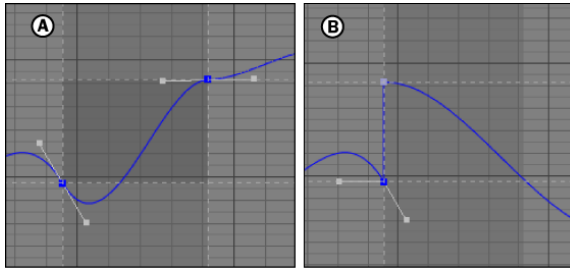
When your animation contains keyframes that all have the same value, using the Constant Key Reducer can remove all of these keyframes. Activating the Keep At Least One Keyframe option prevents this from happening.

■ [Filters window](#) on page 799

Cut filter

Cuts the selected region, keeps the first and last keyframes in the selected region, and offsets the last keyframe of the region to the same frame of the region. This is similar to deleting a region, but also adds an offset to data that follows the cut.

For example, after cutting the selected region in , the B keyframe moves to the same frame as the A keyframe, and the two keys are interpolated.



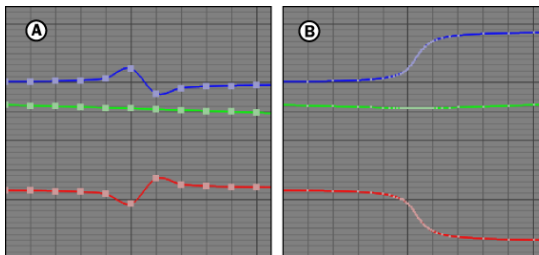
Cutting keys A. Original curve B. Cut applied

■ [Filters window](#) on page 799

Gimbal Killer filter

Visually compensates gimbal locking effects by adding additional keyframes to rotation function curves .

These additional keyframes compensate for sudden flipping or shaking caused by the interpolation between keyframes during large rotational changes. Gimbal lock is most often encountered when you plot animation onto the skeleton (bones) of your model.



Peak removal A. Original curves B. Gimbal Killer applied

■ [Filters window](#) on page 799

Key Reducing filter

Reduces the number of keyframes by eliminating unnecessary keyframes on entire curves. Key Reducing is designed to filter Cubic curves, but it can be used on other curve types.

When you select the Key Reducing filter in the Filters window, you can set the following parameters:

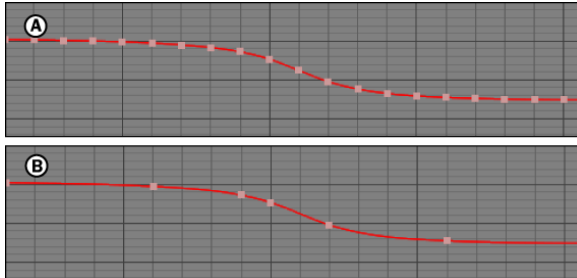
Precision

Lets you set a precision value. The default is 1. Greater values eliminate more keys, giving a less precise result, while lower values eliminate fewer keys giving a more precise result.

Key Sync

After keys are reduced, Key Sync adds a keyframe to all curves (X, Y, Z) for each key that is encountered (see [Reinterpolate filter](#) on page 811).

Avoid using the Key Reducing filter for rotations on a characters's feet since it may introduce offsets that change the motion, such as foot sliding.



Key reducing A. Original curve B. Key Reducing applied

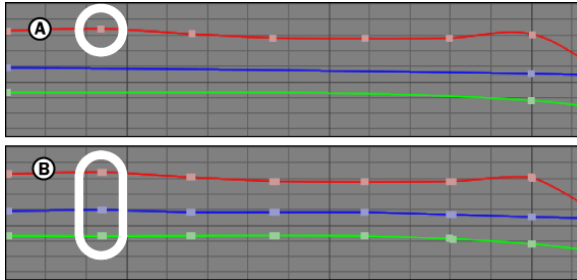
■ [Filters window](#) on page 799

Key Sync filter

Adds a keyframe to all curves (X, Y, Z) for each key that is encountered. For example, if a light has a keyframe set on its X translation function curve, a

keyframe is set on its Y and Z translation curves at exactly the same time. This synchronizes all keyframes on each of the object's function curves.

If you do not have all three (X, Y, and Z) of the attribute's curves selected, Key Sync has no effect.



Key synchronizing A. Original curve B. Key Sync applied

■ [Filters window](#) on page 799

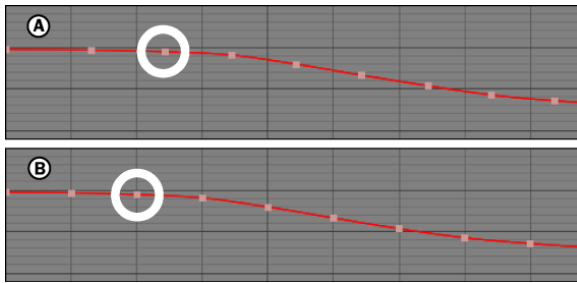
Keys on Frame filter

Snaps all keyframes to the nearest frame . If two keyframes exist for the same frame, Keys on Frame does not change them.

When you select the Keys on Frame filter in the Filters window, you can set the following parameters:

Frame Rate

Lets you set the filtering frame rate. Set this value to the same rate set in the Action timeline Frame Rate menu.

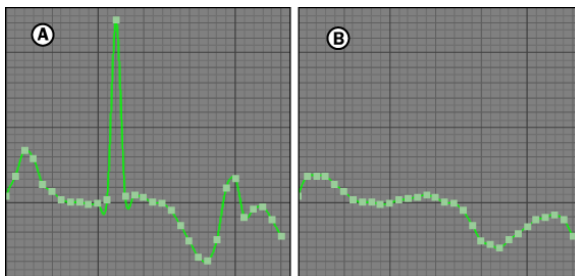


Keys on frame A. Original curve B. Keys on Frame applied

■ [Filters window](#) on page 799

Peak Removal filter

Replaces unwanted peaks and spikes with cubic keys that have an average value based on the neighboring keys .



Peak removal A. Original curve B. Peak Removal applied

■ [Filters window](#) on page 799

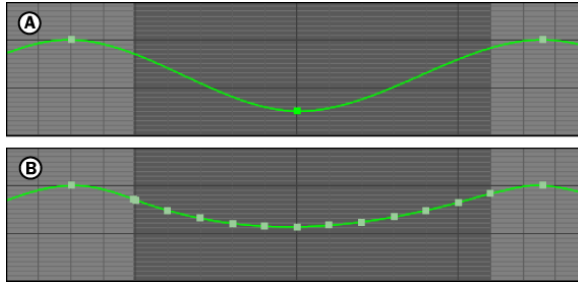
Reinterpolate filter

Replaces the selected region with a simple cubic curve . A keyframe is set at the beginning and end of the region, if one does not already exist. A smooth cubic curve joins these two keyframes and replaces all other keyframes in the region.

When you select the Reinterpolate filter in the Filters window, you can set the following parameters:

Resample and Resample Frame Rate

Resamples the selected region by creating keys on the curve (see [Resample filter](#) on page 812).



Reinterpolate A. Original curve B. Reinterpolate applied (with Resample)

■ [Filters window](#) on page 799

Resample filter

Resamples the selected region by creating keys on the curve .

When you select the Resample filter in the Filters window, you can set the following parameters:

Frame Rate

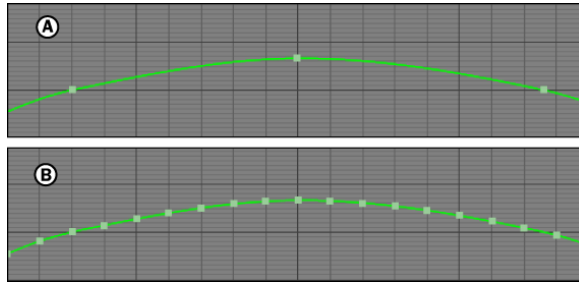
Lets you determine the amount of keys that are created. The equation works as follows:

Action timeline Frame Rate / Resample Frame Rate equals the frame rate at which keys are added.

For example, if your *Action timeline Frame Rate* is set to 30 FPS and you set the *Resample Frame Rate* to 15, the equation calculates a value of 2 ($30/15=2$). Therefore, a keyframe is added every 2 frames.

Keys on Frame

Snaps all keyframes to the nearest frame (see [Keys on Frame filter](#) on page 810).



Resample A. Original curve B. Resample applied

With Interpolation

Affects the key type and the tangent.

When activated, the With Interpolation option makes the interpolation of each FCurve keyframe equal to the interpolation of the nearest keyframe. Also, the Tangent mode for each created FCurve keyframe is set to match the tangent mode of the nearest keyframe.

When disabled, the With Interpolation option sets each created FCurve keyframe to Bezier Interpolation mode. It also sets each created keyframe's Tangent mode to auto.

NOTE Sometimes, when you activate the With Interpolation option, filtered keyframes produce inconsistent results.

■ [Filters window](#) on page 799

Smooth filter

Averages all keyframes to create smooth movement. Smooth works best when filtering cubic (auto) or resampled curves.

When you select the Smooth filter in the Filters window, you can set the following parameters:

Sample Count

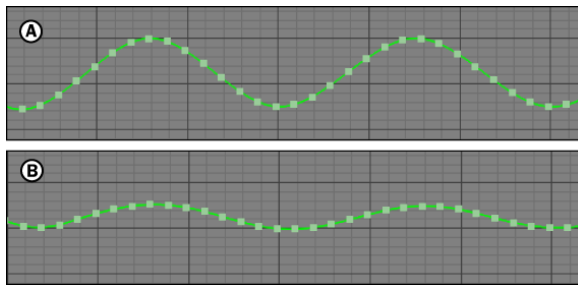
Lets you set the number of samples that are taken on the curve. The default value is 8.

Width

Lets you set the smoothing window width. The default value is 4. Greater values strengthen smoothing, while lesser values decrease smoothing.

Use Quaternions

Converts rotation curves to quaternions before smoothing. Quaternions are converted back to Euler curves after smoothing.



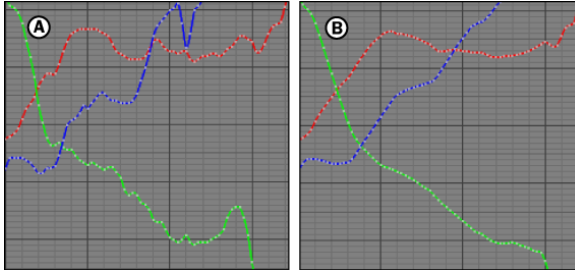
Smooth A. Original curve B. Smooth applied with Use Quaternions

■ [Filters window](#) on page 799

Smooth Translation filter

Like the Smooth filter, Smooth Translation averages all keyframes to smooth movement. Smooth Translation also smooths the curve motion by reducing the shaking of data.

Shaking (or “noise”) mostly occurs on translation data obtained with motion capture devices. Smooth Translation was specifically developed for smoothing translation curves .



Smooth Translation A. Original curves B. Smooth Translation applied

When you select the Smooth Translation filter in the Filters window, you can set the following parameters:

Width

Lets you set the smoothing window width. The default value is 8. Greater values strengthen smoothing, while lesser values decrease smoothing.

Factor

Lets you set the smooth multiplying factor. The default value is 1.5. Greater values decrease smoothing, while lesser values increase smoothing. Factor values normally range from 0-2.

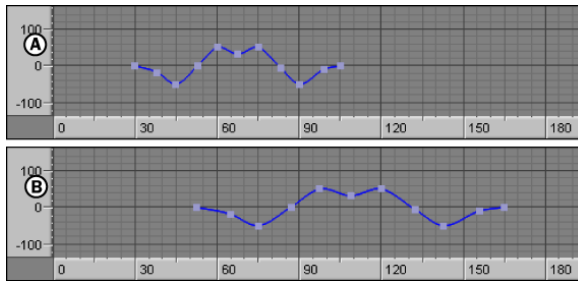
Sample Count

Lets you set the number of samples that are taken on the curve. The default value is 8.

■ [Filters window](#) on page 799

Time Shift and Scale filter

Changes the time and scale of selected function curves .



Time shift and scale A. Original curve B. Time Shift and Scale applied

When you select the Time Shift and Scale filter in the Filters window, you can set the following parameters:

Shift

Lets you select the number of frames by which you want to shift (offset in time) the curve.

Scale

Lets you select the scaling factor. This option only scales time, not value.

■ [Filters window](#) on page 799

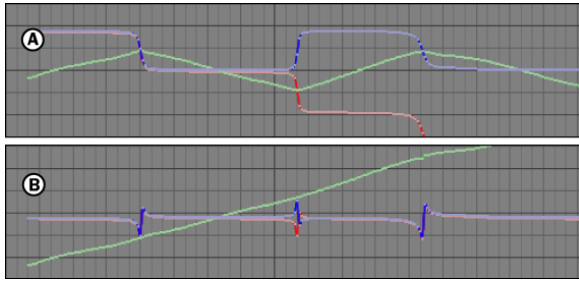
Transformation filter

Applies a translation, rotation, or scaling change to a selected function curve or region. You can choose which curves (X, Y, or Z) you want to manipulate using the Translation, Rotation, and Scaling options. The curve or region is resampled after a transformation.

■ [Filters window](#) on page 799

Unroll Rotations filter

Compensates for gimbal locking effects by unrolling rotations. Unroll Rotations is designed to clean motion capture data that contains large rotations which cause flipping or shaking in animations.



Unroll rotations filter A. Original curves B. Unroll Rotations applied

When you select the Unroll Rotations filter in the Filters window, you can set the following parameters:

Quality

Lets you manipulate the algorithm that affects the path of rotation curves. The default value (.25) concentrates on the Y curve path . Tweak the Quality value to manipulate the path of the X, Y, and Z rotation curves.

Path

Select Path to enable the Quality field. When Path is disabled, the Unroll Rotations filter searches for and cleans sudden jumps in the Y rotation curves.

■ [Filters window](#) on page 799

Animating with Constraints

This section is about MotionBuilder constraints. In the real world, we are surrounded by constraints; for example gravity constrains us to the ground, or a dog is constrained by the length of his leash.

To simulate these limits in the 3D animation world, these relationships between objects must be established by the animator.

Constraints are tools used to create relationships between objects. You can use constraints to make a character pick up an object, have a camera follow a character, manipulate other objects in relation to each other or use the keyboard or mouse to trigger events.

This section covers MotionBuilder constraints, their settings, properties, and how you can use them to create relationships with models and animation.

This section covers the following topics:

- [3 Points constraint](#) on page 839
- [Aim constraint](#) on page 845
- [Chain IK constraint](#) on page 851
- [Expressions constraints](#) on page 863
- [Mapping constraint](#) on page 897
- [Multi-Referential constraint](#) on page 901
- [Parent-child constraint](#) on page 909
- [Path constraint](#) on page 915
- [Position constraint](#) on page 927
- [Range constraint](#) on page 933
- [Relations constraints](#) on page 937

- [Rigid Body constraint](#) on page 1001
- [Rotation constraint](#) on page 1007
- [Scale constraint](#) on page 1013

Constraints basics

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In the real world, we are surrounded by constraints; for example gravity constrains us to the ground, or a dog is constrained by the length of his leash.

To simulate these limits in the 3D animation world, these relationships between objects must be established by the animator.

Constraints are tools used to create relationships between objects. You can use constraints to make a character pick up an object, have a camera follow a character, or use the keyboard or mouse to trigger events. For example, in the image below, a lantern is constrained to the character's hand, so that however he moves his arm, the lantern follows.



The lantern is constrained to the character's hand.

Another way to think of constraints is that they are a restriction of the translation, rotation, and other data of an object based on the position, translation, rotation, and other data of another object. So, in the image above, the transformation information of the character's hand informs the behavior of the lantern.

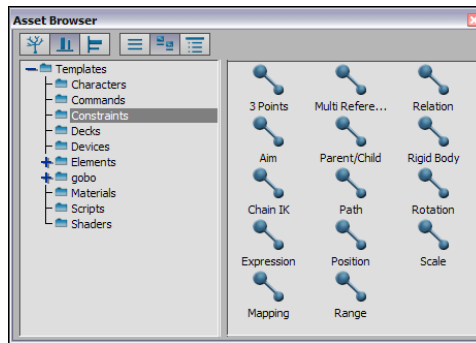
The equation $x < 3$ is a mathematical constraint of the variable x , limiting it to any value smaller than 3.

You can use these limits to simulate real-world relationships between objects. For example, the constraint on a dog attached to a five-foot leash is $X < 5$, meaning that x , representing the dog's area of motion, must be less than 5, which is the full length of the leash. This simple constraint ensures that your dog behaves like it is on a leash.

Similar constraints can be used to restrain a model's arm motion to an area defined by the shoulder joint, and so on. In fact, the whole Control rig is actually a series of many constraints. The rig's hand is constrained by the motion of the arm, which is constrained by the elbow joint, which in turn is constrained by the upper arm, and so on.

Each of these connections form complex relationships that work to create a recognizable simulation of the human body in motion.

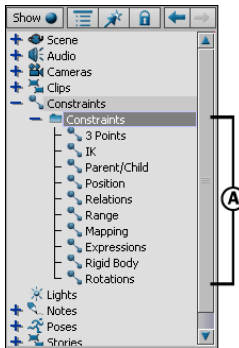
In the Asset browser, the Constraints folder lets view and access constraint assets you can add to your scene.



Asset browser: Constraints folder

Constraints in the Scene browser

The Scene browser in the Navigator window lists all the constraints used in the scene. This is where you add and remove constraints.



Constraints in the Scene browser.

You can add a constraint to your scene by right-clicking the Constraints folder in the Scene browser and selecting Insert Constraint from the contextual menu.

Import and export of constraints

Constraints can be exchanged between MotionBuilder and Maya using the FBX file format.

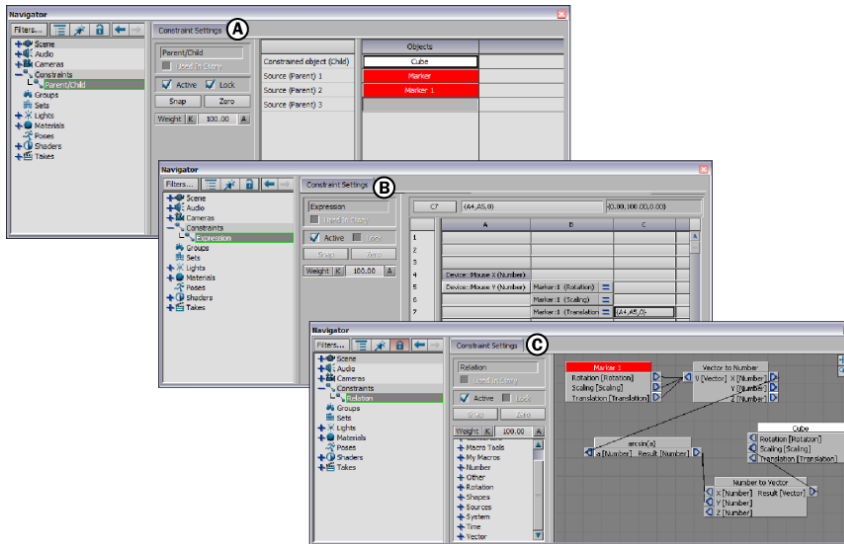
For example, you can import a Parent constraint created in Maya or into MotionBuilder and vice-versa.

Adding a constraint asset

Constraint types

Since you can use constraints to make anything from simple relationships to complex mathematically-based constructs that generate random variables to subtly affect objects, there are three different types of constraints you can use, depending on your approach:

- a simple fill-in-the-blanks formula found in the Navigator window (A). Most constraints are of this basic type.
- a mathematical spreadsheet-style system called Expression constraints.
- a graphical approach called Relations constraints where you “connect the dots” by drawing connections between the data, represented by boxes



Constraint types: A. Simple constraint B. Expressions constraint C. Relations constraint

Adding a constraint asset

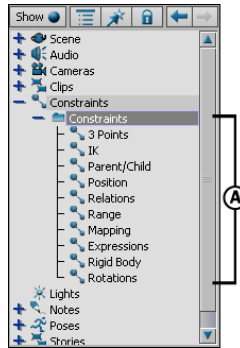
To create constraints between objects you must first add a constraint to your scene.

To add a constraint asset:

- 1 Select a constraint asset in the Asset browser, and drag it into the Viewer window.

If you drag the constraint on top of an object in the Viewer window, a contextual menu appears asking you if you would like to constrain the object or set it as a source object in the constraint. If you drag the constraint into an empty

The Navigator window displays the Constraint settings, and the constraint is added to the Scene browser.



Scene browser A.
Constraints folder

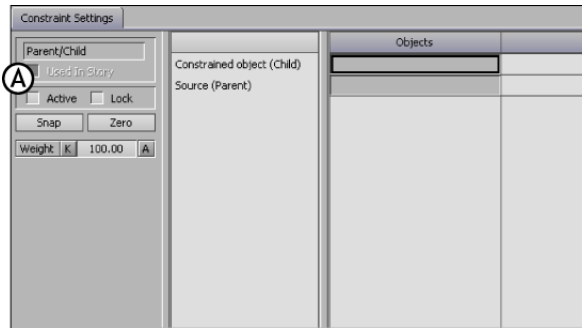
A new folder named “Constraints” appears in the Scene browser, with the new constraint added, and the Navigator window displays the Constraint settings.

- 2 Alt-drag objects from the Viewer window or Scene browser and assign them to the appropriate object cells in the constraint settings.
- 3 Click Active to activate the constraint. The objects move to accommodate the constraint.
- 4 You can make the following adjustments to the positioning and offset of objects:
 - You can create a blend between the constrained object’s original position and its constrained position by activating the constraint and adjusting the Weight values. See [Creating and removing constraint offsets](#) on page 829.
 - You can retain the constrained object’s base position so that it maintains the same position in relation to the source object by clicking Snap before activating the Active option. Clicking Snap also activates the constraint, but with the offset retained. See [Snap button](#) on page 834.
 - You can zero the constraint offset by clicking Zero. This locks the constrained object and disables the Source object’s offset values in the Properties window.

Common constraint settings

Activating a constraint

To activate a constraint, click the Active option in the Navigator or Properties window's Constraints settings.



Relations constraint A. Active option.

Activating the constraint changes the position of the object being constrained, for example, when you activate a Range constraint, the constrained object moves on top of the source object when Active is enabled.

To “turn off” the constraint, you can disable the Active option.

Common constraint settings

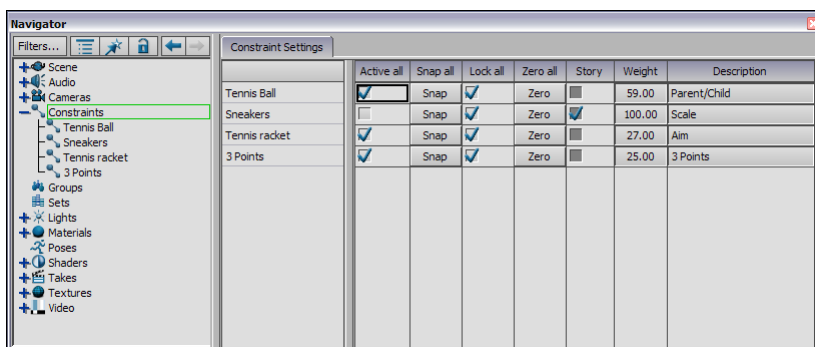
Setting basic constraint commands in the Root folder

You can use the constraint root folder to Activate, Snap, Lock, Zero, View in Story, and set Weighting for multiple constraints at the same time.

The Constraints root folder is like a table of contents that lets you view constraints settings all at once, rather than opening each individual constraint.

To set commands in the constraints Root folder:

- 1 Select the Constraints folder in the Scene browser to display the contents of the folder in the Constraint settings.



Constraints Root folder

- 2 Set basic commands in the Constraints Root folder, such as Activate, Snap, Lock, Zero, View in Story, and set Weights for each constraint in the Folder, without needing to open the constraint.

For more on these basic commands see [Common constraint settings](#) on page 832.

Common constraint settings

Grouping constraints

Create Constraints folders in the Scene browser to group your constraints. For example, you can use one folder to coordinate constraints for a model's facial animation, and another folder with all of the constraints affecting a light.

To group constraints into folders:

- 1 Add a new constraint folder by right-clicking the Constraints folder in the Scene browser.
- 2 Selecting Insert Folder from the contextual menu.
- 3 Drag constraints from the Scene browser or the Asset browser into the new folder.

Remove a constraint folder by right-clicking it and selecting Delete from the contextual menu.

NOTE Deleting a folder does not remove the constraints within it. Instead, they are added to the Constraint root directory in the Scene browser.

Common constraint settings
Changing constraint priority
Constraint types

Changing constraint priority

Constraints are applied from top to bottom in the Constraints Root folder in the Scene browser. That is, constraints at the bottom of the list are applied last.

To change a constraint's priority:

- 1 In the Scene browser, drag the constraint above or below the other constraints.

If two constraints affect the same model, the constraint closest to the bottom overrides any earlier constraints. However, two separate constraints can influence different properties of a model. For example, if you create a Relations constraint to change the rotation of a cube, and follow it with a Position constraint to change the marker's position, the marker is rotated using the first constraint and translated using the second constraint. If the second constraint was a Rotations constraint, it would override the Relations constraint.

Common constraint settings

Duplicating constraints

To duplicate constraints:

- 1 Right-click a constraint in the Scene browser and select Duplicate from the contextual menu.

The new, cloned constraint is added at the end of the Scene browser's Constraints folder. Constraints can be copied into different Constraints folders.

The new constraint is given the same name as the original, plus a sequential number. For example, if your constraint is called "Arm", the duplicate constraints are called "Arm1", "Arm2", and so on.

- 2 Rename a Constraints folder by right-clicking it and selecting Rename from the contextual menu.

RELATIONS.fm|Creating Macro relations

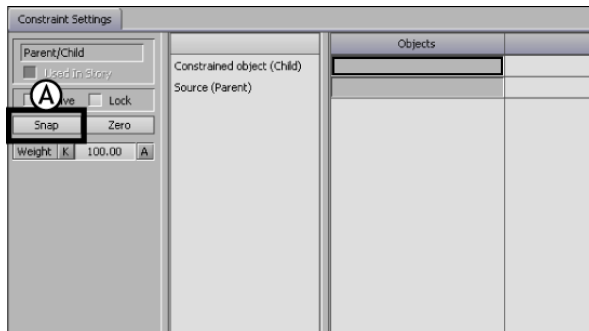
Setting basic constraint commands in the Root folder

Creating and removing constraint offsets

Activating a constraint zeros the constrained (child) object's translation, rotation, or scaling to match that of its source (parent) objects. You can reposition your objects to create a more appropriate offset.

To create a constraint offset:

- 1 Arrange the objects in your constraint.
- 2 Click Snap to create an offset between the position, rotation, or scale of the constraint and the current position of the object being constrained.



Parent/Child constraint A. Snap button

- 3 Activate the Lock option so the constrained object is frozen in position and cannot be transformed.

To remove a constraint's offset:

- 1 Disable the Active, and Lock (if applicable) options in the Constraints Settings.
- 2 Re-position your objects.

- 3 Click Snap to reestablish the constraint's new offset.
- 4 Activate the Lock option so the constrained object cannot be moved.

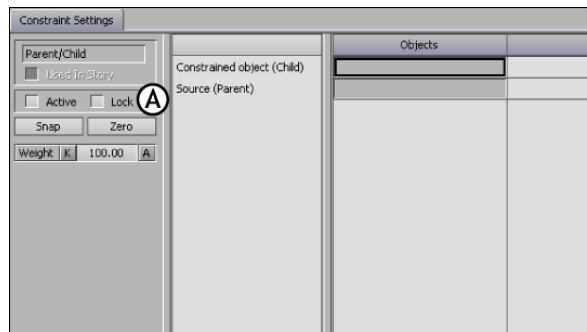
Locking the position of a constrained object

Lock a constraint to make sure that the position and rotation of its constrained object does not change after the constraint is active. This can be useful in complex scenes where you do not want to move constrained objects accidentally.

NOTE You cannot lock Expression or Rotations constraints.

To lock the position of a constrained object:

- 1 In the constraints setting for the appropriate constraint, make sure the constraint is activated.
- 2 Activate the Lock option. This locks the position or rotation of the constrained object.



Parent/Child constraint A. Lock option

To reposition locked objects:

- 1 Disable the constraint's Active and Lock options.
- 2 Transform the object and click Snap
- 3 Activate the lock Option.

Weighting constraints

Use the weight values in a constraint to moderate a source object's influence on the constrained object.

NOTE While all constraints can be weighted, individual weight settings apply only to the Aim, Parent/Child, Rotation, Scale, and Chain IK constraints. See [Aim constraint settings](#) on page 847, [Parent-child constraint settings](#) on page 913, [Rotation constraint settings](#) on page 1010, [Scale constraint settings](#) on page 1015, and [Chain IK constraint settings](#) on page 855 for information on these constraints' other settings.

To weight source objects:

- 1 Double-click to select the constraint in the Scene browser. The constraint settings display in the Properties or Navigator window.
- 2 Adjust the Weight values until you achieve the desired effect.

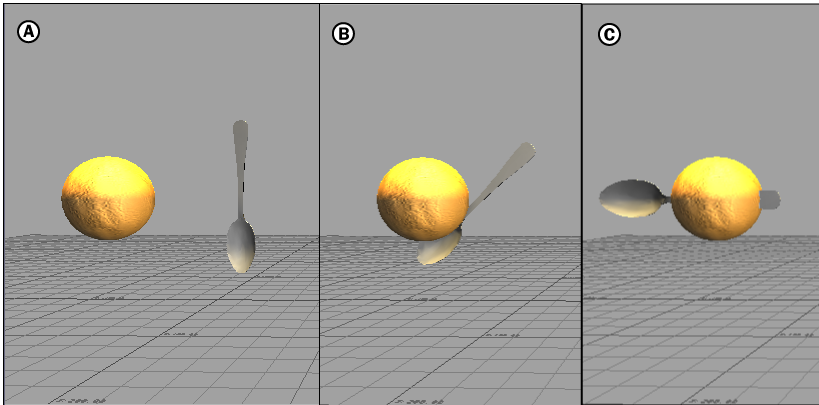
See [Blending constraints](#) on page 831 for more on changing weight values.

Weight setting

Blending constraints

Use the Weight setting to control the level of activity of the constraint and create constraint “blends”. The default Weight value is 100%, meaning that the constraint is fully active.

A weight value of 50% indicates that the affected constraint is half as active, and a value of 0% would make the constraint completely inactive.



A. 0% weighting (the constraint is inactive) B. 50% weighting C. 100% weighting

For example, if you set the weight for a Position constraint at 50%, the position of the [constrained object](#) on page 1759 is halfway between its original position and the position of its source object.

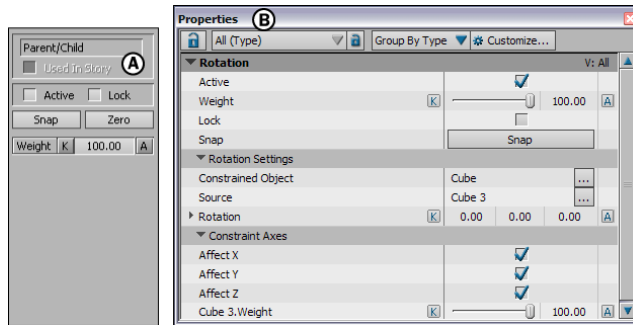
The Weight value can also be animated or used in a Relations constraint.

NOTE The Story window can be used to perform the same function on multiple constraints. See [Story clips](#) on page 1549.

`_STORY_CLIPS_MANIP.fml`Cross-blending Story clips

Common constraint settings

The Constraint settings contain controls that let you activate, offset, lock, and set other factors that govern the behavior of your constraints. These features are found in both the Navigator and Properties window constraint settings (, A and B).



Constraint settings A. Navigator window B. Properties window

Constraint Type field

The Constraint Type field shows the kind of constraint that is selected, for example “Relations” or “Position”. This is useful if you have renamed the constraint, as it always shows you what kind of constraint it was originally.

Used In Story indicator

The Used In Story indicator displays if the current constraint is used by the Story window. The Story window lets you schedule when constraints are active.

By changing a constraint’s status when it is active, you can simulate changes in a character’s environment, switch and blend between different constraints, and fade constraints in and out.

Active option

Enable Active if activating the constraint changes the position of the object being constrained. For example, when you activate a Range constraint, the constrained object moves on top of the source object when Active is enabled.

Lock option

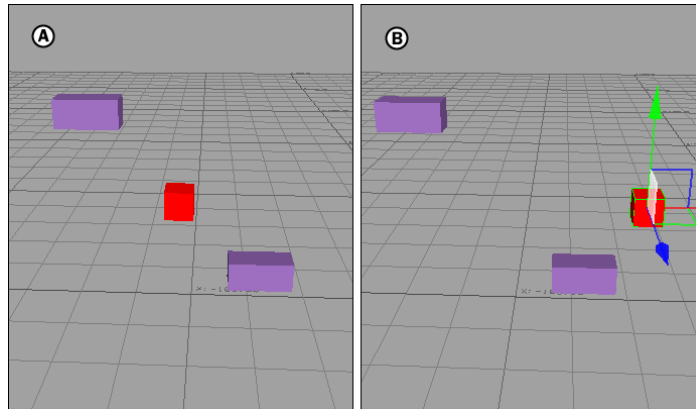
Activate Lock to lock the position or rotation of the constrained object. This locks the constrained object so you cannot move it while the constraint is activated.

NOTE Relations and Expressions constraints do not use the Lock button.

For example, in a Position constraint where two markers influence the position of a third marker, you can translate the third marker after the constraint is

activated. You can do this in order to add a local offset to the constrained object.

Once you have applied an offset to the constrained object, activate the Lock option to save the offset. If you disable the constraint, translate the constrained object, then activate the constraint again. The constrained object returns to the position it was in when you originally enabled the Lock option. This is illustrated below.



You can move the constrained object after activating the constraint.
A. Before activating the constraint B. After activating the constraint.

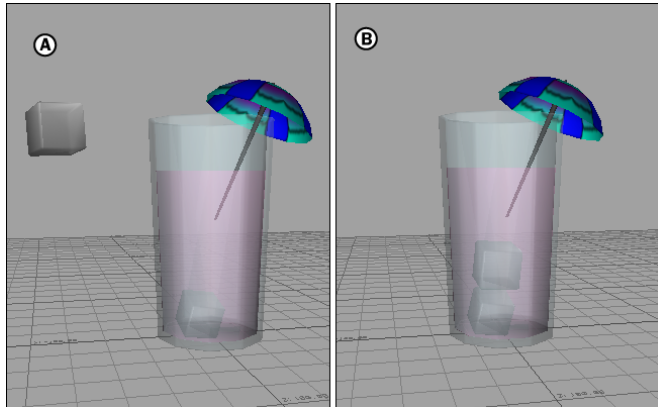
NOTE When you lock a constraint, you cannot use any of the other constraint options such as Snap or Zero. No translation or rotation of the constrained object is allowed as long as the constraint is active.

Locking a constraint stops you from accidentally moving an object, which would prove unfortunate if you had spent time fine-tuning its position or rotation.

If you have plotted data to a model used in a constraint, it is recommended that you disable the constraint. Otherwise, the source object controls the model and not the model's data.

Snap button

Click Snap to create an offset between the position, rotation, or scale of the constraint and the current position of the object being constrained. Snap is used when repositioning the constrained object and adding offsets.



Snap example A. The ice cube in a parent/child constraint before Snap is activated B. The ice cube after Snap is activated, inside the glass.

When you click Snap, the constraint is activated, but the offset between the constrained object's current translation and rotation and its constrained translation and rotation is kept. This is useful when you want to activate a constraint, but you do not want to change its current position or rotation.

When a constraint is active, you can translate and rotate the constrained object to change its local offset. Click Snap to save the new offset. Disable the constraint, translate the constrained object, and then activate the constraint again. The constrained object returns to its position from the last time you clicked the Snap option.

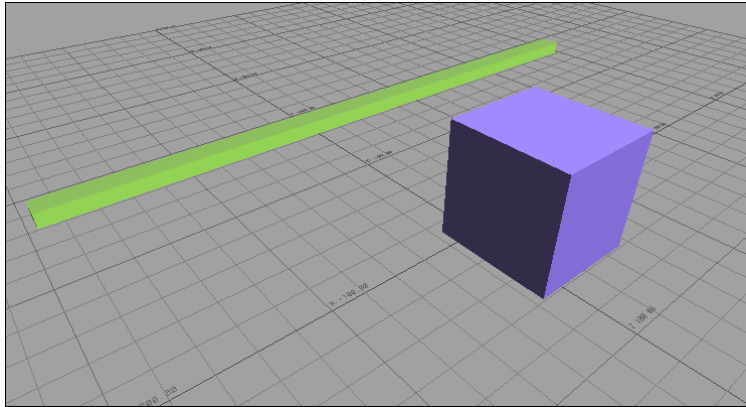
Snap and the Chain IK constraint

Clicking Snap with a Chain IK constraint does not move Pole objects. If you set the Chain IK Pole Type to Object in the Chain IK settings' Pole Type menu manually overrides the Pole Vector, causing the chain to flip or move after Snap is activated.

Zero button

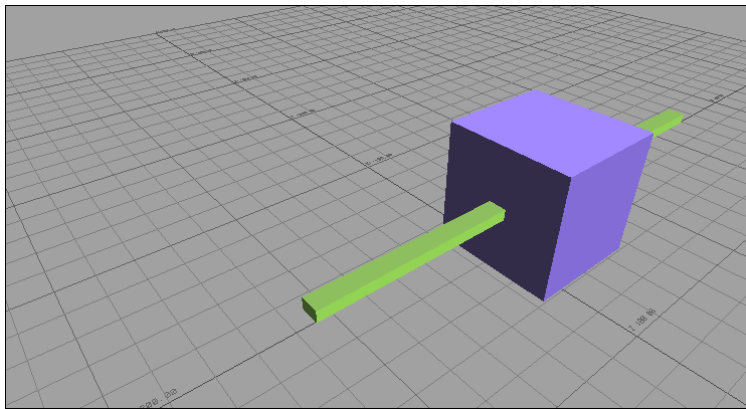
Click Zero to remove the translation and rotation offset between the source and the constrained object.

For example, if two markers are constrained using the Position constraint, an offset is established between the markers.



A cube is constrained and offset from its source object, the rod.

If you click the Zero option for this constraint, the offset is removed and the constrained object is placed at the position of the source object.



Click Zero to remove the offset and align the axes to the cube and rod.

Zero works only with constraints that use source and constrained objects.

NOTE Relations and Expressions do not use the Zero button.

Weight setting

Use the Weight setting to control the level of activity of the constraint and create constraint “blends”. The default Weight value is 100%, meaning that the constraint is fully active.

A weight value of 50% indicates that the affected constraint is half as active, and a value of 0% would make the constraint completely inactive.

For example, if you set the weight for a Position constraint at 50%, the position of the constrained object is halfway between its original position and the position of its source object.

The Weight value can also be animated or used in a Relations constraint.

The Story window can be used to perform the same function on multiple constraints.

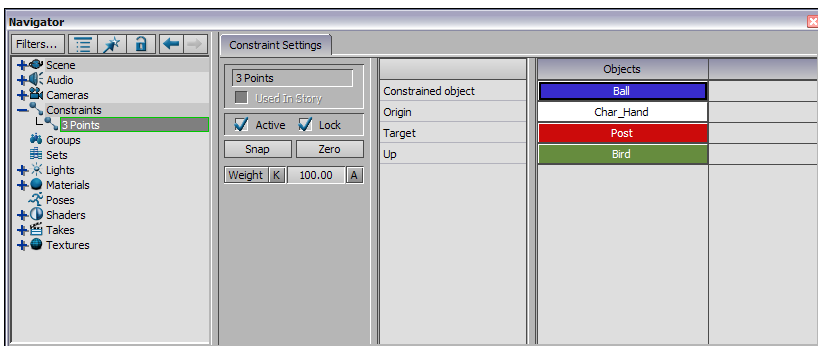
Locking the position of a `x_Glossary.fml` constrained object

Creating and removing constraint offsets

3 Points constraint

55

The 3 Points constraint is a rotations constraint where the position of three objects is used to constrain the rotation of another object.

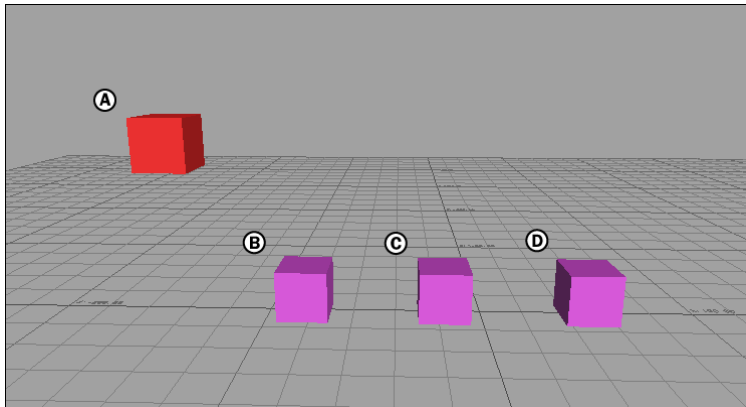


3 Points constraint

When you perform optical motion capture, only the translation of each sensor is captured. Optical sensors do not send rotation information.

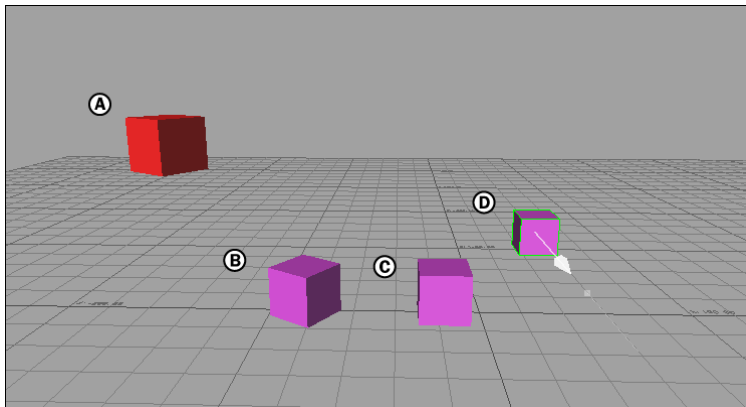
However, the rotation of a limb, for example, can be derived based on the translation of three sensor positions. For more on Optical motion capture, see [Optical motion data](#) on page 1195.

When you first activate or snap the Rotation From 3 Points constraint, it aligns the constrained object's X-axis with the vector defined by the Origin and Target sources. The constraint then attempts to align the Y-axis of the constrained object to point towards the Up source.



3 Points constraint A. Constrained object B. Up source object C. Origin source object D. Target source object.

In the following graphic, the cube A is the constrained object. When you move any of the three cubes (the sources) after the constraint is active, the X, Y, and Z rotation of the constrained object changes.



3 Points constraint activated: Translating B, C, and D rotates the constrained object (A) in various directions.

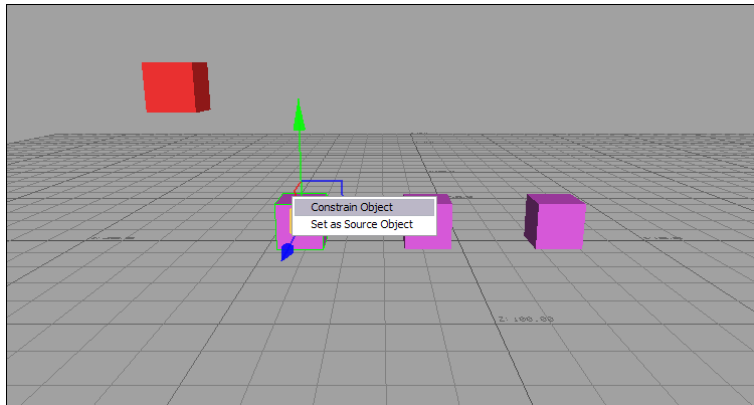
NOTE If you rotate or scale the source objects, it does not alter the constrained object.

Constraining an object's rotation with another object

You can use the 3 Points constraint to constrain the rotation of an object with the position of three objects.

To constrain an object's rotation with the 3-Points constraint:

- 1 Select a 3-Points constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
 - If you drag it into an empty area of the Viewer window, the 3-Points constraint template appears in the Constraint settings.
 - If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source (parent) or Constrained (child) object.



Constraint contextual menu

- 2 Assign the object whose rotation on which you want to base the position and movement of three source objects to the Constrained Object cell.
- 3 Assign the object whose position affects the pivot point of the constrained object to the Origin cell.

NOTE You can specify the same asset, model, or marker as the Origin and the constrained object.

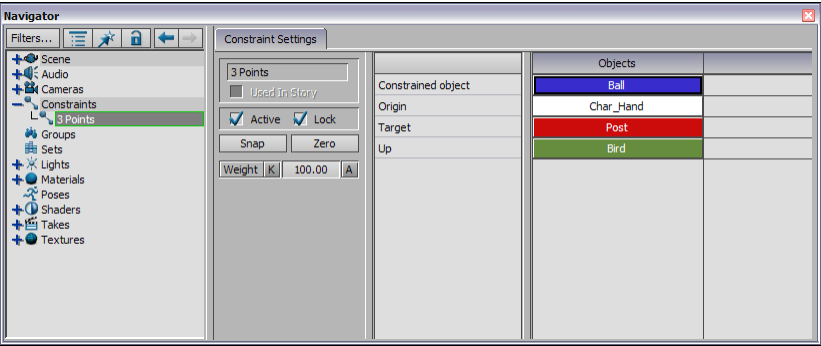
- 4 Assign the object whose position affects the rotation of the constrained object to the Target cell.
- 5 Assign the object whose position affects the roll of the constrained object to the Up cell.
- 6 Click Lock in the Constraint settings to lock the position of the objects to be constrained.
- 7 Click Active to activate the constraint.

NOTE Rotating or scaling the source objects does not alter the constrained object.

■ [3 Points constraint settings](#) on page 842

3 Points constraint settings

Use the 3 Points constraint to use the position of three objects to constrain the rotation of another object.



3 Points constraint

The 3 Points constraint requires the following objects:

Constrained object

An asset, model, or other object whose rotation is based on the position and movement of three source objects (Origin, Target, and Up).

Origin

An asset, model, or marker whose position affects the pivot point of the constrained object. You can specify the same asset, model, or marker as the Origin and the constrained object.

Target

An asset, model, or marker whose position affects the rotation of the constrained object.

Up

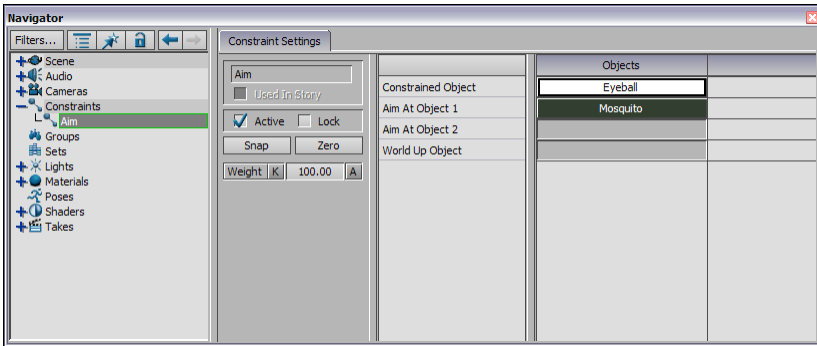
An asset, model, or marker whose position affects the roll of the constrained object.

■ [3 Points constraint](#) on page 839

Aim constraint

56

The Aim constraint governs an object's orientation so that the object points to other objects, much the same as camera interest. For example, you can use the aim constraint to point a light at an object or group of objects, or with character setups, to set a locator that you can use to control eyeball movement.



Aim constraint

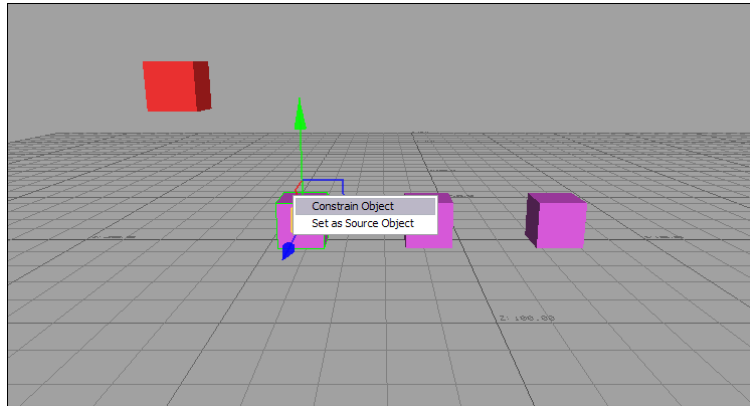
- [Aim constraint settings](#) on page 847
- [Making objects point at other objects](#) on page 845

Making objects point at other objects

You can use the Aim constraint to modify an object's orientation so that the object points to other objects.

To use the Aim constraint to orient objects:

- 1 Select an Aim constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
 - If you drag it into an empty area of the Viewer window, the Aim constraint template appears in the Constraint settings.
 - If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as one of the constraint's operators.



Constraint contextual menu

- 2 Assign the object that you want to aim to the Constrained object (child object) cell.
- 3 Assign the objects that you want set as a target for the aimed object to the Source (parent object) cell.

TIP You can have more the object divide its aim between multiple objects by Alt-dragging them to the resulting Source cells.

- 4 Click Lock in the Constraint settings if you want to maintain the current offset between the source and target.
- 5 Click Snap.
- 6 Click Active to activate the constraint.

- [Aim constraint](#) on page 845

Constraining individual axes (Aim constraint)

You can constrain an individual axis with the Aim constraint. For example you can have the child object only affected on its Y-axis.

To constrain an axis with the Aim constraint:

- 1 Double-click the Aim constraint in the Scene browser to select it.
- 2 Open the Properties window. The Aim constraint settings display.
- 3 Expand Constraint Axes and disable the X, Y, or Z axis for the desired translation effect you want to inhibit.
- 4 To reactivate the unconstrained axes, activate the option.

Setting the rotation offset for an Aim constraint

To set a rotation offset with the Aim constraint:

- 1 Expand the constraints folder in the Scene browser and double-click the Aim constraint.
- 2 In the Properties window, expand Aim settings.
- 3 Set the Rotation Offset X, Y, or Z for the parent object you want to affect.

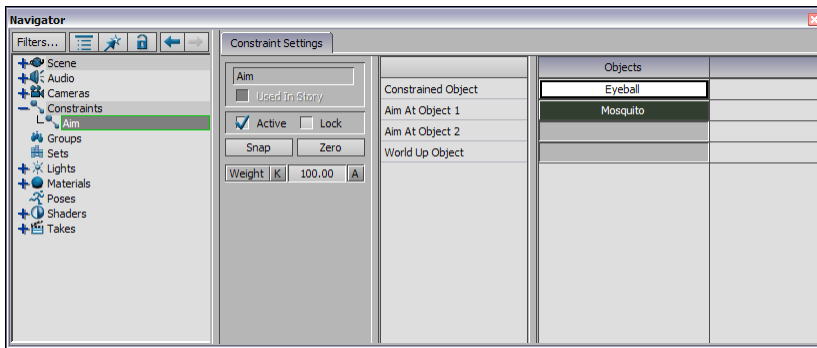
NOTE If the numbers are disabled, click Lock in the Aim constraint settings.

You can key and animate this offset by activating the Key and Animate buttons next to each setting you modify.

- [Aim constraint](#) on page 845
- [Making objects point at other objects](#) on page 845

Aim constraint settings

Use the Aim constraint to make an object point in the direction of another object, creating an effect similar to a camera interest.



The Aim constraint

The Aim constraint requires the following objects:

Constrained object

An asset, model, or other object whose orientation derives from the Aim At Object(s) position. Also known as the “child” object.

Aim at object(s)

Object from which the position of the constrained object is derived. You can have multiple Aim At objects for this constraint.

World Up object

Lets you select an asset, model, or other object whose orientation defines the Up rotation for the object.

NOTE It is not necessary to specify a World Up Object for the Aim constraint to function.

Properties settings

The following Aim constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

| Properties window setting | Function |
|---------------------------|--|
| Aim Vector | Lets you set a specific XYZ axis for the constrained object to orient towards. Ex- |

| Properties window setting | Function |
|---------------------------|--|
| | Expand Aim Vector to view the individual X, Y, and Z axes. |
| Up Vector | Lets you set a specific XYZ axis for the object whose orientation defines the Up rotation for the object. Expand Up Vector to view the individual X, Y, and Z axes. |
| Rotation Offset | Lets you set a specific XYZ offset for the object whose orientation defines the Up rotation for the object. Expand Rotation Offset to view the individual X, Y, and Z axes. |
| World Up Type | An asset, model, or other object whose orientation defines the Up for the object. See World Up type settings on page 850 for information about what objects you can specify as a World Up Type. |
| Up Vector | Lets you specify an X, Y, or Z coordinate for the Up Vector. |
| World Up Object | Lets you assign an asset, model, or other object whose orientation defines the Up for the constrained object. This is the same setting as the World Up Object cell in the Navigator window Aim constraint settings. This setting is active when either Object Up or Object Rotation Up is selected at the World Up Type. |
| Constraint Axes | Activate the Affect X, Y, or Z axis option to assign which axis the Aim constraint takes effect on. |
| [Object] Weight | Adjust the Weight setting(s) to set the amount of influence the Source object has |

| Properties window setting | Function |
|---------------------------|--|
| | over the constrained objects, letting you create constraint “blends”. Each Aim At object has a Weight slider so you can modify its offset. |

- [Aim constraint](#) on page 845
- [Making objects point at other objects](#) on page 845

World Up type settings

You can specify an asset, model, or other object whose orientation defines the Up for the object as your World Up type object.

| World Up type | Description |
|--------------------|--|
| Scene Up | Specifies the direction of the world up vector relative to the scene's axis. |
| Object Up | Lets you use a specific object in the scene influence the rotation of the constrained object. To set an object, select the Aim constraint, expand the World UP Object asset list, and select an object in the scene. |
| Object Rotation Up | When World Up Type is Object Up, this is the object from which the World Up Vector is derived. |
| Vector | Activates the WorldUpVector values where you can specify a precise X, Y, or Z coordinate of the world up vector. |
| None | Specifies no World Up Vector for the constrained object. |

Chain IK constraint

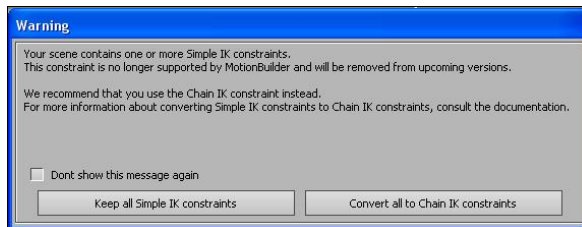
57

This constraint lets you use Inverse Kinematics to constrain the movement of a chain. This is done by calculating the position of the IK effector in relation to the root node of the joint chain, and rotating all the joints so that the end node reaches the IK effector's position.

- [Chain IK constraint settings](#) on page 855
- [Using Chain IK to constrain a chain of bones](#) on page 853

Simple IK constraint conversion

The Simple IK constraint is no longer available in MotionBuilder. It is strongly recommended that you convert Simple IK constraints as they will no longer be developed in future versions of MotionBuilder.



Simple IK constraint warning

If the Simple IK constraint warning appears when you load a scene, you can do one of the following:

- Select **Convert all to Chain IK constraints** to convert your Simple IK constraints immediately. Doing this ensures that no conversion is needed in future versions of MotionBuilder.

- Select Keep all Simple IK constraints if you do not wish to convert the constraint. MotionBuilder recognizes this constraint, but in the next version of MotionBuilder it will be automatically transformed into a Chain IK constraint.

Earlier Simple IK constraints are automatically converted to Chain IK constraints. The Chain IK constraint is similar to the Simple IK constraint, but with additional control.

Simple IK conversion process

When a Simple IK constraint is converted into a Chain IK constraint the following occurs:

- Objects are re-assigned in the corresponding object list properties.
- The solver type is switched to ikRPsolver.
- The constraint snaps so it can calculate the pole vector and twist angle.

A new floor property has been created for the Chain IK constraint so that it can interpret converted Simple IK constraint behaviors correctly.

Limitations

- Because the iKRP solver is used, chains may be solved differently in some situations.
- Certain conversions of the Simple IK constraint into a Chain IK constraint cause inconsistencies in the Twist values of the Chain IK constraint.
- Effector offsets are not supported. Unlike the Simple IK constraint, the Chain IK constraint does not create offsets between the end joint and the effector. With the Chain IK constraint, the end joint always reaches the effector.

NOTE You can recreate the original offset behavior by adding a Null child-object to the end point and then using it as the end point.

- The Pole Vector may cause the chain to flip.

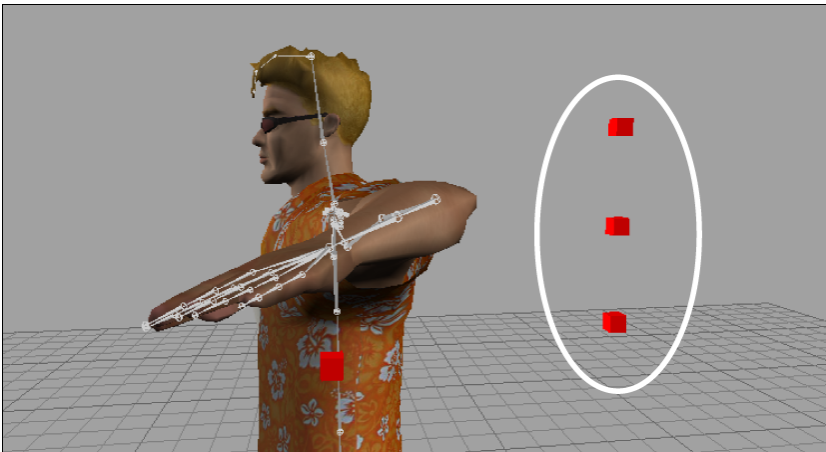
TIP If the chain flips when it should not, adjust the Pole Vector to fix the problem. You can also try changing the solver type to ikSCsolver or tweaking the Twist value.

- When the End Point is not a direct child of the Last Limb object, the conversion process of the Simple IK constraint to a Chain IK constraint makes the first child of the Last Limb object become the End Joint object for the Chain IK constraint. This causes the End Joint to reach the effector, creating a different result.

TIP To recreate the original Simple IK behavior, create a Null and make it a child of the original Last Limb object. Set it at the position of the original End Point object, and use it instead as the End Joint object of the Chain IK constraint.

Multiple Pole Vector objects

When you assign multiple objects to be the Pole Vector, the vector is drawn from a calculation of the Pole objects' average position, as illustrated in the following figure.



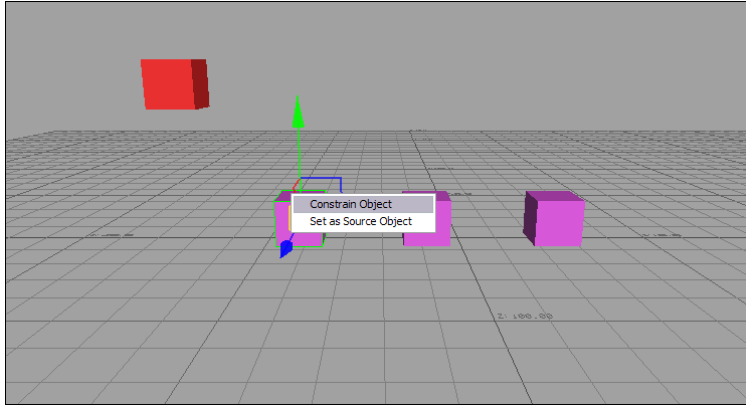
(Circled) Pole Vector objects.

Using Chain IK to constrain a chain of bones

The Chain IK constraint lets you use Inverse Kinematics to constrain the movement of a chain.

To constrain a chain of bones with the Chain IK constraint:

- 1 Select a Chain IK constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
- If you drag it into an empty area of the Viewer window, the Chain IK settings appear in the Constraint settings.
 - If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as one of the constraint's operators.



Constraint contextual menu

- 1 Assign the objects that you want to be the first and last nodes in the IK chain to the First Joint and End Joint cells.
- 2 If you have a node that branches to more than one node, drag a node into the Effector cell to specify which one is the End Joint.
- 3 If you want, assign an object to be the aim of the chain to the Pole object cell.
- 4 Click Snap to activate the constraint without moving the constrained objects, or click Active to activate the constraint.

NOTE If you are using IkRPSolver, rotating the effector object does not alter the constrained object. See [Solver Type](#) on page 857 for more information.

- [Chain IK constraint settings](#) on page 855

Creating Pole offsets for the Chain IK constraint

You can use the Pole offset settings found in the Chain IK constraint to change the Pole's position. These values are added to the Pole object's position.

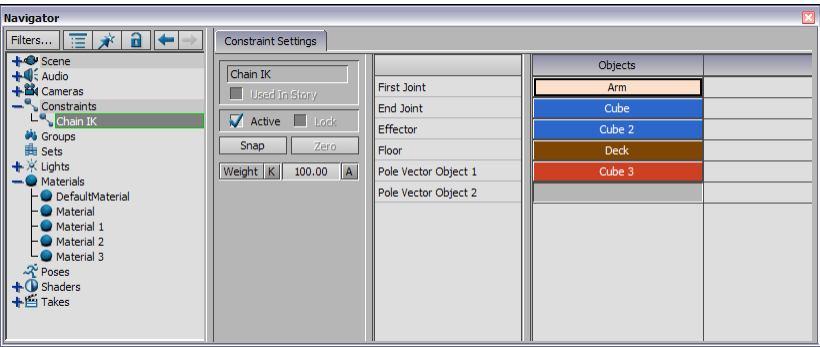
To create a Pole offset:

- 1 Double-click the Chain IK constraint in the Scene browser to select it.
- 2 Open the Properties window. The constraint settings display.
- 3 Expand IK Settings > Pole Offset and set a value in the Pole Offset X, Y, or Z fields for the desired effect.

Chain IK constraint settings

The Chain IK constraint uses Inverse Kinematics to constrain the movement of the elements in a bone chain, or hierarchy, so that the end node reaches toward the position of another object, defined as the object assigned to the constraint's Effector cell.

For more on configuring elements of the bone chain, see [Chain IK properties](#) on page 860.



Chain IK constraint

First Joint

The first node or the root of the IK chain.

End Joint

The last node in the IK chain.

Effector

The object that the IK chain tries to reach. Clicking Snap in the constraint settings moves the effector object to the position of the last node of the chain.

Pole Object I

The Pole object is used to specify an object that the chain is to aim at. For example, in a leg chain, you can use an object to orient the bending of the knee in a specific direction.

NOTE You can assign multiple Pole objects and weight their influence independently.

Properties settings

The following Chain IK constraint settings are found only in the Properties window:

First Joint

Use the Asset list to select a First Joint. The first node or the root of the IK chain. This is the same setting as the First Joint cell in the Chain IK constraint settings.

End Joint

Use the Asset list to select an End Joint, the last node in the IK chain. This is the same setting as the End Joint cell in the Chain IK constraint settings.

Effector

Use the Asset list to select an Effector, the object that the IK chain tries to reach. This is the same setting as the Effector cell in the Chain IK constraint settings.

Setup

Click the Setup button to re initialize the solver.

Solver Type

There are two solver types: ikRPSolver and ikSCSolver.

| Solver Type | Description |
|-------------|--|
| ikRP Solver | Lets you use and customize a Pole Vector. RP stands for "Rotation Plane". Uses a Pole Vector or Pole Object to orient the chain. Scaling the effector object does not alter the constrained object. |
| ikSC Solver | Lets you adjust the orientation of the bone chain. SC stands for "Single Chain". Uses the rotation of the effector to orient the chain instead of a Pole Vector or Pole Object. Scaling the effector object does not alter the constrained object. |

Twist

Lets you adjust the difference in orientation between the reference plane and the joint chain plane.

NOTE The Twist settings are only available when ikRPSolver is set as the Solver Type.

Pole Type

Lets you specify whether a specific vector or the position of the pole object computes the vector.

NOTE The Pole Type menu is available only when ikRPSolver is set as the Solver Type.

Pole Vector X/Y/Z

Lets you specify the absolute point in space at which the chain is aiming.

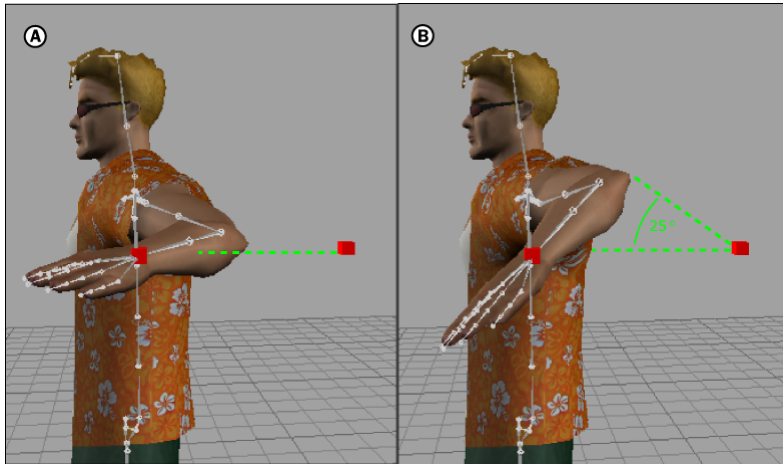
NOTE The Pole Vector XYZ fields are available only when ikRPSolver is set as the Solver Type, and the Pole Vector Type is set as Vector. Click Snap to set the Pole Vector so the chain does not move and automatically computes the Pole Vector.

Pole Object

Use the Asset list to select a Pole Vector Object(s). This is the same setting as the Pole vector object cell in the Chain IK constraint settings.

Pole Offset X/Y/Z

Use this setting to offset the Pole relative to the Pole object's position.



Pole Vector offset A. No offset B. Y-value offset to 25 degrees

NOTE This property can only be used with the ikRP solver using a Pole object.

Evaluate TS Anim menu

Lets you select a method for the Chain IK constraint to evaluate Translation and Scaling animation of each object in the chain.

Evaluating Translation and Scaling animation is done by pre-solving the IK chain at every frame, which causes significant delays in performance.

| Setting | Description |
|---------|---|
| Never | Does not calculate translation or scaling animation on the chain. This method is fastest, and is recommended if you need the constraint only to calculate chain rotation or have a very complex chain. Select this option when there is no translation or scaling animation on any object in the chain, or you do not want the solver to take the translation and scaling animation into consideration. This provides you with consistent and fast CPU performance. If there is any Translation or Scaling animation on the nodes, the chain will not reach its effector. |
| Auto | Detects if there is Translation or Scaling animation and pre-solves it so that the chain always reaches its effector. This option is the default setting. By selecting this option, rendering performance may vary during playback depending the detection of Translation and Scaling animation. |
| Always | Always pre-solves the constraint so that the chain reaches its effector. Select this option to ensure consistent but slow, CPU performance. |

If you have a scene with many IK chains that have translation and scaling animation, you may want to use the Never setting while you work on another part of the scene to benefit from the increased performance, reserving the Always setting for when you play back the whole scene.

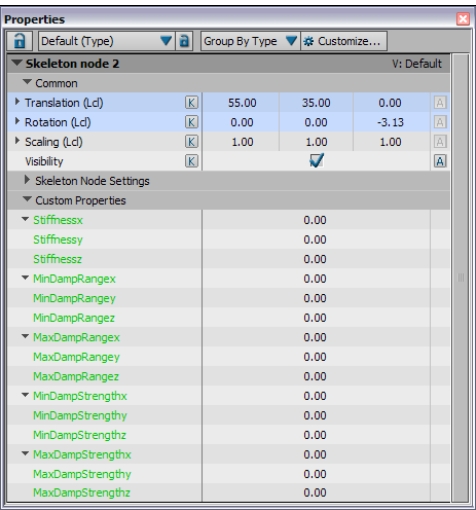
SourceObject.Weight

Use this setting to give different amounts of influence to pole vector objects.

■ [Using Chain IK to constrain a chain of bones](#) on page 853

Chain IK properties

The following Chain IK constraint properties are included with bones when you use the Chain IK constraint:



Chain IK constraint bone properties

Rotation Stiffness

Specifies the current node's resistance to movement.

Damp Min Range X/Y/Z

Sets an angle used by the IK chain to create resistance for joint movement when it approaches the lower boundary (the minimum) of its limits.

Use these settings to create slow joint motion until the joint reaches its movement limits, creating a gradual stop. Use Damp Min Strength to set the rate of deceleration.

NOTE You must have Degrees of Freedom (DOF) set in order to use this property.

Damp Max Range X/Y/Z

Sets an angle used by the IK chain to create resistance for joint movement when it approaches the upper boundary (the maximum) of its limits.

Use these settings to slow joint motion until the joint reaches its movement limits, creating a gradual stop. Use Damp Max Strength to set the rate of deceleration.

NOTE You must have Degrees of Freedom (DOF) set in order to use this property.

Damp Min Strength X/Y/Z

Used by the IK chain to create resistance to joint movement as it approaches the lower boundary, or minimum, of its limits.

Use these settings to define the Damp Min Range's deceleration.

Damp Max Strength

Damp Min Strength is used by IK to create resistance to joint movement as it approaches the upper boundary, or maximum, of its limits.

Use these settings to define the Damp Max Range's deceleration.

Preferred Angle X/Y/Z

Lets you specify an angle you want each joint to assume by default.

Click Snap in the Chain IK constraint settings to set all nodes to their current rotation value.

NOTE These settings work only with chains containing more than two bones.

Set Preferred Angle

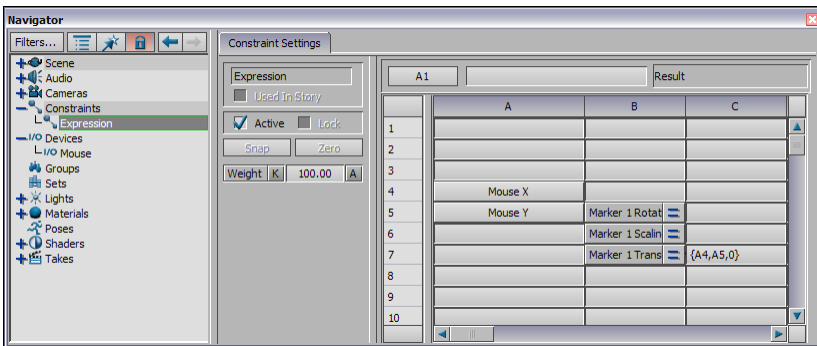
Resets the bone to the angle specified in the Preferred Angle settings.

NOTE This setting is individual to each bone.

Expressions constraints

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Expressions constraints, also known as Expressions, are similar to Relations constraints in that you create them to suit your needs, but instead use a spreadsheet-style interface to construct the expression. This spreadsheet interface is called the Expressions pane.



Expressions pane

The Expressions pane lets you use a more mathematical, and less graphic, method of constraining objects. This can be useful if you are familiar with commonly-used spreadsheet programs.

With an Expressions constraint, you enter data in cells instead of linking them together with connectors, as you do with Relations constraints. Once these elements are combined, they create an Expressions constraint that can be applied to a model.

Similar to Relations constraints, the Expressions method is useful for complex relationships, but in this case, they are helpful for creating more mathematically-based relationships.

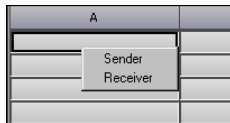
- [Creating an Expressions constraint](#) on page 864
- [Expressions pane](#) on page 865

Creating an Expressions constraint

The Expressions pane lets you use a more mathematical, and less graphic, method of constraining objects.

To create an Expressions constraint:

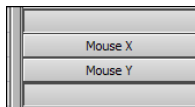
- 1 Drag the Expression constraint asset into the Viewer window from the Asset browser.
The Navigator window displays the Expressions pane, and the constraint is added to the Scene browser.
A new folder named “Constraints” appears in the Scene browser, with the new folder named Expressions added, and the Navigator window displays the Expressions pane.
- 2 *Alt*-drag assets and devices from the Viewer window and Scene browser into the Expressions pane.
- 3 A dialog box appears asking you if you want to create the expression as a Sender or a Receiver.



Sender/Receiver dialog box

- Select Sender to create the Expression as a Sender that transmits data
- select Receiver to create the expression as a Receiver that is influenced by the data transmitted from the Sender.

Each of the object's properties are split into separate cells.



Dragging the mouse device into the Expressions pane splits its properties into separate cells.

- 4 Double-click a cell and type a value to set a value in a cell.
- 5 Right-click in the cell and select a new data type from the Data editor to change the cell to a vector or another numerical type.
Edit a cell's value by dragging left or right to increase or decrease the value.

- Setting basic constraint commands in the Root folder
- [Expressions reference](#) on page 870

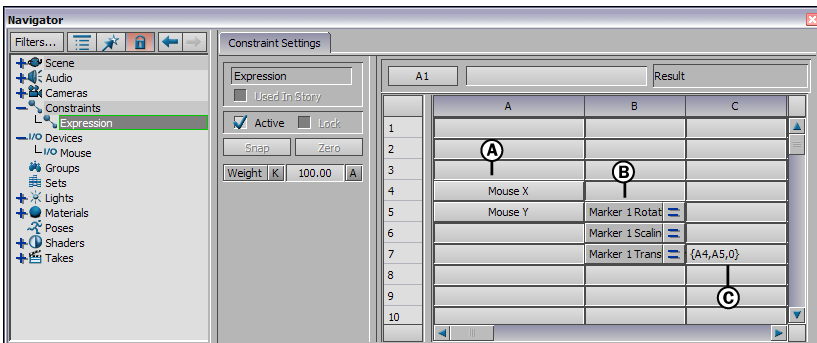
Navigating the Expressions pane

The Expressions pane contains a total of 100 rows and 26 columns (A-Z).

- Change the width of a column by dragging the border of the column heading.
- Scroll the Expressions pane by Shift-click-dragging.
- [Creating an Expressions constraint](#) on page 864

Expressions pane

The Expressions pane contains a total of 100 rows and 26 columns (A-Z).



Expressions constraint A. Sender Cells B. Receiver Cells C. Expression

Types of cells

When constructing Expressions constraints, a cell may contain one of the following:

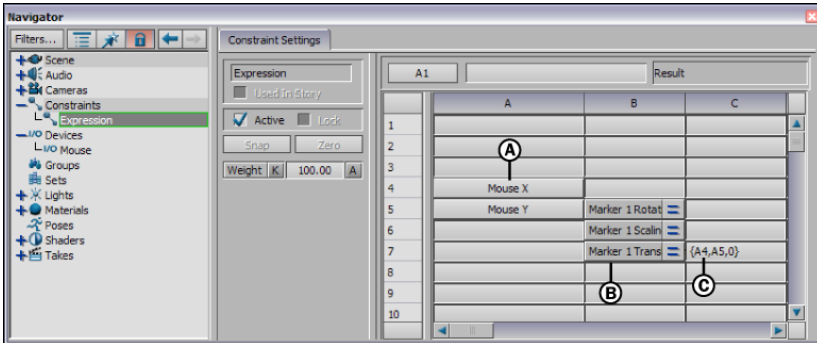
| Cell Type | Purpose |
|-------------|---|
| Senders | A Sender can be an input device or a model. Senders are used to send data to other cells. Senders only send data. |
| Expressions | An Expression is a recognized keyword that performs a mathematical operation using the cells or numbers within its parentheses or on either side of its operator. For example, an addition symbol (+) is an operator. The result of the operation is assigned to the Receiver cell to the left and to the cell itself. This means that you can reference the cell in other expressions. |
| Values | A cell may also contain a value referenced by an expression or Receiver. Before assigning a value to a cell, you should select the cell's data type. |
| Receivers | A Receiver cell assigns the results of an expression to the properties of a model or an output device. |

- [Creating an Expressions constraint](#) on page 864
- [Navigating the Expressions pane](#) on page 865
- [Expressions reference](#) on page 870

Expressions constraints settings

When an Expressions constraint is selected, the Constraint settings display the Expressions pane, a spreadsheet where you construct the expression.

Expressions constraints let you constrain the translation, rotation, scaling, and other data of an object (models, lights, cameras, and so on) with that of another object. Unlike other constraints, you construct your own Expressions constraints using a spreadsheet-like interface called the Expressions pane.



Expressions constraint A. Sender Cells B. Receiver Cells C. Expression

The Expressions pane spreadsheet gives you a mathematical method of constraining objects, as opposed to the Relations pane, which offers a more graphical approach.

An Expression is comprised of at least three cells. One cell contains a reference to a Sender while the other two cells are split into a Receiver cell and a mathematical expression cell.

An Expression constraint constrains the translation, rotation, scaling, and other data of an object (models, lights, cameras, and so on) with that of another object.

The following conventions are used to describe each type of expression used in an Expressions constraint:

Number

Refers to a numerical value or a cell that contains a numerical value.

Vector

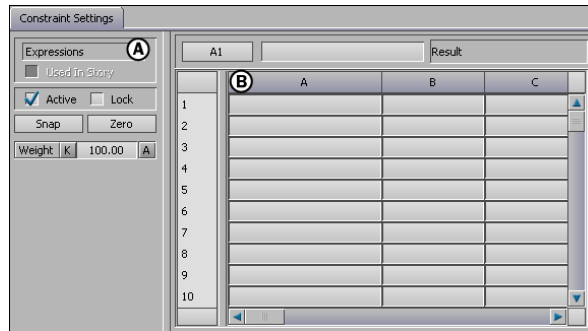
Refers to a vector (X, Y, Z) or a cell that contains a vector value.

Boolean (or Bool,)

Refers to a Boolean value (0 or 1) or a cell that contains a Boolean value.

An Expression constraint consists of at least three cells. One cell contains a reference to a Sender while the other two cells are split into a Receiver cell and a mathematical expression.

The cell sending the data can refer to an input device such as a mouse device, and the object receiving data can be a model, light, or an output device. For example, shows a mouse mapped to a marker in the Expressions pane.



Expressions constraint A. Objects area B. Expressions pane

Between the Sender and Receiver, a mathematical expression is used to convert the numerical data from the X and Y mouse values to a vector.

You can use an unlimited amount of mathematical expressions between the Sender cell and the Receiver cell.

■ [Creating an Expressions constraint](#) on page 864

Data cells in Expressions constraints

Different properties may have different types of numeric fields. Make sure that when you reference cells you reference them with the proper numeric type.

The Expressions pane includes the following conversion syntax for converting between numbers and vectors:

D7[0]

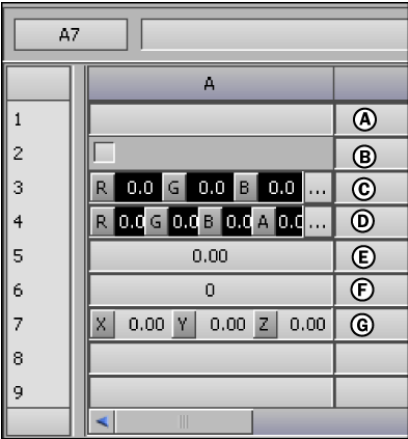
Extracts the value of the X co-ordinate of the vector in cell D7. Use 1 and 2 for the Y and Z co-ordinates respectively.

{A4,A5,0}

Uses the number in cell A4 as the X co-ordinate, and the number in A5 as the Y co-ordinate in a vector.

Data Types

There are seven possible data types shown in the Data editor:



Different data cell types **A. Default** **B. Boolean** **C. Color** **D. ColorAndAlpha** **E. Number** **F. Time** **G. Vector**

| Data Type | Description |
|-----------|--|
| Default | Changes the data type to the default numerical value expressed as 0.00. Vectors and colors are expressed as {0.00,0.00,0.00,0.00}. |
| Bool | Changes the data type to a Boolean value (represented by a check box). This value is true (1.00) when the box is checked, and false (0.00) when it is not. |
| Color | Changes the data type to an RGB color vector. Separate data cells appear for each coordinate, and show the coordinate's |

| Data Type | Description |
|---------------|---|
| | color. Each coordinate holds a decimal value between 0 and 1. |
| ColorAndAlpha | Changes the data type to an RGBA color vector. Similar to the Color data type, but with an additional data cell for the Alpha channel. |
| Number | Changes the data type to 0.00. When switching from vectors and colors, the new number cell takes the first coordinate. |
| Time | Changes the data type to time code (000:00:00:00 (00)). |
| Vector | Changes the data type to an X, Y, Z vector. Separate data cells appear for each coordinate. When switching from a number cell, the number is placed in the vector's first coordinate. |

■ [Creating an Expressions constraint](#) on page 864

Expressions reference

This section lists the Expressions supported by MotionBuilder. Each is shown with an example that you can use as a guide when building your own Expressions.

Converters

The following expressions can be used as Converters:

HSB TO RGB

| | |
|----------|------------------|
| Converts | HSB to RGB mode. |
|----------|------------------|

HSB TO RGB

| | |
|--------|---------|
| Syntax | HSB2RGB |
|--------|---------|

NUMBER TO COLOR ALPHA

| | |
|----------|-----------------------------------|
| Converts | Four numbers into a color vector. |
|----------|-----------------------------------|

| | |
|--------|-------------------|
| Syntax | number2coloralpha |
|--------|-------------------|

NUMBER TO VECTOR

| | |
|----------|-----------------------|
| Converts | A number to a vector. |
|----------|-----------------------|

| | |
|--------|---------|
| Syntax | num2vec |
|--------|---------|

RGB TO RGBA

| | |
|----------|-------------------|
| Converts | RGB to RGBA mode. |
|----------|-------------------|

| | |
|--------|----------|
| Syntax | RGB2RGBA |
|--------|----------|

RGB TO HSB

| | |
|----------|------------------|
| Converts | RGB to HSB mode. |
|----------|------------------|

| | |
|--------|---------|
| Syntax | RGB2HSB |
|--------|---------|

RGBA TO RGB

| | |
|----------|-------------------|
| Converts | RGBA mode to RGB. |
|----------|-------------------|

RGBA TO RGB

| | |
|--------|----------|
| Syntax | RGBA2RGB |
|--------|----------|

SECONDS TO TIME

| | |
|----------|---------------------------------------|
| Converts | A number of seconds to a time format. |
|----------|---------------------------------------|

| | |
|--------|--------------|
| Syntax | seconds2time |
|--------|--------------|

TIME TO SECONDS

| | |
|----------|--|
| Converts | A time format to a number of seconds. Use the time2seconds expression to convert time to a number of seconds in an Expressions constraint. |
|----------|--|

| | |
|--------|--------------|
| Syntax | time2seconds |
|--------|--------------|

Logical functions (Boolean)

The following are expressions of logical functions:

AND

| | |
|---------|-------------------------------------|
| Returns | TRUE if all its arguments are TRUE. |
|---------|-------------------------------------|

| | |
|--------|---|
| Syntax | and(number1, number2) Number1 and number2 should be logical values. |
|--------|---|

EQUAL

| | |
|---------|----------------------------------|
| Returns | TRUE if its arguments are EQUAL. |
|---------|----------------------------------|

EQUAL

| | |
|--------|--|
| Syntax | number1 = number2 (number, number) Number1 and number2 are the numbers that you want to test. |
|--------|--|

GREATER

| | |
|---------|---|
| Returns | TRUE if the first argument is greater than the second argument. |
|---------|---|

| | |
|--------|---|
| Syntax | number1 >= number2 (number, number) Number1 and number2 are the numbers that you want to test. |
|--------|---|

GREATER OR EQUAL

| | |
|---------|---|
| Returns | TRUE if the first argument is greater than or equal to the second argument. |
|---------|---|

| | |
|--------|---|
| Syntax | number1 >= number2 (number, number) Number1 and number2 are the numbers that you want to test. |
|--------|---|

IF

| | |
|-----------|----------------------------|
| Specifies | A logical test to perform) |
|-----------|----------------------------|

| | |
|--------|--|
| Syntax | if (test, value1, value2)Test is any value or expression that can be evaluated to TRUE or FALSE. Value1 is the value that is returned if test is TRUE.Value2 is the value that is returned if test is FALSE. |
|--------|--|

IS BETWEEN

| | |
|--------|--|
| Checks | Checks if one value is between two others) |
|--------|--|

IS BETWEEN

| | |
|--------|-----------|
| Syntax | isbetween |
|--------|-----------|

LESS

| | |
|---------|--|
| Returns | TRUE if the first argument is less than the second argument) |
|---------|--|

| | |
|--------|--|
| Syntax | number1 < number2 (number, number) Number1 and number2 are the numbers that you want to test. |
|--------|--|

LESS OR EQUAL

| | |
|---------|--|
| Returns | TRUE if the first argument is less than or equal to the second argument. |
|---------|--|

| | |
|--------|---|
| Syntax | number1 <= number2 (number, number) Number1 and number2 are the numbers that you want to test. |
|--------|---|

NAND

| | |
|---------|--------------------------------------|
| Returns | FALSE if all its arguments are TRUE. |
|---------|--------------------------------------|

| | |
|--------|---|
| Syntax | nand(number1, number2)Number1 and number2 should be logical values. |
|--------|---|

NOR

| | |
|---------|--------------------------------|
| Returns | FALSE if any argument is TRUE. |
|---------|--------------------------------|

NOR

| | |
|--------|--|
| Syntax | <code>nor(number1, number2)</code> Number1 and number2 should be logical values. |
|--------|--|

NOT

| | |
|---------|-------------------------------------|
| Purpose | Reverses the logic of its argument. |
|---------|-------------------------------------|

| | |
|--------|---|
| Syntax | <code>not(number)</code> Number is a value or expression that can be evaluated to TRUE or FALSE. If number is FALSE, NOT returns TRUE.if number is TRUE, NOT returns FALSE. |
|--------|---|

NOT EQUAL

| | |
|---------|--------------------------------------|
| Returns | TRUE if its arguments are NOT EQUAL. |
|---------|--------------------------------------|

| | |
|--------|---|
| Syntax | <code>number1 <> number 2</code> (number 1, number 2)Number1 and number2 are the numbers that you want to test. |
|--------|---|

OR

| | |
|---------|-------------------------------|
| Returns | TRUE if any argument is TRUE. |
|---------|-------------------------------|

| | |
|--------|---|
| Syntax | <code>or(number1, number2)</code> Number1 and number2 should be logical values. |
|--------|---|

Mathematical expressions

The following are mathematical expressions:

DISTANCE

| | |
|---------|---|
| Purpose | Finds the distance between two vectors. |
|---------|---|

DISTANCE

| | |
|--------|--|
| Syntax | distance(vector1, vector2)Point1 and point2 should be two positions in 3D space. |
|--------|--|

DISTANCE NUMBERS

| | |
|-------|---------------------------------------|
| Sends | The distance between the two numbers. |
|-------|---------------------------------------|

| | |
|--------|--------------------|
| Syntax | SetDistanceNumbers |
|--------|--------------------|

GO TO BEGIN

| | |
|---------|--|
| Purpose | When triggered (the value is changed from 0 to 1), the Transport Controls move to the start of the take. |
|---------|--|

| | |
|--------|----------------|
| Syntax | Gotobegin (A2) |
|--------|----------------|

GO TO END

| | |
|---------|--|
| Purpose | When triggered (the value is changed from 0 to 1), the Transport Controls move to the end of the take. |
|---------|--|

| | |
|--------|----------------|
| Syntax | GotoEnd (bool) |
|--------|----------------|

GO TO POSITION

| | |
|---------|---|
| Purpose | When triggered (the value is changed from 0 to 1), the Transport Controls move to a specified position. |
|---------|---|

GO TO POSITION

| | |
|--------|---------------------|
| Syntax | GotoPosition (cell) |
|--------|---------------------|

LENGTH

| | |
|---------|-------------------------------|
| Purpose | Finds the length of a vector. |
|---------|-------------------------------|

| | |
|--------|----------------|
| Syntax | length(vector) |
|--------|----------------|

MIDDLE POINT

| | |
|---------|--|
| Returns | The position vector dependent on the ratio between the two position's vectors. |
|---------|--|

| | |
|--------|---|
| Syntax | middlepoint(vector1,vector2,number)Vec- tor1 is a position vector. Vector2 is a posi- tion vector. Number is a real number that represents the position ratio between the two positions' vectors. |
|--------|---|

NORM

| | |
|---------|---|
| Returns | The normalized vector. Vector is the vector you want to normalize. |
|---------|---|

| | |
|--------|--------------|
| Syntax | norm(vector) |
|--------|--------------|

PLAY MODE

| | |
|---------|---|
| Purpose | Changes the value of the playback mode. |
|---------|---|

| | |
|--------|-------------|
| Syntax | SetPlayMode |
|--------|-------------|

PLAY BACKWARD MODE

| | |
|---------|---|
| Purpose | Changes the value of the playback mode. |
|---------|---|

PLAY BACKWARD MODE

| | |
|--------|---------------------|
| Syntax | SetPlayBackwardMode |
|--------|---------------------|

POW

| | |
|---------|---|
| Returns | The result of a number raised to a power. |
|---------|---|

| | |
|--------|---|
| Syntax | $\text{number1}^{\text{number2}}$ Number1 is the base number. It can be any real number. Number2 is the exponent, to which the base number is raised. |
|--------|---|

PRODUCT

| | |
|---------|---------------------------|
| Purpose | Multiplies its arguments. |
|---------|---------------------------|

| | |
|----------|---|
| Syntax 1 | $\text{number1} * \text{number2}$ Number1 is the number that you want to multiply with number2. |
|----------|---|

| | |
|----------|--|
| Syntax 2 | $\text{vector1} * \text{vector2}$ Vector1 and vector2 combine to give you the cross product. |
|----------|--|

QUOTIENT

| | |
|---------|--|
| Purpose | Number2 is the number by which you want to divide number1. |
|---------|--|

| | |
|--------|-----------------------------------|
| Syntax | $\text{number1} / \text{number2}$ |
|--------|-----------------------------------|

RECORD MODE

| | |
|---------|---------------------------------------|
| Purpose | Changes the value of the Record mode. |
|---------|---------------------------------------|

RECORD MODE

| | |
|--------|---------------|
| Syntax | SetRecordMode |
|--------|---------------|

STEP FORWARD

| | |
|--------|--|
| Syntax | StepForward (cell)When triggered (the value is changed from 0 to 1), the Transport Controls move one step forward. |
|--------|--|

STEP BACKWARD

| | |
|---------|---|
| Purpose | When triggered (the value is changed from 0 to 1), the Transport Controls move one step backward. |
|---------|---|

| | |
|--------|--------------|
| Syntax | StepBackward |
|--------|--------------|

SUM

| | |
|---------|---------------------|
| Purpose | Adds two arguments. |
|---------|---------------------|

| | |
|----------|--|
| Syntax 1 | number1 + number2 Number1 and number2 are the numbers or numerical cells that you want to add. |
|----------|--|

| | |
|----------|---|
| Syntax 2 | vector1 + vector2 Vector1 and vector2 are the vectors or vector cells that you want to add. |
|----------|---|

SUB

| | |
|---------|------------------------|
| Purpose | Substitutes arguments. |
|---------|------------------------|

| | |
|----------|---|
| Syntax 1 | number1 - number2 Number1 is the number that you want substituted by number2. |
|----------|---|

SUB

| | |
|----------|---|
| Syntax 2 | vector1 - vector2 Vector1 is the vector that you want substituted by vector2. |
|----------|---|

Numerical functions

The following are expressions of numerical functions:

ABS

| | |
|---------|---|
| Returns | The absolute value of a number or cell. |
|---------|---|

| | |
|--------|-------------|
| Syntax | abs(number) |
|--------|-------------|

ACOS

| | |
|---------|--|
| Returns | The arccosine of a number. Number is the cosine of the angle you want. |
|---------|--|

| | |
|--------|--------------|
| Syntax | acos(number) |
|--------|--------------|

ASIN

| | |
|---------|--|
| Returns | The arcsine of a number. Number is the sine of the angle you want. |
|---------|--|

| | |
|--------|--------------|
| Syntax | asin(number) |
|--------|--------------|

ATAN

| | |
|---------|--|
| Returns | The arctangent of a number. Number is the tangent of the angle you want. |
|---------|--|

ATAN

| | |
|--------|--------------|
| Syntax | atan(number) |
|--------|--------------|

ATAN2

| | |
|---------|--|
| Returns | The arctangent from X and Y coordinates. Number1 is the X-coordinate of the point. Number2 is the Y-coordinate of the point. |
|---------|--|

| | |
|--------|------------------------|
| Syntax | atan2(number1,number2) |
|--------|------------------------|

COS

| | |
|---------|--|
| Returns | The cosine of a number. Angle is the angle in radians for which you want the cosine. |
|---------|--|

| | |
|--------|------------|
| Syntax | cos(angle) |
|--------|------------|

DEG2RAD

| | |
|----------|---|
| Converts | Degrees to radians. Angle is the angle in degrees that you want to convert. |
|----------|---|

| | |
|--------|----------------|
| Syntax | deg2rad(angle) |
|--------|----------------|

EXP

| | |
|---------|---|
| Purpose | Number is the exponent applied to the base value e. |
|---------|---|

EXP

| | |
|--------|-------------|
| Syntax | exp(number) |
|--------|-------------|

INTEGER

| | |
|---------|--|
| Purpose | Rounds numerical values down to the next full digit. |
|---------|--|

| | |
|--------|---------|
| Syntax | integer |
|--------|---------|

LN

| | |
|---------|---|
| Returns | The natural logarithm of a number. Number is the positive real number for which you want the natural logarithm. |
|---------|---|

| | |
|--------|------------|
| Syntax | ln(number) |
|--------|------------|

LOG

| | |
|---------|---|
| Returns | The base-10 logarithm of a number. Number is the positive real number for which you want the base-10 logarithm. |
|---------|---|

| | |
|--------|-------------|
| Syntax | log(number) |
|--------|-------------|

ONEOVER

| | |
|---------|---|
| Returns | The result of 1/number. Number is the positive real number for which you want 1/number. |
|---------|---|

ONEOVER

| | |
|--------|-----------------|
| Syntax | oneover(number) |
|--------|-----------------|

PULL NUMBER

| | |
|---------|---|
| Purpose | Continuously takes the value from the input parameter and stores the result in its internal buffer, which is then used as the Result value. This gives you the same value as the last evaluation. |
|---------|---|

| | |
|--------|------|
| Syntax | pull |
|--------|------|

PRECISION NUMBERS

| | |
|---------|--|
| Purpose | Cuts the number at a specified precision value, for example, if a = 12.36 and the assigned precision value is 0.1, then the output is 12.30. |
|---------|--|

| | |
|--------|-------------------|
| Syntax | precision(number) |
|--------|-------------------|

RAD2DEG

| | |
|---------|--|
| Purpose | Converts radians to degrees. Angle is the angle (in radians) that you want to convert. |
|---------|--|

| | |
|--------|----------------|
| Syntax | rad2deg(angle) |
|--------|----------------|

SIN

| | |
|---------|---|
| Returns | The sine of the given angle. Angle is the angle in radians for which you want the sine. |
|---------|---|

SIN

| | |
|--------|-------------------------|
| Syntax | <code>sin(angle)</code> |
|--------|-------------------------|

SQRT

| | |
|---------|--|
| Returns | A positive square root. Number is the number for which you want the square root. |
|---------|--|

| | |
|--------|---------------------------|
| Syntax | <code>sqrt(number)</code> |
|--------|---------------------------|

TAN

| | |
|---------|---|
| Returns | The tangent of a number. Number is the angle in radians for which you want the tangent. |
|---------|---|

| | |
|--------|--------------------------|
| Syntax | <code>tan(number)</code> |
|--------|--------------------------|

Other functions

The following are miscellaneous expressions:

BUFFER

| | |
|---------|--|
| Returns | The old value when current value is off. |
|---------|--|

| | |
|---------|---|
| Syntax1 | <code>buffer(vector,number)</code> Vector is a vector. Number is a Boolean number, and can be switched on or off. |
|---------|---|

BUFFER

| | |
|---------|--|
| Syntax2 | buffer(number1,number2) Number1 is a real number.Number2 is a Boolean number, and can be switched on or off. |
|---------|--|

DAMPING

| | |
|---------|---------------------------------------|
| Purpose | Applies damping to a numerical value. |
|---------|---------------------------------------|

| | |
|--------|-----------------|
| Syntax | damping(number) |
|--------|-----------------|

DAMP (Clock based)

| | |
|---------|--|
| Purpose | Similar to Damping, except this expression is based on the MotionBuilder clock instead of the refresh rate. This relation is recommended over the Damp relation, as that makes your scene identical on every computer. |
|---------|--|

| | |
|--------|------------------|
| Syntax | damp3dclockbased |
|--------|------------------|

DAMP (3D) (Clock based)

| | |
|---------|---|
| Purpose | Similar to Damp (clock-based), except this expression is based on the Damp (3D) relation. |
|---------|---|

| | |
|--------|------------------|
| Syntax | damp3dclockbased |
|--------|------------------|

DAMPING (3D)

| | |
|---------|--|
| Purpose | Damps the position of a vector using a specified damping factor. |
|---------|--|

DAMPING (3D)

| | |
|--------|-----------|
| Syntax | damping3d |
|--------|-----------|

PRECISION VECTOR

| | |
|---------|--|
| Purpose | Use this constraint to apply a precise value to every component of the vector: X, Y, and Z can each have different precision values. |
|---------|--|

| | |
|--------|-----------------|
| Syntax | precisionVector |
|--------|-----------------|

| | |
|----------|-----------------------------------|
| Receives | a (Number) and Precision (Number) |
|----------|-----------------------------------|

| | |
|-------|-----------------|
| Sends | Result (Number) |
|-------|-----------------|

PULL VECTOR

| | |
|---------|---|
| Purpose | Continuously pulls the vector from the input parameter and stores the result in the internal buffer, which is then used as the Result value. This value gives you the value of the last evaluation. |
|---------|---|

| | |
|--------|------------|
| Syntax | pullVector |
|--------|------------|

PULSE

| | |
|---------|---|
| Purpose | Sends an alternating stream of zeroes and ones at the specified frequency, for example: 0101010101. |
|---------|---|

PULSE

| | |
|--------|-------|
| Syntax | pulse |
|--------|-------|

TRIGGERED PLUS MINUS COUNTER

| | |
|---------|---|
| Purpose | Creates a trigger to add the increment/decrement. |
|---------|---|

| | |
|--------|---------------------------|
| Syntax | triggeredplusminuscounter |
|--------|---------------------------|

TRIGGERED RANDOM

| | |
|---------|--------------------------------------|
| Purpose | Generates a random number on demand. |
|---------|--------------------------------------|

| | |
|--------|-----------------|
| Syntax | triggeredrandom |
|--------|-----------------|

Rotation expressions

The following expressions are used for rotation functions:

3 POINTS ROTATION

| | |
|---------|-------------------|
| Returns | A rotation value. |
|---------|-------------------|

| | |
|--------|---|
| Syntax | <pre>point3rotation(vector1,vector2,vector3)</pre> <p>Vector1, vector2, and vector3 are vectors that represent three discrete positions in 3D space. Example: point3rotation({0,0,0},{100,100,100},{100,0,-100})The rotation vector that this returns is: {-120,-35.26,45}.This rotation vector is derived by the axes (vector2-vector1) to</p> |
|--------|---|

3 POINTS ROTATION

spin the axes correctly on the third position vector (vector3).

ADD ROTATION

Purpose Adds two rotations. Vector1 and vector2 are vectors that represent discrete XYZ rotations.

Syntax `addrotation(vector1,vector2)`

ANGLE DIFF POINTS

Purpose Calculates the angle between two vectors or points, using a supplied radius.

Syntax `anglediffpoints`

ANGLE DIFF ROTATIONS

Purpose Calculates the difference between the rotation of two objects. The result can be scaled and offset.

Syntax `anglediffrotations (R1, R2)`

ANGULAR ACCELERATION

Returns The angular acceleration of a rotation vector.

ANGULAR ACCELERATION

| | |
|--------|---|
| Syntax | <code>angularacc(vector)</code> Vector is a vector that represents an XYZ rotation. |
|--------|---|

ANGULAR SPEED

| | |
|---------|---|
| Returns | The angular speed of a rotation vector. |
|---------|---|

| | |
|--------|---|
| Syntax | <code>angularspeed(vector)</code> Vector is a vector that represents an XYZ rotation. |
|--------|---|

DERIVATIVE

| | |
|---------|-------------------------------------|
| Returns | The derivative of a vector by time. |
|---------|-------------------------------------|

| | |
|--------|---------------------------------|
| Syntax | <code>derivative(vector)</code> |
|--------|---------------------------------|

GLOBAL TO LOCAL

| | |
|---------|--|
| Purpose | Converts a rotation vector from global to local coordinates. |
|---------|--|

| | |
|--------|---|
| Syntax | <code>globaltolocal (rotation)</code> Vector is a vector that represents a position or a speed in 3D space. |
|--------|---|

GRAVITY MOVE

| | |
|---------|-------------|
| Returns | A position. |
|---------|-------------|

| | |
|--------|---|
| Syntax | <code>gravitymove(vector1, vector2, vector3)</code> Vector1 is a vector that represents an initial position in 3D space. Vector2 is a vector that represents an initial speed. Vector3 is a vector that represents the acceleration |
|--------|---|

GRAVITY MOVE

that you want to give to your current position.

INTERPOLATE ROTATION

Purpose Interpolates between two rotations.

Syntax `interpolaterotation(R1, R2)`

LOCAL TO GLOBAL

Purpose Converts a rotation vector from local to global coordinates.

Syntax `localtogloba(Rotation)`

MOVE

Returns A position.

Syntax `move(vector1, vector2, vector3)` Vector1 is a vector that represents an initial position in 3D space. Vector2 is a vector that represents an initial speed. Vector3 is a vector that represents the acceleration that you want to give to your current position.

ORBIT

Returns A position. Number is a real number that represents the acceleration constant (MorimobjG6.673E-11) between the origin and the current position ($G = 6,672e-11 \text{ N m}^2/\text{kg}^2$).

ORBIT

| | |
|--------|--|
| Syntax | <code>orbit(vector1, vector2, vector3, number)</code> Vector1 is a vector that represents an initial origin position in 3D space (attractive point). Vector2 is a vector that represents the initial object position in 3D space. Vector3 is a vector that represents an initial speed of your object position. |
|--------|--|

POSITION DAMPING

| | |
|---------|--|
| Returns | A position. Number1 is a number that represents the maximum speed. Number2 is a number that represents the maximum acceleration. Number3 is a number that represents the damping ratio. (Includes Play Mode in-connector.) |
| Syntax | <code>positiondamping(vector1, number1, number2, number3)</code> Vector1 is a position vector in 3D space. |

ROTATION DAMPING

| | |
|---------|--|
| Returns | An XYZ rotation. Vector1 is an XYZ rotation vector. Number1 is a number that represents the maximum angular speed. Number2 is a number that represents the maximum angular acceleration. Number3 is a number that represents the damping ratio. (Includes Play Mode in-connector.) |
|---------|--|

ROTATION DAMPING

| | |
|--------|--|
| Syntax | <code>rotationdamping(vector1, number1, number2, number3)</code> |
|--------|--|

ROTATION PRODUCT

| | |
|---------|---|
| Returns | The rotation vector multiplied by a ratio number. Number is a real number that represents a multiplication ratio. |
|---------|---|

| | |
|--------|--|
| Syntax | <code>multrotation(vector,number)</code> Vector is a vector that represents an XYZ rotation. |
|--------|--|

SENSOR ROTATION HELPER

| | |
|--------|-----------------------------------|
| Syntax | <code>sensorrotationhelper</code> |
|--------|-----------------------------------|

SUB ROTATION

| | |
|---------|----------------------------|
| Purpose | Substitutes two rotations. |
|---------|----------------------------|

| | |
|--------|--|
| Syntax | <code>subrotation(vector1,vector2)</code> Vector1 and vector2 are vectors that represent discrete XYZ rotations. |
|--------|--|

SPEED

| | |
|---------|---------------------------------|
| Returns | The speed of a position vector. |
|---------|---------------------------------|

| | |
|--------|---|
| Syntax | <code>speed(vector)</code> Vector is a vector that represents a position in 3D space. |
|--------|---|

Source functions

The following expressions are source functions:

HALF CIRCLE RAMP

| | |
|--------|---|
| Syntax | ramphalfcircle(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.) |
|--------|---|

ISOCELES TRIANGLE RAMP

| | |
|--------|---|
| Syntax | ramptriiso(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.) |
|--------|---|

PLAY PAUSE COUNTER

| | |
|---------|----------------------------|
| Purpose | Lets you create a counter. |
|---------|----------------------------|

| | |
|--------|------------------|
| Syntax | playpausecounter |
|--------|------------------|

RANDOM

| | |
|---------|--|
| Purpose | Creates a stream of random numbers at a specified frequency. |
|---------|--|

RANDOM

| | |
|--------|--------|
| Syntax | random |
|--------|--------|

RIGHT TRIANGLE RAMP

| | |
|--------|--|
| Syntax | ramptriirec(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.) |
|--------|--|

SINE RAMP

| | |
|--------|---|
| Syntax | rampsine(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.) |
|--------|---|

SQUARE RAMP

| | |
|--------|---|
| Syntax | rampsquare(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.) |
|--------|---|

START STOP COUNTER

| | |
|---------|----------------------------|
| Purpose | Lets you create a counter. |
|---------|----------------------------|

| | |
|--------|------------------|
| Syntax | startstopcounter |
|--------|------------------|

Time functions

The following expressions concern time functions:

TIMETOSECONDS

| | |
|---------|---------------------------------------|
| Purpose | Converts time to a number of seconds. |
|---------|---------------------------------------|

| | |
|--------|--|
| Syntax | timetosecond(number)Number is the time code that you want to convert to seconds. |
|--------|--|

Vector expressions

The following are vector expressions:

ACCELERATION

| | |
|---------|--|
| Purpose | Returns the acceleration of a position vector. |
|---------|--|

| | |
|--------|--|
| Syntax | <code>acceleration(vector)</code> Vector is a vector that represents a position in 3D space. |
|--------|--|

ANGLE

| | |
|---------|--|
| Purpose | Finds the angle between the arguments. |
|---------|--|

| | |
|--------|--|
| Syntax | <code>angle(vector1,vector2)</code> Vector1 is a vector. Vector2 is a vector. |
|--------|--|

DETERMINANT VECTOR

| | |
|---------|---|
| Returns | The determinant of a 3x3 column (I,J,K) matrix. |
|---------|---|

| | |
|--------|-----------------------------|
| Syntax | <code>determinantvec</code> |
|--------|-----------------------------|

DOT PRODUCT

| | |
|---------|---|
| Purpose | Scalar product of the arguments. Returns the scalar product of vector1 and vector2. |
|---------|---|

| | |
|--------|------------------------------|
| Syntax | <code>vector1^vector2</code> |
|--------|------------------------------|

SCALE DAMPING

| | |
|---------|---|
| Returns | Damping to a scaling vector. (Includes a Play Mode in-connector.) |
|---------|---|

SCALE DAMPING

| | |
|--------|--------------|
| Syntax | scaledamping |
|--------|--------------|

SCALE OFFSET VECTOR

| | |
|---------|------------------------------|
| Purpose | Scales and offsets a vector. |
|---------|------------------------------|

| | |
|--------|----------------|
| Syntax | scaleoffsetvec |
|--------|----------------|

* (NUMBER*VECTOR)

| | |
|---------|------------------|
| Purpose | Scales a vector. |
|---------|------------------|

* (VECTOR*NUMBER)

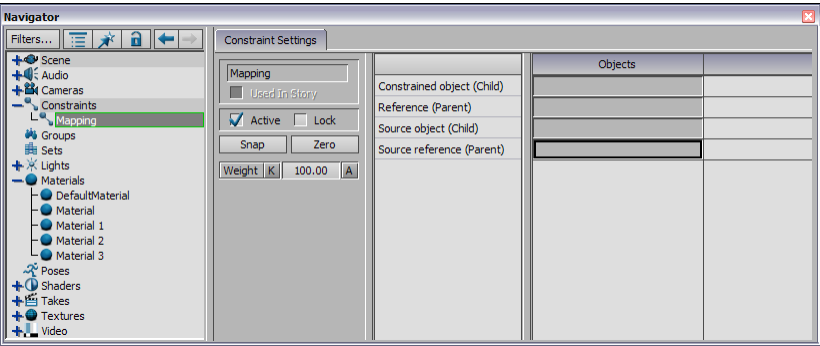
| | |
|---------|------------------|
| Purpose | Scales a vector. |
|---------|------------------|

- [Creating an Expressions constraint](#) on page 864
- [Expressions pane](#) on page 865
- [Navigating the Expressions pane](#) on page 865

Mapping constraint

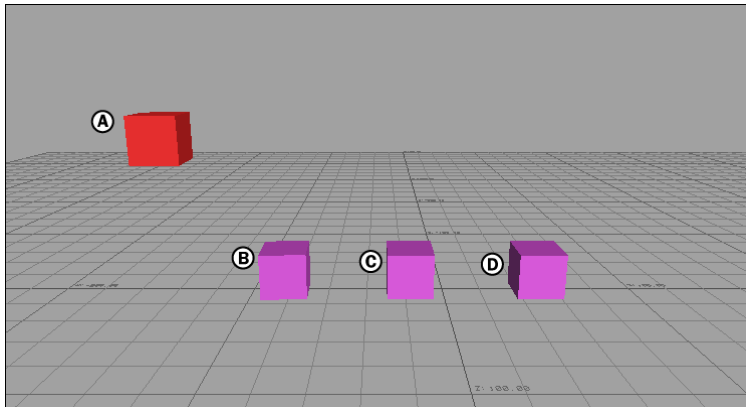
59

The Mapping constraint lets you map one Parent/Child relation to another Parent/Child relation. It is mainly used to scale movement between limbs or other structures of different sizes.

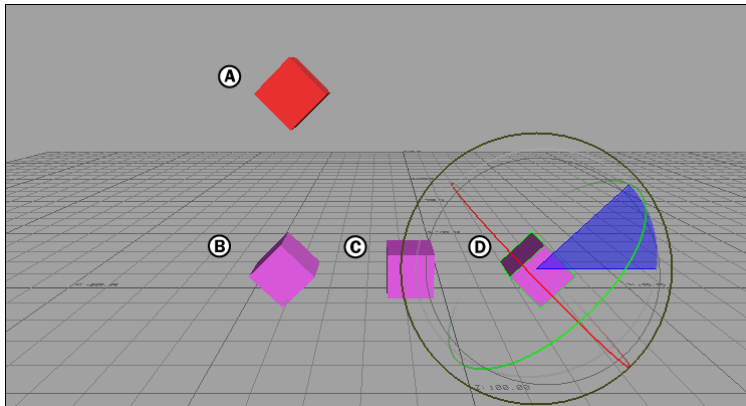


Mapping constraint

For example, in , a Mapping constraint is created using four cubes. When the constraint is activated, the constrained object moves when the reference, source object, or the Source reference is translated or rotated.



Mapping constraint A. Constrained object (child) B. Reference (parent) C. Source Object (child) D. Source Reference Parent



Mapping constraint activated: rotating or translating B, C, and/or D creates motion in A.

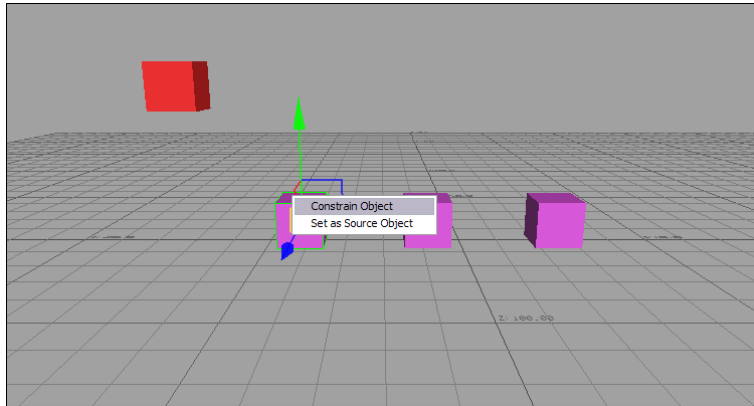
■ [Mapping constraint settings](#) on page 900

Mapping Parent/Child constraints to one another

The Mapping constraint lets you map one Parent/Child relation to another Parent/Child relation. You can use it to scale movement between limbs or other structures of different sizes.

To map Parent/Child constraints to one another:

- 1 Select a Mapping constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
 - If you drag it into an empty area of the Viewer window, the Mapping constraint template appears in the Constraint settings.
 - If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as either the Source (parent) or Constrained (child) object .



Constraint contextual menu

- 2 Assign the object that you want to be the Child object of the Parent/Child relation that inherits translation and rotation from the source Parent/Child relation to the Constrained object (child) cell.
- 3 Assign the object that you want to be the Parent object of the Parent/Child relation that inherits translation and rotation from the source Parent/Child relation to the Reference (parent) cell.
- 4 Assign the object that you want to be the Child object of the Parent/Child relation that sends translation and rotation information to the constrained Parent/Child relation to the Source object (child) cell.
- 5 Assign the object that you want to be the Parent object of the Parent/Child relation that sends translation and rotation information to the constrained Parent/Child relation to the Source reference (parent) cell.
- 6 Click Lock in the Constraint settings to lock the position of the objects to be constrained.

- 7 Click Active to activate the constraint.

Mapping constraint settings

The Mapping constraint lets you map one Parent/Child relation to another Parent/Child relation.

The Mapping constraint requires the following objects:

Constrained object (child)

Child object of the Parent/Child relation that inherits translation and rotation from the source Parent/Child relation.

Reference (parent)

Parent object of the Parent/Child relation that inherits translation and rotation from the source Parent/Child relation.

Source object (Child)

Child object of the Parent/Child relation that sends translation and rotation information to the constrained Parent/Child relation.

Source reference (Parent)

Parent object of the Parent/Child relation that sends translation and rotation information to the constrained Parent/Child relation.

- [Mapping Parent/Child constraints to one another](#) on page 898

Multi-Referential constraint

60

The Multi-Referential constraint is a way to create a type of complex Parent/Child constraint, capable of letting you use more than one transformation reference as a Source object. This lets you reassign the transformation reference of one object to any other.

Unlike other constraints, you can create a Multi-Referential constraint using the Key Controls.

The Multi-Referential constraint is useful whenever you want to change a model's reference point. This type of referential adjustment can occur in many different situations. Here are some examples:

Different locations

You can use the Multi-Referential constraint in a scene with vehicles so that a character can walk to a car model (Global referential), climb into it, and drive it to another location (Car referential).

The character can then get out of the car, get into an elevator model (Elevator referential), take it to another floor, and get aboard a moving sidewalk model (Sidewalk referential), and so on.

Props

You can use the Multi-Referential constraint to let characters manipulate props, for example making the character switch a prop from hand to hand, or carry props in a case strapped to the character's body, such as a gun in a holster. With this constraint props can be caught, thrown, and so on.

- [Creating a Multi-Referential constraint](#) on page 902
- [Key Controls settings](#) on page 906

Creating a Multi-Referential constraint

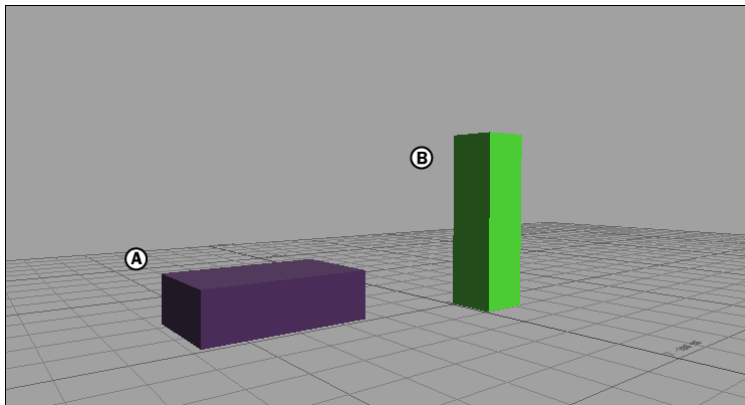
The Multi-Referential constraint lets you create a complex form of Parent/Child constraint that lets you use more than one transformation reference as a Source object.

To create a Multi-Referential constraint:

- 1 Select the model to be the Rigid object (or child) in the Scene browser or Viewer window and Alt-drag it into the Reference (Ref) field of the Key Controls.

NOTE Unlike other constraints, the Multi-Referential constraint is created automatically when you drag objects into the Key Controls Reference field.

In the example shown in , the “Driver” (B) is assigned to the Reference (Ref) field.

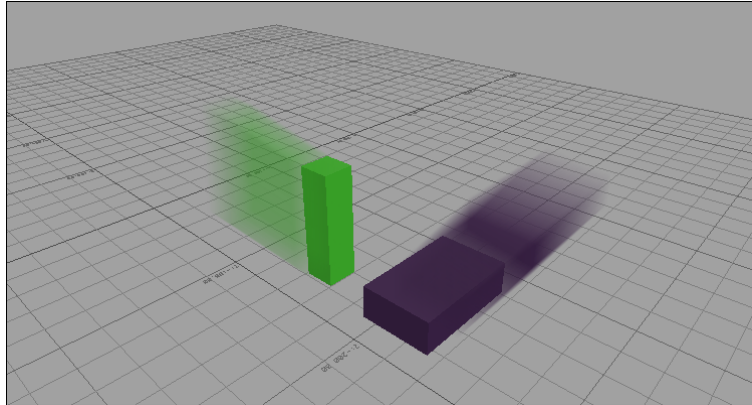


A basic Multi-Referential constraint example A. “Car” B. “Driver”

- 2 Next, select the model you want to assign as the Source object, in this case, the “Car”, in the Scene browser or Viewer window, Alt-drag it into the Reference (Ref) field of the Key Controls, and select Set as Source object from the menu that appears.

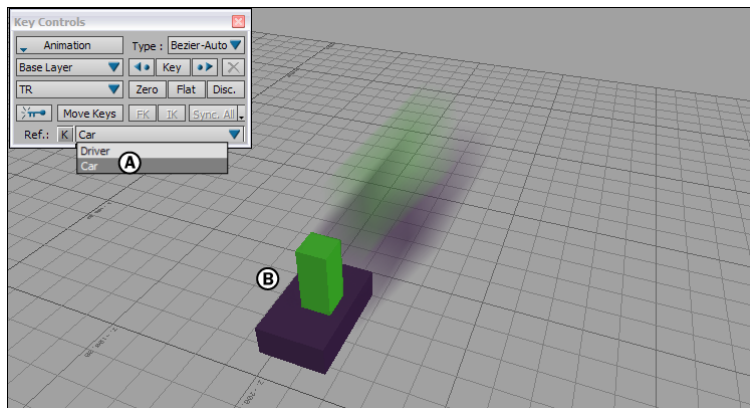
NOTE When you drag a Source object into the Reference (Ref) field, the Reference field still shows the name of your Rigid object. If it does not, reselect the Source object in the Scene browser until you see it appear in the Reference (Ref) field.

- 3 Click the Key (K) button next to the Reference field in the Key Controls to set a keyframe for the child object.
- 4 Advance the scene to the moment where the Rigid object is to join the Source object .



Advance the scene to the keyframe before the driver meets the car.

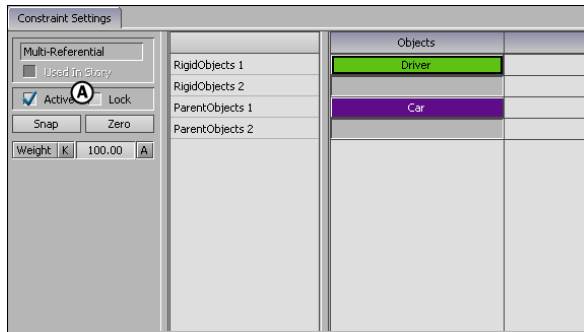
- 5 Select the Source object (Car) from the Key Controls Reference menu. A Key is automatically set.



A. Select the Source object from the Reference menu. B. The “Driver” joins the “Car” and they drive off together.

NOTE If you use the Key Controls window to create the constraint, the constraint is automatically activated.

- 6 To join the Rigid object to another source object, repeat Step 2 onwards, but select the other Source object from the Reference menu in the Key Controls.



Multi-Referential Constraint settings A. Active option

If there are any jumps in the animation, click Sync in the Key Controls to synchronize the animation of the two objects.

NOTE You can also use the Multi-Referential constraint with multiple Rigid objects and no Source object to create a multiple-pivot effect. The Rigid object currently selected in the Reference (Ref) field is used as the Source object.

- 7 To create another Multi-Referential constraint, simply drag a Multi-Referential constraint from the Asset browser into the Viewer window and assign new Rigid and Source objects.

- [Creating offsets in a Multi-referential constraint](#) on page 904
- [Sync button](#) on page 907

Creating offsets in a Multi-referential constraint

You can offset the position of a Source (parent) object in a Multi-referential constraint.

To create offsets in a Multi-referential constraint:

- 1 Expand the constraints folder in the Scene browser and double-click the Multi-Referential constraint to select it.
- 2 In the Properties window, expand (Parent object) Offset translation and (Parent object) Offset rotation.
- 3 Set the Offset translation and rotation for the Parent object you want to affect.
- 4 Do this for all the parent objects you want to adjust.

You can key and animate this offset by activating the Key and Animate buttons next to each setting you modify.

Multi-Referential constraint settings

The Multi-Referential constraint is a quick way to create a type of complex Parent/Child constraint, capable of letting you use more than one transformation reference as a Source object.

This section on Multi-Referential constraint settings is divided into three parts:

- [Multi-Referential constraint settings](#) on page 905
- [Properties settings](#) on page 906
- [Key Controls settings](#) on page 906

Multi-Referential constraint settings

If you create a Multi-Referential constraint in the Navigator window, it requires the following objects:

| Object cell | Function |
|-----------------|--|
| Rigid Object 1 | Assign the model you want as the source object into the Rigid object field. You can have multiple Rigid Objects. |
| Parent Object 1 | Assign the model you want as the Parent object into the Parent object field. You can have multiple Parent Objects. |

Properties settings

The following Multi-Referential constraint settings are found only in the Properties window when the constraint is select in the Scene browser:

| Property | Description |
|----------------------------------|---|
| Active Reference | Shows you when the Source (Parent) object takes over from the Reference (Child) object in the constraint. |
| Parent Object Offset Translation | Lets you view the translation offset of the Parent object, |
| Parent Object Offset Rotation | Lets you view the rotation offset of the Parent object |

Key Controls settings

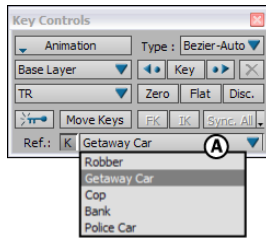
Unlike other constraints, you can quickly create a Multi-Referential constraint through the Key Controls by dragging models into the Key Controls Reference (Ref) field.

The following settings are required to create a Multi-Referential constraint in the Key Controls:

Reference field

The Key Controls Reference (Ref.) field is where you drag Rigid and Source objects to create a Multi-Referential constraint.

After you have assigned a source object to the Key Controls Reference (Ref) field, you can change the object's referential by selecting a new reference from the Reference (Ref) menu .



Expand the Reference menu to select a new Source object.

Dragging objects into the Reference field automatically creates a Multi-Referential constraint.

Click the arrow next to the Reference (Ref) field to expand a list of objects that have been set as Source objects.

Sync button

The Key Controls Sync button is used for both character and Multi-Referential constraint keyframing.

Use the Sync button when there is a switch between different references in a scene that creates “jumps” in the animation.

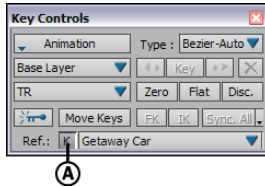
In situations where there is a reference change, such as a scene with a character moving from a car to the street, then to an elevator, jumps may be created if you change the timing or values of the keys of one of the references.

Jumps can be created whenever you make even a small element change, such as tweaking the rotation of the constrained object in the FCurves window.

NOTE The Rigid object should be selected when you click the Sync button, otherwise the animation is not changed. The Sync button tracks all the reference changes in the animation, correcting any inconsistencies by re-synchronizing the previous reference to the new one.

Keyframe button

Click the Keyframe (K) button next to the Reference (Ref.) field to set keyframes for objects in the Reference field .



Reference field A. Keyframe button

NOTE The K button appears only if an object has been dropped in the Reference (Ref.) field.

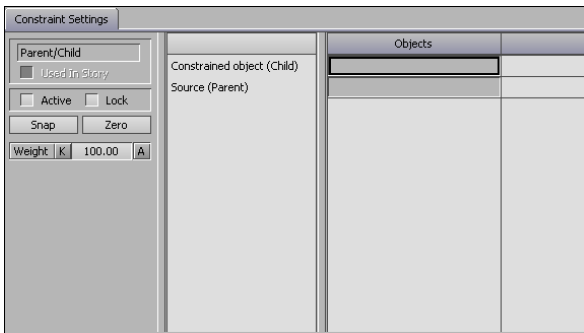
Clicking the Keyframe button twice disables the key you have set.

- [Sync button](#) on page 907
- [Creating a Multi-Referential constraint](#) on page 902

Parent-child constraint

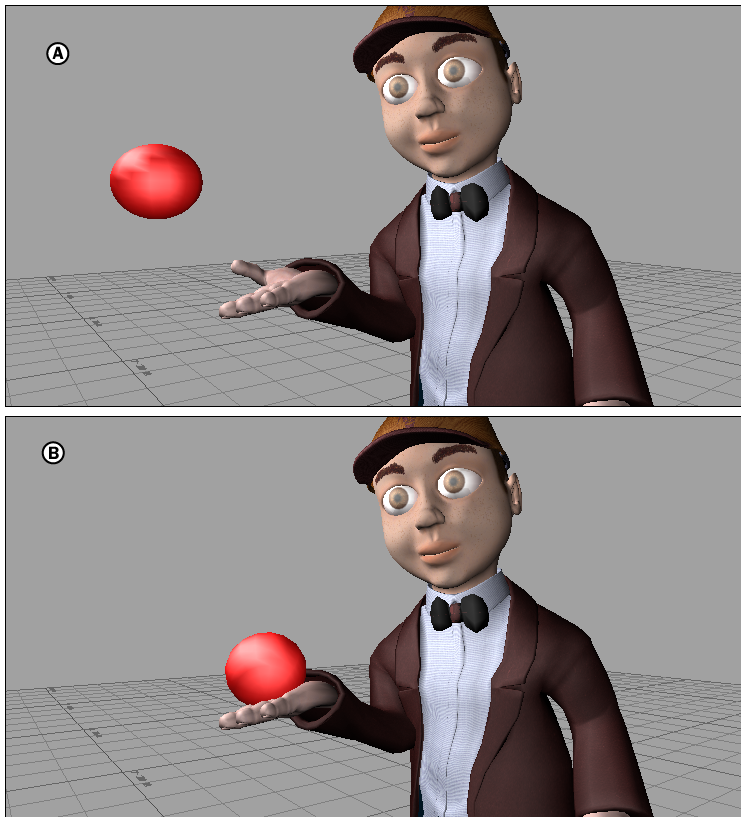
61

The Parent-Child constraint creates a parent-to-child relationship between any two objects, from any two hierarchies. It creates the same relationship as the parent-to-child relationships found in hierarchies.



Parent-Child constraint

Use this constraint to connect objects without changing hierarchies or making hard connections. For example, in , a model's hand effector is parented to a child-object sphere. Once the constraint is activated, any movement of the parent "hand" also occurs for the "ball" child in this way you can connect an object to the hand of a model without changing the model's hierarchy.



Parent/Child constraint before and after activation. A. Before activation. B. When activated, the child object is constrained to the (parent object, in this case the model's wrist effector.

It does not matter if the objects in the Parent/Child relationship are in different hierarchies. You can also use the Story window to activate and disable scheduled Parent/Child constraints. Normal Parent/Child connections are globally active.

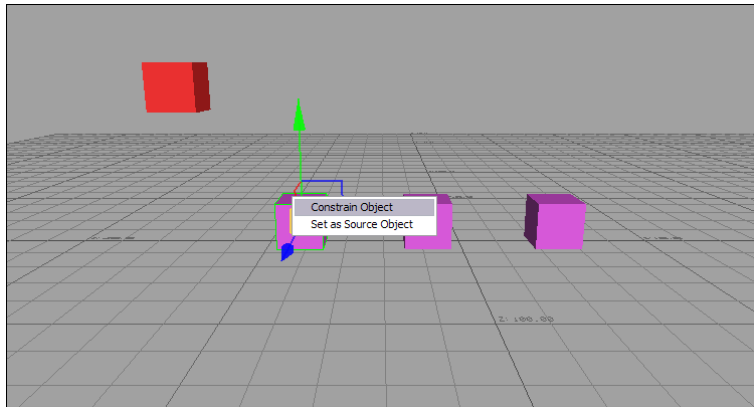
- [Creating a parent-child relationship between objects](#) on page 911

Creating a parent-child relationship between objects

Use the Parent/Child constraint to create a parent-to-child relationship between any two objects.

To create a Parent/Child relationship between objects:

- 1 Select a Parent/Child constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
 - If you drag it into an empty area of the Viewer window, the Parent/Child constraint template appears in the Constraint settings.
 - If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source or Constrained object .



Constraint contextual menu

- 2 Assign the object that you want to inherit translation and rotation from the source object (parent object) to the Constrained object (child object) cell.
- 3 Assign the object that you want to send translation and rotation information to the constrained object (child object) to the Source (parent object) cell.
- 4 Click Lock in the Constraint settings to lock the position of the objects to be constrained.
- 5 Click Active to activate the constraint.

Creating an offset with multiple parents

You can use multiple parent-objects to define the position of an object constrained with the Parent/Child constraint.

To create an offset with multiple parents:

- 1 Expand the constraints folder in the Asset browser and select the Parent/Child constraint.
- 2 In the Properties window, expand Constraint Source Weight.
- 3 Set the Translation, Rotation, and Scaling offsets for the Parent object you want to affect.
- 4 Do this for all the parent objects you want to change.

You can key and animate this offset by activating the Key and Animate buttons next to each setting you modify.

■ [Parent-child constraint settings](#) on page 913

Constraining individual axes (parent-child constraint)

You can have the source objects in a Parent/Child constraint affect only certain axes of a constrained object.

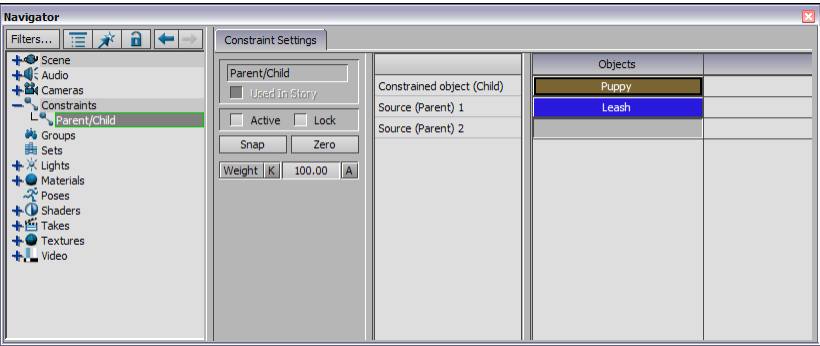
You can constrain an individual axis with the Parent Child constraint. For example you can have an object only parented on its Y-axis.

To constrain individual axes:

- 1 Double-click the Parent/Child constraint in the Scene browser to select it.
- 2 Open the Properties window. The constraint settings display.
- 3 Expand Constraint Axes and disable the X, Y, or Z axis for the desired translation effect you want to inhibit.
- 4 To reactivate the unconstrained axes, activate the option.

Parent-child constraint settings

The Parent-Child constraint creates a parent-to-child relationship between any two objects, from any two hierarchies .



The Parent Child constraint

The Parent/Child constraint requires the following objects:

Constrained object (child object)

Inherits translation and rotation from the source object (parent), but not scaling.

NOTE You can have multiple Constrained (child) objects in this constraint.

Source (parent object)

Sends translation and rotation information to the constrained object (child).

NOTE You can have multiple Source (parent) objects in this constraint.

Properties settings

The following Parent/Child constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

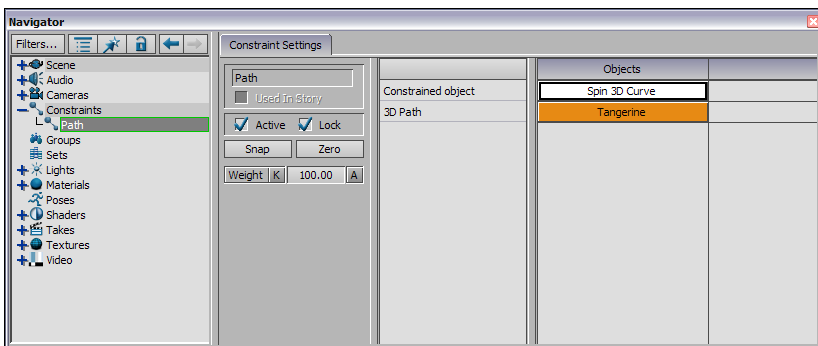
| Setting | Description |
|-----------------|--|
| Constraint Axes | The Constraint Axes settings in the properties window let you choose on which axis |

| Setting | Description |
|-----------------------------|---|
| | the Parent/Child constraint takes effect. For example, you can activate only the translation on the X-axis and the rotation on the Y-axis, so that the constrained object is only affected when the Source (parent) object is moved from side to side or rotated up and down. You can also activate the AffectScaling X, Y, and Z options so you can constrain the Scaling of the child object to the parent. |
| Scaling Affects Translation | Activate this option if you want the Child object's position to be affected when the Parent object is scaled. |
| (Parent) Offset T/R/S | The (Parent) Offset T/R/S settings let you offset the Source (parent) object's translation, rotation and scaling from the Child object. Expand each setting to enter values for the x, y, and z- positions. |
| (Parent) Weight | The Constraint Source Weight settings let you set the weighting for the Source (parent) object(s) or the entire constraint, letting you create blends. You can also use these setting to create an offset between the child and parent object(s). |

Path constraint

62

The Path constraint lets you convert a 3D Curve created in the Viewer window into an animation path.



Path constraint

The time-length of the path animation is determined by the time set in the Transport Controls End field. For example, if the End field has a value of 300 frames, the constrained object takes 300 frames to reach the end point of the path.

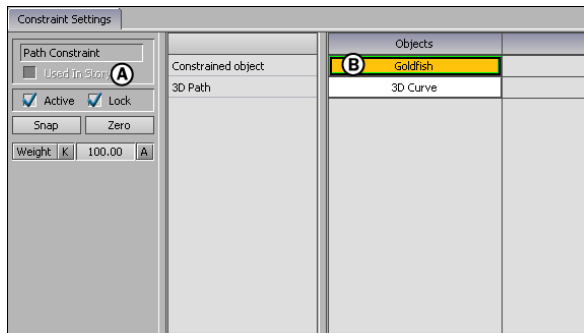
- [Creating a 3D curve](#) on page 921
- [Creating an animated path with a 3D Curve](#) on page 915

Creating an animated path with a 3D Curve

You can use the Path constraint to convert a 3D Curve created in the Viewer window into an animation path.

To create an animated path:

- 1 Create a 3D curve. For more on creating 3D curves, see [Creating a 3D curve](#) on page 921.
- 2 Drag a Path constraint into the Viewer window from the Asset browser's Constraints folder.
- 3 In the Path constraint settings, drag the 3D Curve into the 3D Path field.
- 4 Assign your light, camera, or object to the Constrained object field and click Active.

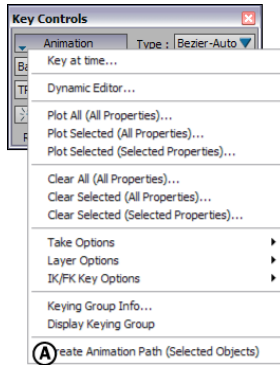


Path constraint settings A. Object settings B. Objects cells

Your object is constrained to the start point of the 3D Path. Click play in the Transport Controls and the object travels along the curve.

To create an animated path using the Key Controls:

- 1 Create a 3D curve. For more on creating 3D curves, see [Creating a 3D curve](#) on page 921.
- 2 Select the object or objects that you want to constrain along the 3D Path in the Viewer window.
- 3 Open the Key Controls Animation Menu and select Create Animation Path (Selected Objects).



Key Controls Animation menu A. Create Animated Path option.

- 4 Click Ok in the resulting dialog box that asks you to confirm the creation of an Animation Path.

A Path constraint is added to the Constraints folder in the Scene browser.

This number is the start frame as specified in the Transport Controls Start field. A key also appears at this frame.

- 5 Advance the Transport Controls a few frames, and set a key frame. An Animation Path is created as you work, with a node appearing for every key that is set.

- [Creating a 3D curve](#) on page 921
- [Editing a 3D Curve](#) on page 922
- [Viewing the trajectory of an object](#) on page 924

Offsetting Path constraint objects

You can create an offset between Constrained and Source objects using the translation offsets found in the Properties window.

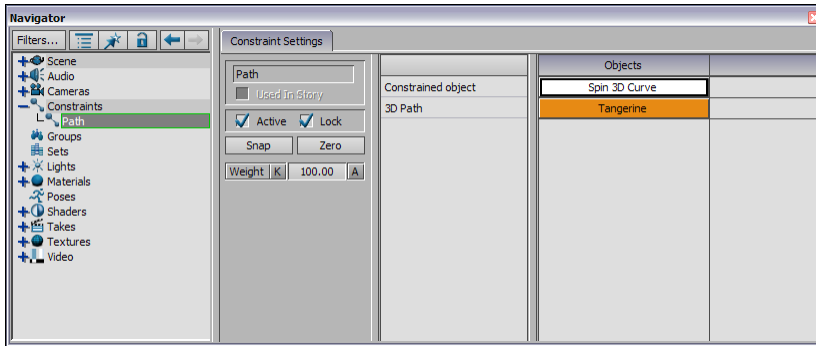
To offset the Constrained and Source objects in a Path constraint:

- 1 Double-click the constraint in the Scene browser to select it.
- 2 Open the Properties window. The Path constraint settings display.

- 3 Expand Path Settings > Offsets > Translation offset and set a value in the Roll, Pitch, or Yaw fields for the desired effect. See [Offsets](#) on page 919 for more information on roll, pitch, and yaw.

Path constraint settings

The Path constraint lets you use a 3D Curve created in the Viewer window as an animation path.



Path constraint

The Path constraint requires the following objects:

Constrained Object

Assign the object that you want to follow the 3D Path to this cell.

3D Path

Assign the 3D Curve that you want to use as a path to this cell.

Properties settings

The following Path constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

Warp Mode

Use the Warp Mode menu to select a method to evaluate your curve animation.

| Warp method | Description |
|-------------|--|
| Percent | Evaluates the curve by percent, with 0 being the start and 100% being the end. |
| Segment | Evaluates the curve animation point by point. |

Warp

Shows the progress of the Curve animation on a slider. Move the slider forward to advance the animation to a later point.

Follow Path

Aligns the constrained object's axes with the direction of the 3D path.

Up Vector

If Follow Path is activated, lets you select a different axis to orient the constrained object's Up vector.

Front Vector

If Follow Path is activated, lets you select a different axis for the constrained object to face.

Offsets

| Offset type | Description |
|-------------------------|---|
| Translation Offsets XYZ | Use these fields to move the constrained object from the 3D Path. You can set key animation on any of these settings. |
| Roll | Use the Roll slider to rotate the constrained object around the X-axis. |

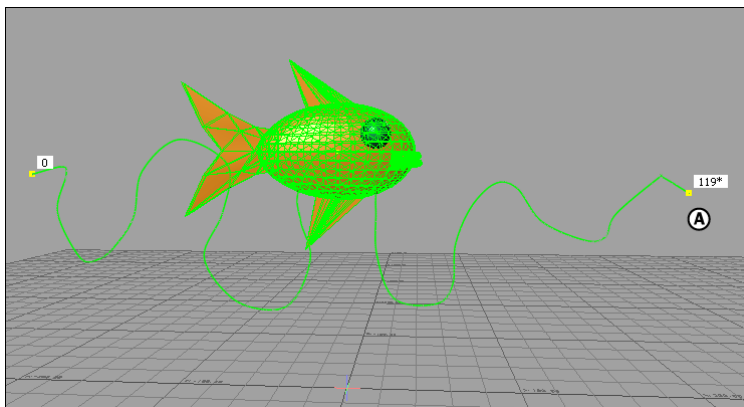
| Offset type | Description |
|-------------|--|
| Pitch | Use the Pitch slider to bank the constrained object up or down the Y-axis. |
| Yaw | Use the Yaw slider to spin the constrained object using the object's center as the axis. |

Display

| Display setting | Description |
|---------------------|---|
| UI Color | Double-click to open the color window where you can set a color for the start and end points of the path. |
| Show warp key frame | Disable this setting to hide the warp key frame boxes in the Viewer window. |

■ [Creating an animated path with a 3D Curve](#) on page 915

The duration of the path animation is determined by the time set in the Transport Controls End field. For example, if the End field has a value of 300 frames, the object takes 300 frames to travel to the end-point of the path.



A model with the Path constraint added. A. The duration appears in a white field at either end of the path.

TIP You can also create an instant animated path using the Key Controls, letting you animate with a Path instead of FCurves. See [Creating an animated path with a 3D Curve](#) on page 915.

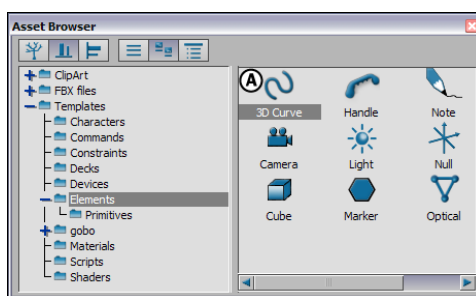
- [Creating a 3D curve](#) on page 921
- [Creating an animated path with a 3D Curve](#) on page 915

Creating a 3D curve

In order to create an animated path, you must first create the curve that is used to derive the animation.

To create a 3D curve:

- 1 Double-click 3D Curve in the Asset browser's Elements folder. The cursor becomes a cross hair.



Asset browser A. 3D Curve asset

- 2 Click anywhere in the Viewer window to set red points that are connected by a green line. This line is a 3D curve.
Use the middle mouse button to create a point between the last two points, or click the right mouse button to add a point at the start point.
- 3 To accept the curve, press Enter. To undo a point, press Ctrl-Z. To delete the entire path, press Escape.

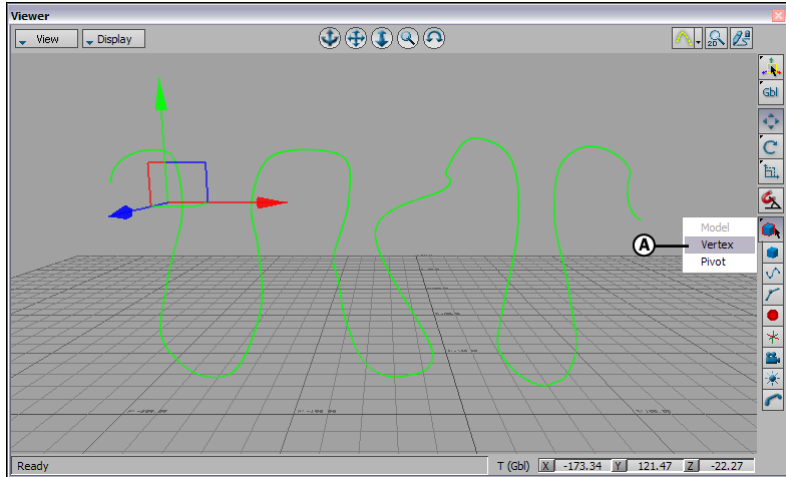
- [Editing a 3D Curve](#) on page 922
- [Creating an animated path with a 3D Curve](#) on page 915

Editing a 3D Curve

There are several ways in which you can edit a 3D curve.

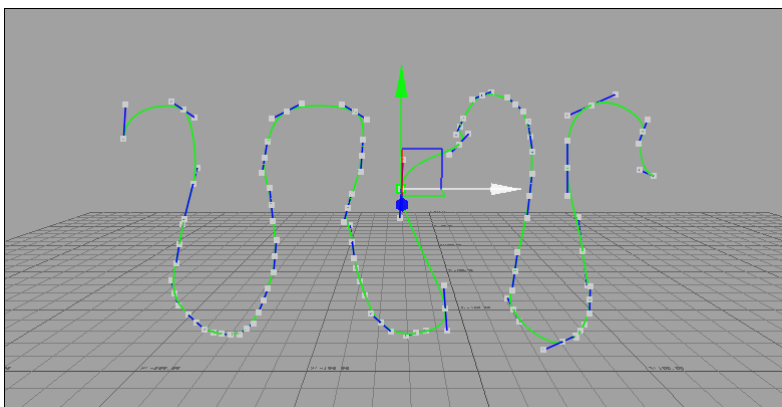
To adjust the placement of points on a curve:

- 1 Select the curve and press T to activate Translation mode.
- 2 Select Vertex from the Viewer toolbar Object Selection menu.



Viewer window Object selection buttons A. Vertex.

The points on the curve transform into editable points with tangent handles.

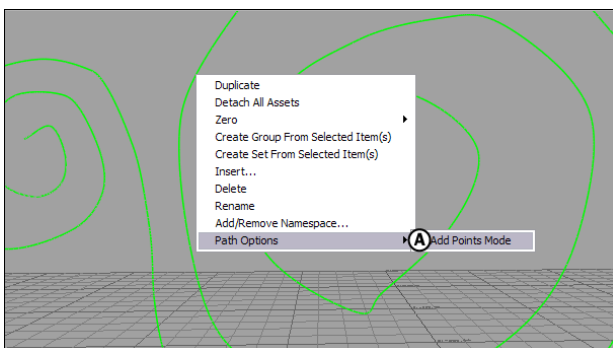


3D path in Edit/Delete Points mode.

- 3 Double-click any point on the curve and translate the point or its handles. Ctrl-click a point to deselect it.

To add points to a curve:

- 1 Right-click the curve and select Path Options > Add Points Mode from the contextual menu. The cursor becomes a crosshair.



3D path contextual menu A. Add Points Mode

- 2 Click the mouse in the Viewer window to add a point to the end of the curve.
 - To add a point to the beginning of the curve, right-click instead.
 - To add a point inside the curve, middle-click.

- 3 Press Escape to exit Add Points mode.

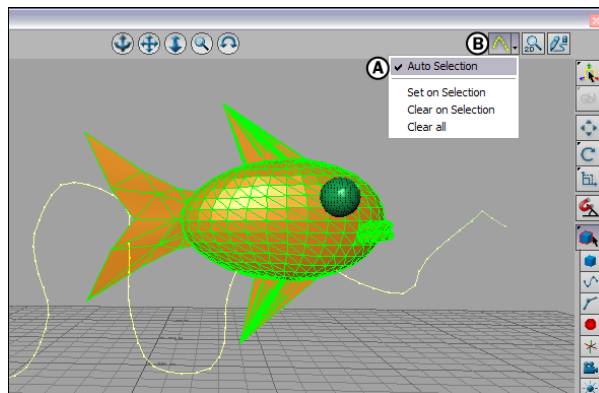
To delete points on a curve:

- 1 Select Vertex mode from the Viewer toolbar Object Mode menu.
- 2 Click the point to be deleted on the curve.
To select multiple points, Ctrl-click or Spacebar-drag.
- 3 Right-click the curve and select Path Options > Delete Selected Points from the contextual menu.

Viewing the trajectory of an object

To view the trajectory of an animated object:

- 1 Select the object, and click the Trajectories button at the top of the Viewer window.



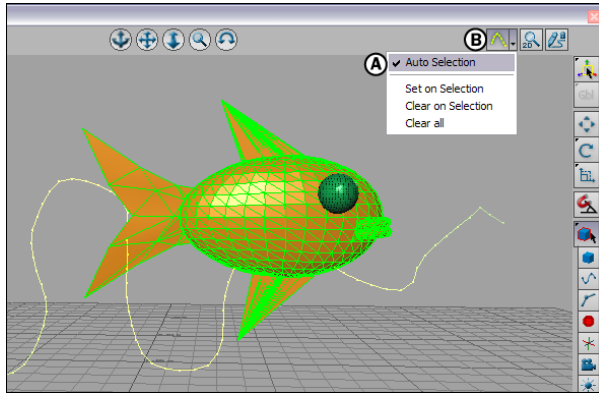
Viewer window A. Trajectories menu B. Trajectories button

- 2 Click the down arrow next to the Trajectories button to open the Trajectories menu and select one of the following:
 - To view trajectories for all selected objects, select Auto-Selection.
 - To view trajectories even when objects are not selected, select Set on Selection.
 - To hide the trajectories of selected models, select Clear on Selection.

- To hide all trajectories, select Clear all.
See also [Motion trajectories settings](#) on page 925.

Motion trajectories settings

You can view the animation trajectory of objects in the Viewer window, including animated paths, using the Viewer window Trajectory button.



Viewer window A. Trajectories menu B. Trajectories button

Auto-Selection

When activated, shows the trajectories for all selected objects.

Set on Selection

When activated, continues to show trajectories even when their objects are not selected.

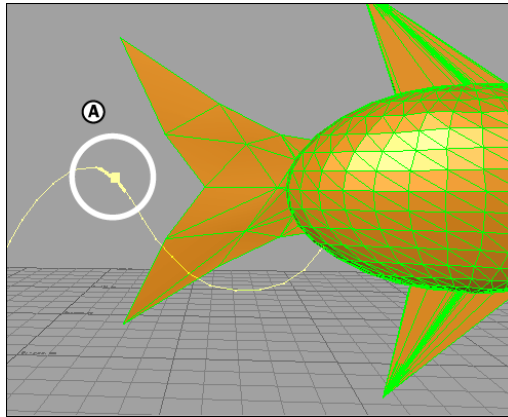
Clear on Selection

Hides the trajectories of the selected models.

Clear all

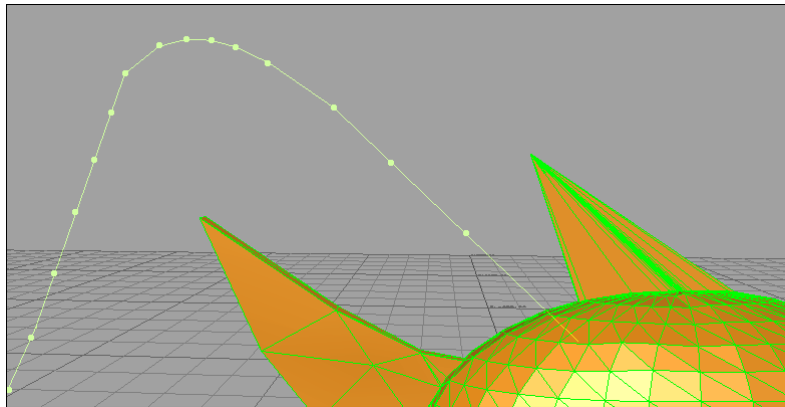
Hides all trajectories.

The trajectory of the animated object is shown as a yellow dotted line. Each dot represents a frame.



Trajectory A. Each dot signifies a frame.

If you change the velocity of the animation in the Key Controls window the dots move closer together or further apart, visually representing changes in the frame's activity.



Trajectory showing increased velocity.

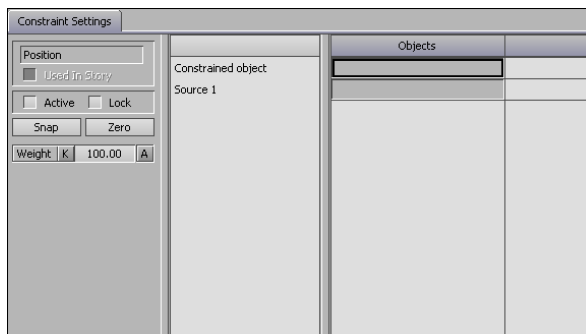
NOTE To move the model with its trajectory, select the model's root.

■ [Editing a 3D Curve](#) on page 922

Position constraint

63

The Position constraint lets you apply a source object (or objects) to constrain the translation of a target object.

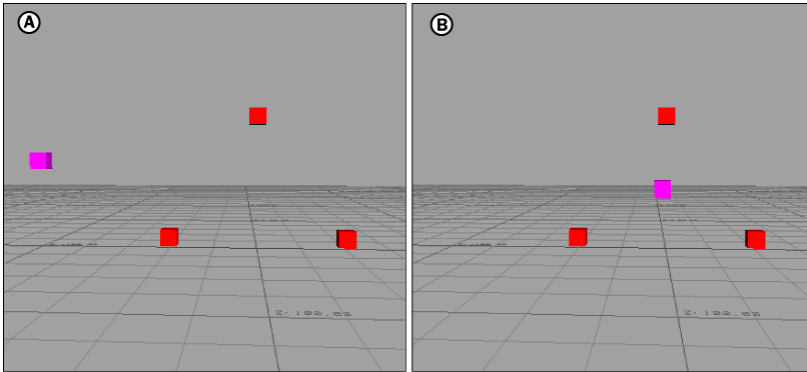


Position constraint

When you drag an object into the Source 1 field, another source (Source 2), is added to the Objects pane. If you drag a second source into Source 2, the position of the constrained object is derived from the position of the two source objects.

You can have as many sources as you want, which let you create complex Position constraints.

For example, in following figure, A, a constrained object to the left of three objects in a triangle formation is shown. When the constraint is activated, the constrained object moves to become equidistant from the three source objects to B.

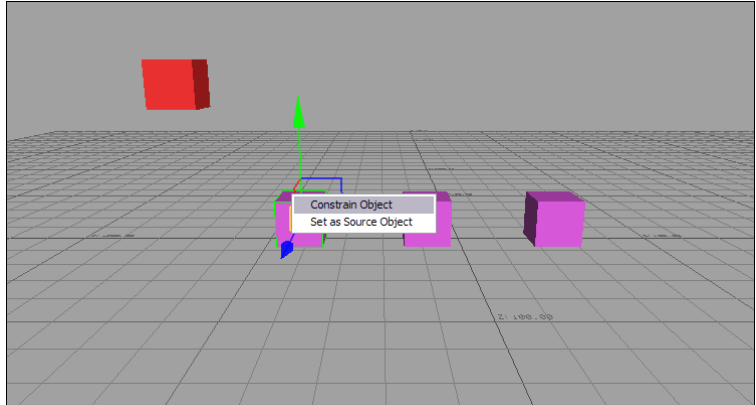


Position constraint A. Pink marker: a constrained object B. The Position constraint is activated

- [Constraining an object's translation with another's translation](#) on page 928

Constraining an object's translation with another's translation

- 1 Select a Position constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
 - If you drag it into an empty area of the Viewer window, the Position constraint template appears in the Constraint settings.
 - If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source or Constrained objects.



Constraint contextual menu

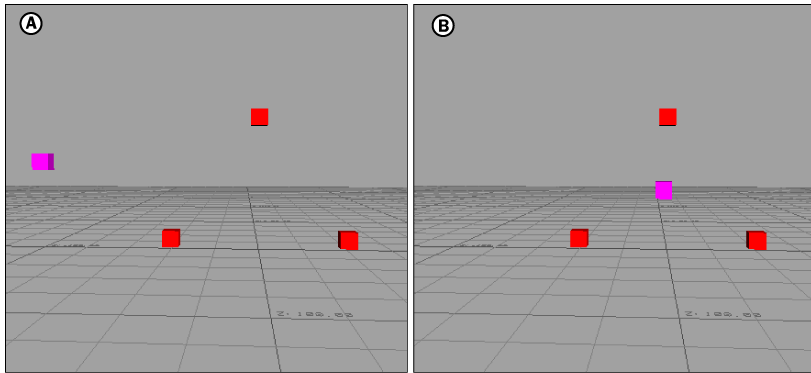
- 2 Assign the object that you want to position and translate in the scene based on the position and movement of one or multiple source objects to the Constrained (child) object cell.
- 3 Assign the object that you want to derive the translation information from for the constrained object to the Source 1 (parent) cell.

When you drag an object into the Source 1 cell, another source (Source 2), is added to the Objects pane. If you drag a second source into Source 2, the position of the constrained object is derived from the position of the two source objects.

You can have as many sources as you want, so you can create complex Position constraints.

NOTE When more than one source is specified, the constrained object is placed at the middle point between all source objects.

- 4 For example, in the following figure, A, illustrates a constrained object to the left of three objects in a triangle formation. When the constraint is activated, the constrained object moves to become equidistant from the three source objects, as shown in B.



Position constraint A. Pink marker: a constrained object B. The Position constraint is activated

- 5 Click Lock in the Constraint settings to lock the position of the objects to be constrained.
- 6 Click Active to activate the constraint.

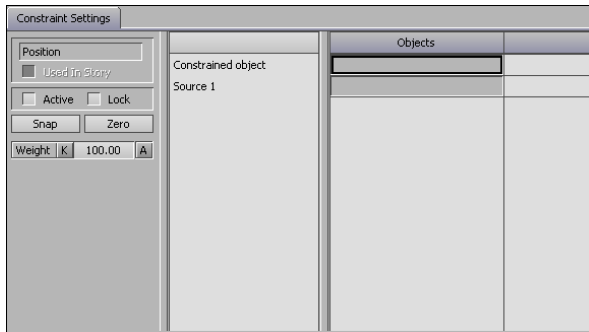
Constraining a single axis (Position constraint)

You can constrain an individual axis with the Position constraint. For example you can have an object only constrained on its Y-axis.

- 1 Create a Position constraint. See [Constraining an object's translation with another's translation](#) on page 928 for more information.
- 2 Double-click the Position constraint in the Scene browser to select it.
- 3 Open the Properties window. The constraints settings display.
- 4 Expand Constraint Axes and disable the X, Y, or Z axis for the desired translation effect you want to inhibit.
- 5 To reactivate the unconstrained axes, activate the option.

Position constraint settings

The Position constraint lets you apply to at least one source object to constrain the translation of a target object.



The Position constraint

The Position constraint requires the following objects:

Constrained object

An asset, model, or other object that is positioned and translated in the scene based on the position and movement of one or multiple source objects. Also known as the “child” object.

Source 1

Sends translation information to the constrained object. Also known as the “parent” object.

When more than one source is specified, the constrained object is placed equidistant from all source objects.

Properties settings

The following Position constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

Translation Offsets XYZ

Use these fields to move the constrained object from the Source object(s). You can set key animation on any of these settings.

These fields are disabled if the Lock option is activated.

Constraint Axes

Activating or disabling these axes affects whether the constrained object is affected by the source objects' movement in this direction.

| Axis setting | Description |
|--------------|--|
| Affect X | When active, the constrained object moves along the X-axis with the source object. |
| Affect Y | When active, the constrained object moves along the Y-axis with the source object. |
| Affect Z | When active, the constrained object moves along the Z-axis with the source object. |

(Source Object) Weight

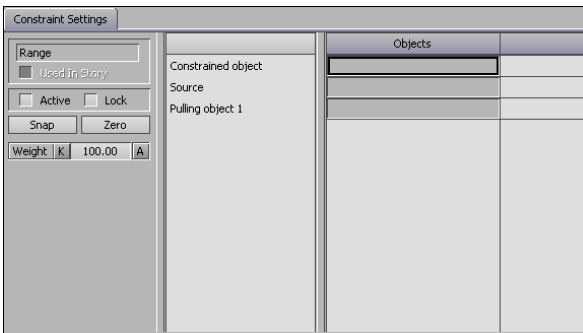
Use this setting to give different amounts of influence to source objects.

NOTE It is no longer necessary to drag the same object in the source field to create weighting for this constraint. If you are working on an earlier version of the Positions constraint where this has been done, this is compensated.

Range constraint

64

The Range constraint lets you influence a constrained object using one or more pulling objects. It limits the movement of an object relative to two or more objects. The object is not pulled past a specified range, which you can define using another object.



Range constraint

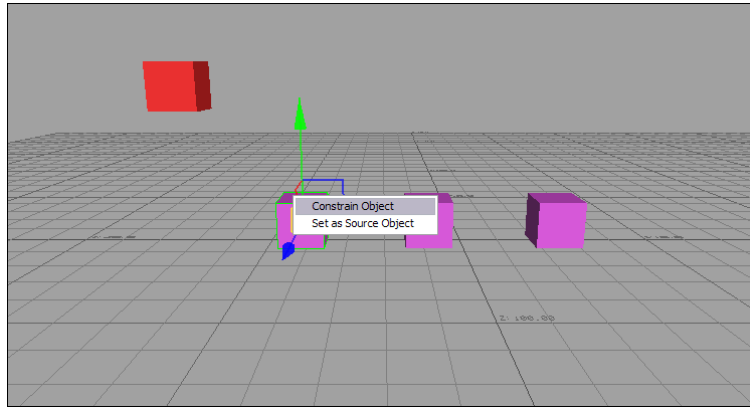
Limiting an object's range with the Range constraint

The Range constraint lets you influence a constrained object using one or more pulling objects.

To limit an object's range:

- 1 Select a Range constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
 - If you drag it into an empty area of the Viewer window, the Range constraint template appears in the Navigator window.

- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source (parent) or Constrained (child) object .



Constraint contextual menu

- 2 Assign the object that you want to constrain to the Constrained (child) object cell.
- 3 Assign the object that you want to define the limit or maximum range that the constrained object can be pulled to the Source (parent) cell.
The limit is a radius centered on the pulling object.
- 4 Assign the object that you want to be the pulling object that affects the constrained object to the Pulling Object 1 cell.
- 5 Click Lock in the Constraint settings to lock the position of the objects to be constrained.
- 6 Click Active to activate the constraint.

- [Range constraint settings](#) on page 935

Using the Range constraint for keyframe animation

This method lets you keyframe the movement of each effector without having to transform and key the root of the skeleton.

- 1 Set up a biped skeleton with Chain IK constraints for each leg.
- 2 Use each foot effector as the root in a Range constraint, the effectors being the source and the root being the constrained object.
When you translate the effectors for each foot, the hips move as well.

- [Range constraint settings](#) on page 935

Range constraint settings

The Range constraint lets you influence a constrained object using one or more pulling objects.

The Range constraint requires the following objects:

Constrained object

Object being pulled by the pulling objects. Also known as the “Child” object.

Source

An object defining the limit or maximum range that the constrained object can be pulled. Also known as the “parent” object.

The limit is a radius centered on the pulling object.

Pulling object 1

Pulling object that affects the constrained object.

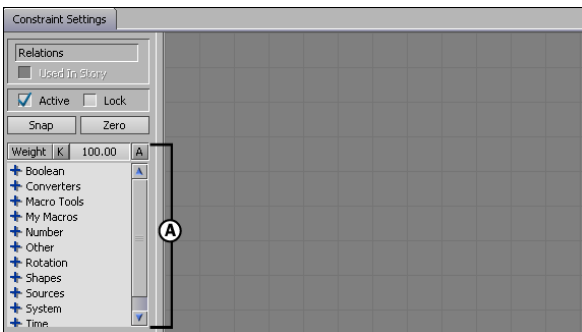
- [Limiting an object's range with the Range constraint](#) on page 933

Relations constraints

65

Relations constraints refer to constraints you create using a graphical interface, called the Relations pane in a connect-the-dots manner.

Elements of the relations constraint, known as objects, once they are added to the Relations pane, are connected to one another to form an equation. Once these elements are combined, they create a relations constraint that can be applied to a model.



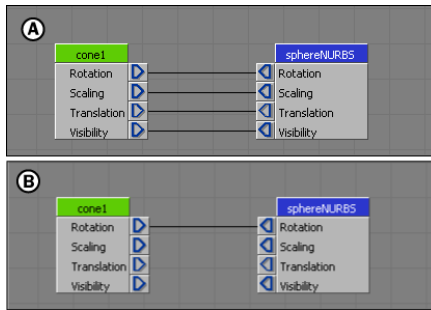
Relations pane A. Objects area

Unlike other constraints, Relations constraints come with mathematical operators that you can use as building blocks to create very specific actions for your models. These building blocks are called Operators.

When a Relations constraint is dragged into the Viewer window, the Constraint settings displays the Relations pane, which is the “drawing board” on which you construct the relation.

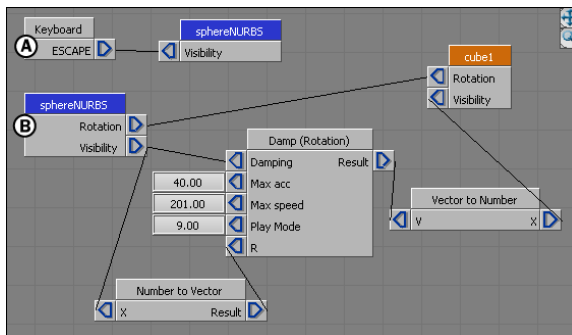
To show how Relations constraints let you create relationships between objects with more control than you can have with other constraint types, see the following figure. This figure shows what a Parent/Child constraint would resemble if it were constructed in the Relations pane.

Unlike a Parent/Child constraint, you can parent the object’s rotation only, so that when the source model moves, the target model is affected only if it rotates. This shows you the kind of precise control you have when you construct a Relations constraint.



Relations pane A. version of a Parent/Child constraint B. With only rotation parented

The constraint shown in shows an even more complex Relations constraint. The keyboard Escape key is used to trigger the visibility of the SphereNURBS model. The second constraint in the pane shows a complex relation that uses the visibility and Rotation of the SphereNURBS model to affect the behavior of the Cube model. For more information on working with complex relations, see [Creating Macro relations](#) on page 944.



Complex Relation A. Keyboard triggering SphereNURB's visibility B. Using SphereNURB's motion to constrain Cube

When using more complex relations, such as the one shown in the previous figure, the Relations pane is helpful because it lets you visualize construction of the relationships between operators. This visualization makes it easy to create and change large constraint interactions involving multiple operators, models, and conditions.

- [Creating a Relations constraint](#) on page 940

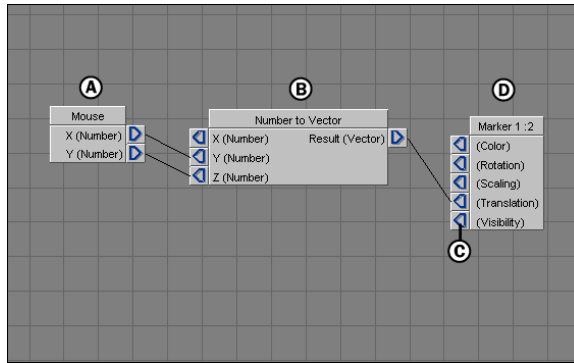
About the Relations pane

When a Relations constraint is selected, the Constraint settings display the Relations pane, a grid where you construct the relation.

Relations constraints map data to models, lights, cameras, and output devices. This data can be animation, a recorded take, or live movement captured from a magnetic system, glove, mouse, joystick, and so on.

A Relations constraint is basically a connection between an input device and a model, but they can also be made between input and output devices, or models and output devices. Unlike other constraints, you construct your own Relations constraint in a grid.

When you select Relations in the Scene browser, the Constraint settings window displays the Relations pane and the Object browser appears in the Constraint settings.



Relations constraint A. Sender B. Operator C. Connector D. Receiver

A Relations constraint consists of at least two objects. One object transmits data (Sender) while the other object interprets the sent data (Receiver).

For example, the relation in maps the movement of the mouse to a marker. Between the Sender and Receiver, an Operator converts the numerical data from the mouse to a vector for use by the marker. Operators are used to perform mathematical operations, comparisons, or conversions.

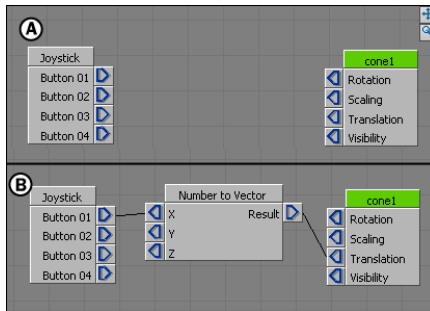
The Sender object can be an input device, such as a mouse, and the Receiver object data can be a model, light, or output device. See [Connecting Senders, Operators, and Receivers](#) on page 942 for information on how to connect input and output boxes.

Conversion relations

Because Relations constraints are mathematical, you cannot connect operators that output different results, such as vectors and numbers.

This would be like trying to perform math functions using musical notes, or trying to spell with numbers. Some translation must occur before you can multiply the number 6 by the note B-flat.

Luckily, to save you time converting all of your operators to universals, MotionBuilder translates these into a common language by automatically inserting a converter between the mismatched operators.



When you try to connect two mismatched operators (A), MotionBuilder inserts a translator between them (B).

In A, the Joystick operator, which produces a numeric result, is about to be connected to the Cone model, which requires a vector result. When they are connected, a Number to Vector converter appears between them.

Creating a Relations constraint

To create a Relations constraint:

- 1 Drag the Relations constraint asset into the Viewer window from the Asset browser.

The Navigator window displays the Constraint settings, and the constraint is added to the Scene browser.

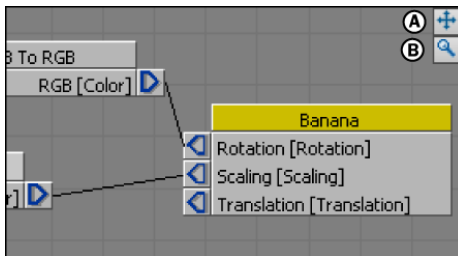
A new folder named “Constraints” appears in the Scene browser, with the new folder named Relations added, and the Navigator window displays the Relations Constraint settings.

- 2 Drag operators into the Relations pane from the Object browser.
You can also Alt-drag materials, objects, and devices from the Scene browser or models from the Viewer window into the Relations pane.
- 3 Connect the Relations boxes together by clicking the arrow at one end of a constraint box and then clicking another arrow on a constraint box.
If a converter is needed in order to correctly join the constraint, it is added automatically.
- 4 Keep dragging boxes into the Relations pane and connecting them until you have the constraint you want.
- 5 Click Active to activate the constraint.

Navigating the Relations pane

You can scroll and zoom in the Relations pane as you would in the Viewer window.

At the upper right of the Relations pane, there are two buttons you can use to move around the pane, the Travelling button and the Zoom button.



**Relations pane Navigation buttons A. Travelling
B. Zoom**

- Dragging the Travelling button lets you pan around the Relations pane.
You can also Shift-drag in the Viewer window to pan in the Relations pane.
You can also Shift-click and drag to scroll through the pane.
- Dragging the Zoom button lets you zoom in and out of the Relations pane.
You can also Ctrl-drag in the Relations pane to zoom. To zoom in on a specific area, Z-click and drag a box around the section you want to expand.
- [Creating a Relations constraint](#) on page 940

- [Relations reference](#) on page 952

Copying and pasting Relations constraints

You can cut, copy, and paste Relations constraint boxes, or entire connected constraints groups, in the Relations pane. You can also copy constraints to be used in a new relation.

To copy and paste Relations constraints:

- 1 Select a constraint box, or a group of constraints in the Relations pane, and press Ctrl-C to copy.
- 2 Press Ctrl-V (paste), and a duplicate of the selected constraint or constraint group appears.

NOTE You can only copy constraints using the Keyboard Ctrl-C and Ctrl-V commands.

- Changing constraint priority

Connecting Senders, Operators, and Receivers

You can connect, sever, or hide connectors on a Relations constraint. You can also set values for Receivers, view values for senders, and switch values from global to local.

When the Relations pane contains all necessary devices, assets, and models for creating a relation, connect the senders, operators, and Receivers. All Relations constraints must start with a Sender and end with a Receiver.

If you are showing values for a Sender, the values are not updated until the Sender is connected to a Receiver.

When you connect two Relations connectors that are different data types (for example, Number and Vector), a conversion relation is automatically created to connect the two Relations constraints.

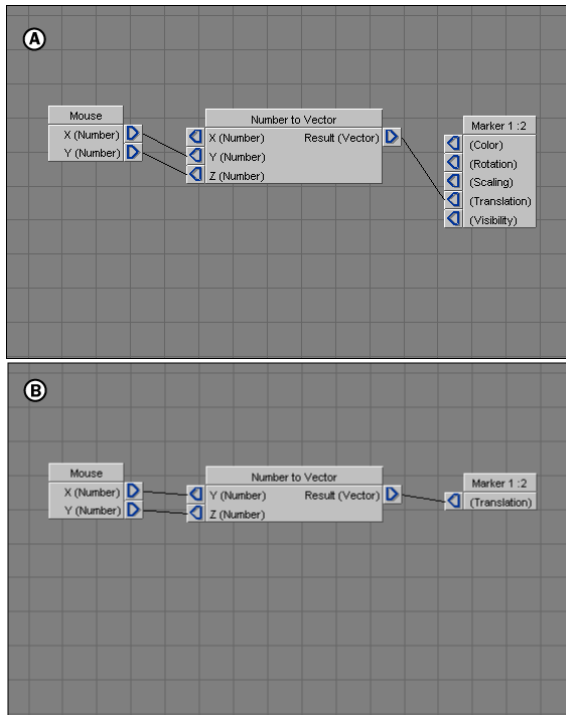
To show or hide connectors:

- 1** Right-click in the Relations pane to display a contextual menu concerning all the connectors in the Relations pane.
- 2** Select Show Value of all Connectors.
This option shows or hides the values of all connectors.
- 3** Select Hide all Unconnected Connectors
This option shows or hides any connectors that are not used by the Relations constraints.

To sever connections, right-click either the Sender or the Receiver and select Disconnect from the contextual menu. The white line that displays between connectors disappears and the connection is broken.

Senders and Receivers have many connectors. Often, not all of these connectors are used within a relation.

To hide the unused connectors, right-click the Senders or Receiver's name and select Hide unconnected from the contextual menu to increase the amount of free window space.



Relations constraint A. Connectors showing B. Connectors hidden.

If you right-click an empty area in the Relations pane you can select an option from a contextual menu to show or hide all unused connectors.

To show the unconnected connectors, right-click the name of the Sender or Receiver that has its connectors hidden and select Show Unconnected.

- [Setting values for Senders and Receivers](#) on page 947

Creating Macro relations

When you create a new Relations constraint, it is automatically added to the operator's My Macros node. Every relation can be used as a Macro that can be renamed and used in another relation. You can add inputs and outputs to your Macro by selecting operators found in the Macro Tools node.

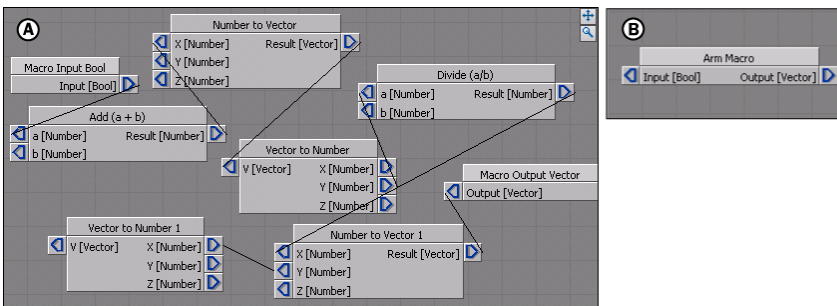
To create Macro relations:

- 1 In the Operators list, expand My Macros, and drag a Macro into the Relations pane.

NOTE You must create a relation constraint for Macros to be in the folder.

- 2 Drag a Macro relation into another relation, a dialog box appears asking if you want to create the relation as a Sender, Receiver, or a Macro.
- 3 Select Macro to create a Relations constraint box that has both Sender and Receiver inputs and outputs, select Sender to create the Relations constraint box as a Sender that transmits data, or select Receiver to create the Relations constraint box as a Receiver that is influenced by the data transmitted from the Sender.

The Macro becomes a single relation, representing the entire set of constraints within that Macro. All the Input-Output Relations constraints used in your Macro become connectors on that relation.



Macro constraint A. A Relations constraint named “Arm Macro” B. “Arm Macro” used as a Macro in the Relations pane.

- [Editing Macro relations](#) on page 945

Editing Macro relations

You can modify a relation used in a Macro constraint by right-clicking it and selecting Edit from the contextual menu.

Edit the full constraint and click Close to return to the Macro constraint’s compressed state.

Deleting Macro relations

Remove Macro relations from the Relations pane the same way you would remove any other Relations constraint.

To delete a Macro relation permanently, right-click it in the Scene browser and select Delete from the contextual menu.

If the Macro is being used in a relation, a warning dialog box appears with the message “The relation constraint x is being used by other Relations. Delete all references to this Macro?”, where x is the name of the relation.

Select Yes to remove the Macro from all Relations constraints.

If the removal of the Macro creates gaps in a constraint, a conversion relation is automatically created to connect the unconnected Relations constraint.

NOTE Macros cannot be recursive. When you delete a Macro, you can choose to delete every reference to that Macro.

Refreshing Macro relations

You can refresh a Macro constraint to show its latest changes by clicking in an empty space in the Relations pane.

Macros are automatically refreshed every time you exit the Relations constraint editor, even if they have not been modified.

Renaming Macro relations

To change the name of your Macro, return to the Scene browser and double-click the Macro’s name. Type the new name in the field and press Enter.

To change the name of a Macro’s Input-Output connector, right-click its name and select Rename from the contextual menu.

Macros are automatically refreshed every time you exit the Relations constraint editor, even if they have not been modified.

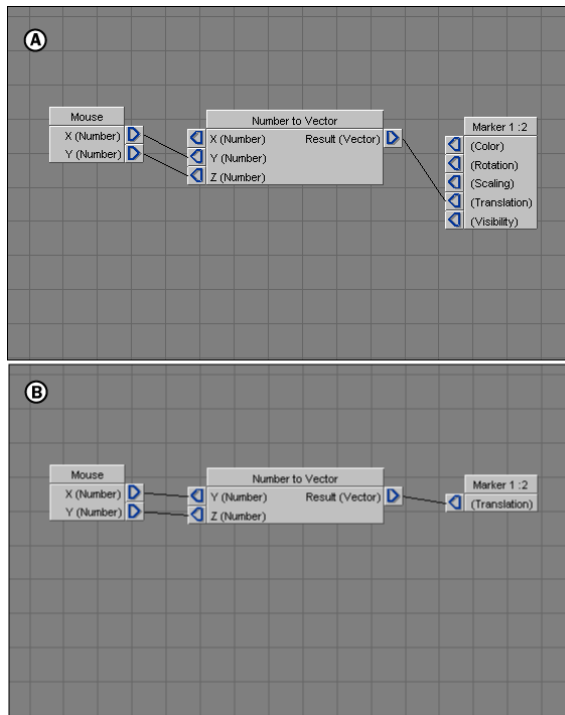
NOTE Macros cannot be recursive. When you delete a Macro, you can choose to delete every reference to that Macro.

Setting values for Senders and Receivers

To set values for Receivers:

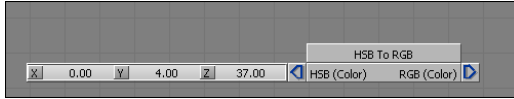
- 1 Right-click the connector and select Set Value.
- 2 Double-click the value field to enter a new value from the contextual menu. Set a value for a Receiver when you want a constant input value.

Setting values deletes any connections previously attached to that connector.



Hiding Connectors A. All connectors shown B. Hide all unused connectors

To show Sender values, right-click the output connector and select Show Value from the contextual menu. White values appear over the connecting lines and change as objects in your constraint change.

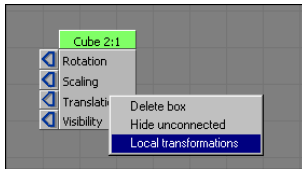


Receiver with values set

When using models in a relation, the values in Relations constraints are expressed in global coordinates (relative to the center of the scene) by default.

You can switch a Sender or Receiver to use local coordinates (relative to its parent).

To do this, right-click the Sender's or Receiver's name and select Local transformations from the contextual menu. The menu item changes to Global transformations which lets you switch to global values.



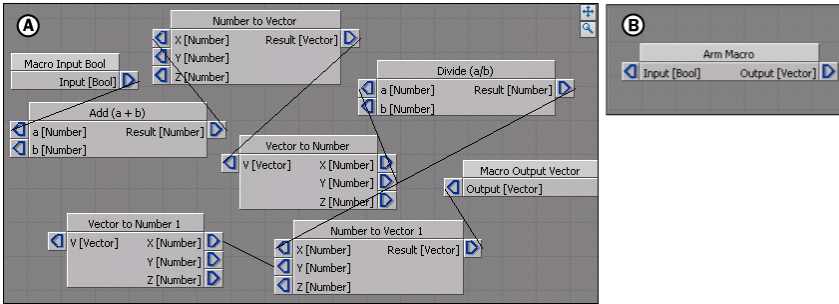
Select Local transformations from the contextual menu

Macro relations

When you create a new Relations constraint, it is automatically added to the operator's My Macros node. Every relation is a Macro that can be renamed and used in another relation. You can add inputs and outputs to your Macro by selecting operators found in the Macro Tools node.

When you drag a Macro relation into another relation, a dialog box appears asking if you want to create the relation as a Sender, Receiver, or a Macro.

Select Macro to create a Relations constraint box that has both Sender and Receiver inputs and outputs, select Sender to create the Relations constraint box as a Sender that transmits data, or select Receiver to create the Relations constraint box as a Receiver that is influenced by the data transmitted from the Sender.



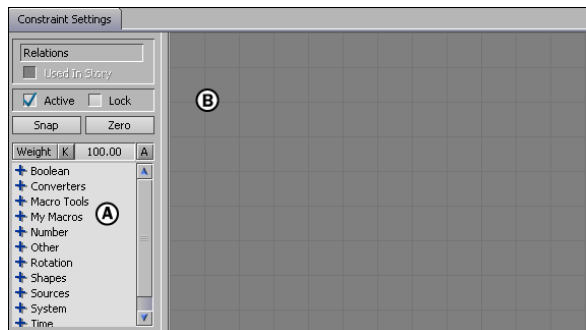
Macro constraint A. A Relations constraint named “Arm Macro” **B.** “Arm Macro” used as a Macro in the Relations pane.

The Macro becomes a single relation, representing the entire set of constraints within that Macro; all the Input-Output Relations constraints used in your Macro become connectors on that relation.

- [Macro relations](#) on page 948
- [Editing Macro relations](#) on page 945

Relations constraint Object browser

The Object browser in the Relations pane appears with operators beneath the Constraint settings only when a Relations constraint is selected.



Relations constraint A. Object browser **B.** Relations pane

The Object browser lets you insert operators, devices, characters, materials, textures, and shaders that form a Relations constraint when connected.

The Object browser contains the following operators:

Boolean

Lists Boolean operators for evaluating Boolean expressions.

Converters

Lists converters for conversion between numerical and vector types.

Macro Tools

Lists Macro Tools with inputs and outputs for creating customized Macro Relations.

My Macros

Lists any existing Relations constraints. You can rename constraints in the Scene browser, and use the My Macros operator to store your custom Relations.

Number

Lists operators for evaluating mathematical expressions involving numbers.

Other

Lists miscellaneous operators, such as trigger controls and FCurve values.

Rotation

Lists operators used specifically for rotation values.

Shapes

Lists operators for use with models that have shape animations (also known as morph targets).

Sources

Lists operators for creating automatic movement, rotation, and shape animation by providing an oscillating data source.

System

Lists operators so you can use a time code and the play or record state in your Relations.

Time

Lists operators for comparing two different times expressed in either SMPTE time code or frames per second. These operators can be used, for example, to trigger rotations, translation, or animation based on the current time code.

Vector

Lists Vector operators for evaluating vector mathematics and other calculations involving vectors. All translation, rotation, and scaling values for models and assets are expressed as vectors.

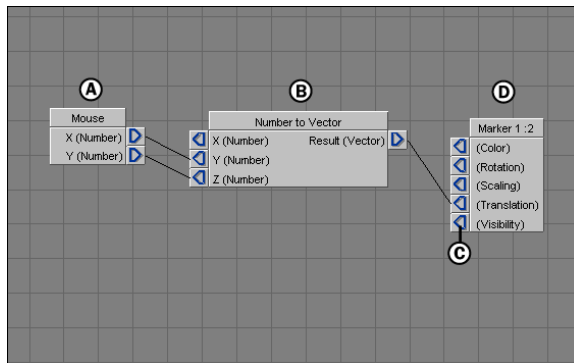
Types of objects used in Relations constraints

The objects used to create a Relations constraint can be broken down into three types:

Senders

A Sender can be an input device or a model. Senders are used to transmit data to operations and Receivers. Senders only send data.

In the following figure, “A” is the mouse Sender, which means that the data used in the constraint is created by the mouse’s X and Y position.



Relations constraint A. Sender B. Operator C. Connector D. Receiver

Operators

An Operator is an object that performs mathematical operations, comparisons, or conversions. It is placed between a Sender and a Receiver. Operators receive and send data.

In the previous figure, the Operator, “B”, takes the mouse’s Y and Z data and interprets the result into vector information to be read by the marker.

Receivers

A Receiver can be a model or an output device. Receivers receive data transmitted from Operators and Senders. In the previous figure, “D” is the Receiver, in this case a Marker, which moves according to the mouse’s (Sender) position, which is modified by the Operator.

■ [Connecting Senders, Operators, and Receivers](#) on page 942

Relations reference

This section lists the Relations operators supported by MotionBuilder. The list of operators used in a Relations constraint is further divided by numeric type or usage. Operators are shown only in the Relations pane.

Boolean

Use Boolean operators to evaluate Boolean expressions. The following Boolean expressions are supported by MotionBuilder:

| AND | |
|----------|---|
| Purpose | Evaluates the Boolean expression (a and b). |
| Receives | Two Boolean values. |

AND

| | |
|-------|--|
| Sends | (1) when both (a) and (b) equal (1). Otherwise, (0) is sent.(a)(b)(Result) 000 010 100 111 |
|-------|--|

Flip flop

| | |
|---------|--|
| Purpose | This is a special box that acts like a switch. |
|---------|--|

| | |
|----------|--------------------------------------|
| Receives | Two Boolean values, (b) and (Clear). |
|----------|--------------------------------------|

| | |
|-------|---|
| Sends | When (b) is equal to (1) the (result) is reversed (0). For example, the first time (b) equals (1) the (result) is (1). The second time the (result) is (0). The third time the (result) is (1), and so on. When (Clear) equals (1), (result) is reset to (0). |
|-------|---|

Memory (B1 when REC)

| | |
|---------|---|
| Purpose | Boolean trigger operator which keeps triggering while a second trigger is received. |
|---------|---|

| | |
|----------|-------------------------------------|
| Receives | Two Boolean values, (b1) and (REC). |
|----------|-------------------------------------|

| | |
|-------|---|
| Sends | The value (b1) is sent to (result) when (REC) equals (1). |
|-------|---|

Memory (last trigger)

| | |
|---------|--|
| Purpose | Boolean trigger operator which keeps the last trigger until a new trigger is received. |
|---------|--|

| | |
|----------|---|
| Receives | Ten Boolean values: (b1-b10) and (Clear). |
|----------|---|

Memory (last trigger)

| | |
|-------|--|
| Sends | Ten Boolean output values (Out1-Out10) and a result number. When any (bn) is set to (1), its relative (Outn) is set to (1) and kept until another (bn) receives a (1). If any (Outn) equals (1), (result) equals (1). When (Clear) equals (1), all (Outn) are reset to (0). If you need to use more than ten entry connectors, you can connect two of these operators together by sending the (result) of the first operator into the (Clear) of the second operator. You also have to connect the (Clear) of the second into the (result) of the first. |
|-------|--|

NAND

| | |
|----------|---|
| Purpose | Evaluates the Boolean expression not ((a) and (b)). |
| Receives | Two Boolean values. |
| Sends | (0) when (a) and (b) equals (1). Otherwise, (1) is sent. (a) (b) (Result) 0 0 1 0 1 1 1 0 1 1 1 0 |

NOR

| | |
|----------|--|
| Purpose | Evaluates the Boolean expression not ((a) or (b)). |
| Receives | Two Boolean values. |

NOR

| | |
|-------|--|
| Sends | (0) when (a) or (b) equals (1). (a) (b) (Result) 0 0 1 0 1 0 1 0 0 1 1 0 |
|-------|--|

NOT

| | |
|---------|---|
| Purpose | Evaluates the Boolean expression not (a). |
|---------|---|

| | |
|----------|------------------|
| Receives | A Boolean value. |
|----------|------------------|

| | |
|-------|---|
| Sends | The opposite of (a). (a) (Result) 0 1 1 0 |
|-------|---|

OR

| | |
|---------|--|
| Purpose | Evaluates the Boolean expression (a or b). |
|---------|--|

| | |
|----------|---------------------|
| Receives | Two Boolean values. |
|----------|---------------------|

| | |
|-------|--|
| Sends | (1) when (a) or (b) equals (1). (a) (b) (Result) 0 0 0 0 1 1 1 0 1 1 1 1 |
|-------|--|

XNOR

| | |
|---------|--|
| Purpose | Evaluates the Boolean expression (a is equivalent to b). |
|---------|--|

| | |
|----------|---------------------|
| Receives | Two Boolean values. |
|----------|---------------------|

| | |
|-------|--|
| Sends | (0) when (a) and (b) are different. (a) (b) (Result) 0 0 1 0 1 0 1 0 0 1 1 1 |
|-------|--|

XOR

| | |
|---------|--|
| Purpose | Evaluates the Boolean expression not (a is equivalent to b). |
|---------|--|

XOR

| | |
|----------|--|
| Receives | Two Boolean values. |
| Sends | (1) when (a) and (b) are different.(a) (b) (Result) 0 0 0 0 1 1 1 0 1 1 0 |

Converters

Use converters to convert between numerical and vector types. MotionBuilder supports the following converters:

Deg to rad

| | |
|----------|--|
| Purpose | Converts an angle from a degree to a radian. |
| Receives | A numerical value. |
| Sends | A numerical value. |

HSB to RGB

| | |
|----------|--|
| Purpose | Converts HSB to RGB mode. |
| Receives | Three numerical values (h), (s), and (b), where h = hue, s = saturation, and b = brightness. |
| Sends | Three numerical values: (x), (y), and (z). |

Number to RGBA

| | |
|----------|--|
| Purpose | Converts four numbers into a color vector. |
| Receives | Four numerical values: (r), (g), (b), and (a). |

Number to RGBA

| | |
|-------|--|
| Sends | A color vector as (result) = {r,g,b,a}. Where (r) = red, (g) = green, (b) = blue, and (a) = alpha. |
|-------|--|

Number to vector

| | |
|---------|---------------------------------------|
| Purpose | Converts three numbers into a vector. |
|---------|---------------------------------------|

| | |
|----------|--|
| Receives | Three numerical values: (x), (y), and (z). |
|----------|--|

| | |
|-------|---------------------------------|
| Sends | A vector as (result) = {x,y,z}. |
|-------|---------------------------------|

Rad to deg

| | |
|---------|--|
| Purpose | Converts representation from a radian to a degree. |
|---------|--|

| | |
|----------|--------------------|
| Receives | A numerical value. |
|----------|--------------------|

| | |
|-------|--------------------|
| Sends | A numerical value. |
|-------|--------------------|

RGB to HSB

| | |
|---------|---------------------------|
| Purpose | Converts RGB to HSB mode. |
|---------|---------------------------|

| | |
|----------|--|
| Receives | Three numerical values: (x), (y), and (z). |
|----------|--|

| | |
|-------|--|
| Sends | Three numerical values (h), (s), and (b), where h = hue, s = saturation, and b = brightness. |
|-------|--|

RGB to RGBA

| | |
|---------|---|
| Purpose | Converts RGB to RGBA with Alpha channel mode. |
|---------|---|

RGB to RGBA

| | |
|----------|---|
| Receives | Three numerical values: (r), (g) and (b). |
|----------|---|

| | |
|-------|--|
| Sends | Four numerical values: (r), (g), (b), and (a). |
|-------|--|

RGBA to number

| | |
|---------|--|
| Purpose | Converts a color vector into four numbers. |
|---------|--|

| | |
|----------|----------------------------|
| Receives | A color vector: {r,g,b,a}. |
|----------|----------------------------|

| | |
|-------|---|
| Sends | Four numerical values (r), (g), (b), and (a) where (r) = red, (g) = green, (b) = blue, and (a) = alpha. |
|-------|---|

RGBA to RGB

| | |
|---------|--|
| Purpose | Converts RGB with Alpha channel to RGB mode. |
|---------|--|

| | |
|----------|--|
| Receives | Four numerical values: (r), (g), (b), and (a). |
|----------|--|

| | |
|-------|---|
| Sends | Three numerical values: (r), (g) and (b). |
|-------|---|

Seconds to Time

| | |
|---------|--|
| Purpose | Converts a number of seconds to a time format. |
|---------|--|

| | |
|----------|--------------------|
| Receives | Number of seconds. |
|----------|--------------------|

| | |
|-------|----------------------|
| Sends | Time in time format. |
|-------|----------------------|

Time to Seconds

| | |
|---------|---------------------------------------|
| Purpose | Converts time to a number of seconds. |
|---------|---------------------------------------|

Time to Seconds

| | |
|----------|----------------------|
| Receives | Time in time format. |
|----------|----------------------|

| | |
|-------|--------------------|
| Sends | Number of seconds. |
|-------|--------------------|

Vector to Number

| | |
|---------|---------------------------------------|
| Purpose | Converts a vector into three numbers. |
|---------|---------------------------------------|

| | |
|----------|----------------------|
| Receives | A vector: {x, y, z}. |
|----------|----------------------|

| | |
|-------|--|
| Sends | Three numerical values: (x), (y), and (z). |
|-------|--|

Macro Tools

Use the Macro Tools to create customized relation boxes. Any input and output boxes you drop into your Macro become connectors on your customized Relations box.

Change the name of your connectors by right-clicking the input or output boxes, and selecting Rename from the contextual menu.

Macro Input Bool

| | |
|-------|------------------|
| Sends | Input (Boolean). |
|-------|------------------|

Macro Input ColorAndAlpha

| | |
|-------|------------------------|
| Sends | Input (ColorAndAlpha). |
|-------|------------------------|

Macro Input Number

| | |
|-------|-----------------|
| Sends | Input (number). |
|-------|-----------------|

Macro Input Time

| | |
|-------|---------------|
| Sends | Input (time). |
|-------|---------------|

Macro Input Vector

| | |
|-------|-----------------|
| Sends | Input (vector). |
|-------|-----------------|

Macro Output Bool

| | |
|----------|-------------------|
| Receives | Output (Boolean). |
|----------|-------------------|

Macro Output ColorAndAlpha

| | |
|----------|-------------------------|
| Receives | Output (ColorAndAlpha). |
|----------|-------------------------|

Macro Output Time

| | |
|----------|----------------|
| Receives | Output (time). |
|----------|----------------|

Macro Output Vector

Macro Output Vector

| | |
|-------|------------------|
| Sends | Output (vector). |
|-------|------------------|

My Macros

Any new Relations constraint you create appears in the My Macros operators. You can rename the constraint in the Scene browser and use the My Macros operator to store your custom Relations constraints.

Drag custom Macro constraints from Operators into the Viewer window. For more on macros, see [Creating Macro relations](#) on page 944.

Number

The Number operators evaluate mathematical expressions involving numbers. If you want to evaluate vector mathematics, use the appropriate rotation or vector operator.

Absolute (|a|)

| | |
|----------|---|
| Purpose | Sends the absolute value of a received number. |
| Receives | A numerical value: (a). |
| Sends | The positive value of the received number. For example, if (a) = -3, the (result) is 3. |

Add (a + b)

| | |
|----------|---------------------------|
| Purpose | Adds two numbers. |
| Receives | Two numbers: (a) and (b). |

Add (a + b)

| | |
|-------|---|
| Sends | The sum of the two numbers. (result) = (a) + (b). |
|-------|---|

arccos (a)

| | |
|---------|---|
| Purpose | Performs the arccosine function on a numerical value. |
|---------|---|

| | |
|----------|-------------------------|
| Receives | A numerical value: (a). |
|----------|-------------------------|

| | |
|-------|---|
| Sends | The arccosine of a. (result) = arccos(a). |
|-------|---|

arcsin (a)

| | |
|---------|---|
| Purpose | Performs the arcsine function on a numerical value. |
|---------|---|

| | |
|----------|------------------------|
| Receives | A numerical value (a). |
|----------|------------------------|

| | |
|-------|---|
| Sends | The arcsine of a. (result) = arcsin(a). |
|-------|---|

arctan (a)

| | |
|---------|---|
| Purpose | Performs the inverse of a tangent function. |
|---------|---|

| | |
|----------|-------------------------|
| Receives | A numerical value: (a). |
|----------|-------------------------|

| | |
|-------|-----------------------------|
| Sends | The inverse tangent of (a). |
|-------|-----------------------------|

arctan2 (b/a)

| | |
|---------|--|
| Purpose | Performs the arctangent function using two numerical values. |
|---------|--|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

arctan2 (b/a)

| | |
|-------|---|
| Sends | The arctangent of (b) divided by (a). (result) = $\arctan(b/a)$. |
|-------|---|

Cosine cos (a)

| | |
|---------|--|
| Purpose | Performs the cosine function on a numerical value. |
|---------|--|

| | |
|----------|-------------------------|
| Receives | A numerical value: (a). |
|----------|-------------------------|

| | |
|-------|---|
| Sends | The cosine of a. (result) = $\cos(a)$. |
|-------|---|

Damp

| | |
|---------|---------------------------------------|
| Purpose | Applies damping to a numerical value. |
|---------|---------------------------------------|

| | |
|----------|---|
| Receives | Two numerical values. The first value (a) is the value to be damped. The second value (Damping Factor) is the damping factor. |
|----------|---|

| | |
|-------|------------------------------|
| Sends | (result) = (a) with damping. |
|-------|------------------------------|

Damp (clock-based)

| | |
|---------|---|
| Purpose | Similar to Damp, except this relation is based on the MotionBuilder clock instead of the refresh rate. This relation is recommended over the Damp relation, as it makes your scene identical on every computer. |
|---------|---|

| | |
|----------|---|
| Receives | A (number), Damping Factor (number) and Play Mode (number). |
|----------|---|

Damp (clock-based)

| | |
|-------|------------------|
| Sends | Result (number). |
|-------|------------------|

Distance Numbers

| | |
|---------|--|
| Purpose | Calculates the distance between two positions. |
|---------|--|

| | |
|----------|---------------------------|
| Receives | Two numbers: (a) and (b). |
|----------|---------------------------|

| | |
|-------|-----------------------------------|
| Sends | The distance between (a) and (b). |
|-------|-----------------------------------|

Divide (a/b)

| | |
|---------|----------------------|
| Purpose | Divides two numbers. |
|---------|----------------------|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

| | |
|-------|--|
| Sends | The quotient of the first number (a) divided by the second number (b). (result) = (a/b). |
|-------|--|

Exp (a)

| | |
|---------|--|
| Purpose | Multiplies the base value [e] by itself (a) times. [e=2.718] |
|---------|--|

| | |
|----------|-------------------------|
| Receives | A numerical value: (a). |
|----------|-------------------------|

| | |
|-------|--|
| Sends | (result) = (e^a). For example (e^2) is 2.718 x 2.718 = 7.3875. |
|-------|--|

Exponent (a^b)

| | |
|---------|---|
| Purpose | Multiplies the numerical value (a) by itself (b) times. |
|---------|---|

Exponent (a^b)

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

| | |
|-------|---|
| Sends | (result) = (a^b), or (a) to the power of (b). |
|-------|---|

If Cond Then A Else B

| | |
|---------|--|
| Purpose | Evaluates an If, Then, Else statement. |
|---------|--|

| | |
|----------|---|
| Receives | Two numerical values: (a) and (b), and a condition: (bool). |
|----------|---|

| | |
|-------|---|
| Sends | If Cond is non-zero, the (a) input is output as the Result. If the Cond is zero, the (b) input is output as the Result. |
|-------|---|

Integer

| | |
|---------|--|
| Purpose | Rounds numerical values down to the next full digit. |
|---------|--|

| | |
|----------|-------------------------|
| Receives | A numerical value: (a). |
|----------|-------------------------|

| | |
|-------|--|
| Sends | The numerical value rounded down to the next full digit. |
|-------|--|

Invert ($1/a$)

| | |
|---------|----------------------------|
| Purpose | Inverts a numerical value. |
|---------|----------------------------|

| | |
|----------|------------------------|
| Receives | a numerical value (a). |
|----------|------------------------|

Invert (1/a)

| | |
|-------|---|
| Sends | 1 divided by a numerical value. (result) = (1/a). |
|-------|---|

Is between A and B

| | |
|---------|--|
| Purpose | Checks if one value is between two others. |
|---------|--|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

| | |
|-------|---|
| Sends | (result) = true (1) if the first value (a) is between the second value (b). Otherwise, (result) is false (0). |
|-------|---|

Is different (a != b)

| | |
|---------|-------------------------------------|
| Purpose | Checks if two values are not equal. |
|---------|-------------------------------------|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

| | |
|-------|--|
| Sends | (result) = true (1) if the first value (a) is not equal to the second value (b). Otherwise, (result) is false (0). |
|-------|--|

Is greater (a > b)

| | |
|---------|--|
| Purpose | Checks if one value is greater than another. |
|---------|--|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

Is greater ($a > b$)

| | |
|-------|--|
| Sends | (result) = true (1) if the first value (a) is greater than the second value (b). Otherwise, (result) is false (0). |
|-------|--|

Is greater or equal ($a \geq b$)

| | |
|---------|--|
| Purpose | Checks if one value is greater than or equal to another. |
|---------|--|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

| | |
|-------|--|
| Sends | (result) = true (1) if the first value (a) is greater than or equal to the second value (b). Otherwise, (result) is false (0). |
|-------|--|

Is identical ($a == b$)

| | |
|---------|---------------------------------|
| Purpose | Checks if two values are equal. |
|---------|---------------------------------|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

| | |
|-------|--|
| Sends | (result) = true (1) if the first value (a) is equal to the second value (b). Otherwise, (result) is false (0). |
|-------|--|

Is less ($a < b$)

| | |
|---------|---|
| Purpose | Checks if one value is less than another. |
|---------|---|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

Is less ($a < b$)

| | |
|-------|---|
| Sends | (result) = true (1) if the first value (a) is less than the second value (b). Otherwise, (result) is false (0). |
|-------|---|

Is less or equal ($a \leq b$)

| | |
|---------|---|
| Purpose | Checks if one value is less than or equal to another. |
|---------|---|

| | |
|----------|------------------------------------|
| Receives | two numerical values: (a) and (b). |
|----------|------------------------------------|

| | |
|-------|---|
| Sends | (result) = true (1) if the first value (a) is less than or equal to the second value (b). Otherwise, (result) is false (0). |
|-------|---|

ln(a)

| | |
|---------|-----------------------------------|
| Purpose | Calculates the natural logarithm. |
|---------|-----------------------------------|

| | |
|----------|-------------------------|
| Receives | A numerical value: (a). |
|----------|-------------------------|

| | |
|-------|---|
| Sends | The natural logarithm of (a). (result) = $\ln(a)$. |
|-------|---|

Log(a)

| | |
|---------|---|
| Purpose | Calculates the base-10 logarithm of a number. |
|---------|---|

| | |
|----------|-------------------------|
| Receives | A numerical value: (a). |
|----------|-------------------------|

Log(a)

| | |
|-------|--|
| Sends | The base-10 logarithm of (a). (result) = $\log(a)$. |
|-------|--|

Memory (a when REC)

| | |
|---------|--|
| Purpose | The value (a) is sent to (result) when (REC) equals (1). Use this operator to send a value when a trigger is received (REC). |
|---------|--|

| | |
|----------|---|
| Receives | A numerical value: (a) and a Boolean value: (REC which is either 0 or 1). |
|----------|---|

| | |
|-------|-----------------------------|
| Sends | (a) when (REC) is true (1). |
|-------|-----------------------------|

Modulo mod (a,b)

| | |
|---------|---|
| Purpose | Divides two values and sends the remainder. |
|---------|---|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

| | |
|-------|---|
| Sends | The quotient of dividing the first value (a) by the second value (b). |
|-------|---|

Multiply (a)(b)

| | |
|---------|------------------------|
| Purpose | Multiplies two values. |
|---------|------------------------|

| | |
|----------|------------------------------------|
| Receives | Two numerical values: (a) and (b). |
|----------|------------------------------------|

Multiply (a)(b)

| | |
|-------|--|
| Sends | The product of multiplying the first value (a) by the second value (b). (result) = (a)(b). |
|-------|--|

Precision numbers

| | |
|---------|--|
| Purpose | Cuts the number at a specified precision value, for example, if a = 12.36 and the assigned precision value is 0.1, then the output is 12.30. |
|---------|--|

| | |
|----------|-------------------------------------|
| Receives | (a)(number) and Precision (number). |
|----------|-------------------------------------|

| | |
|-------|------------------|
| Sends | Result (number). |
|-------|------------------|

Pull number

| | |
|---------|---|
| Purpose | Continuously pulls the value from the input parameter and stores the result in the internal buffer, which is then used as the Result value. Gives you the value of the last evaluation, which is useful if you need to constrain an object with its own data. |
|---------|---|

| | |
|----------|-------------|
| Receives | (a)(number) |
|----------|-------------|

| | |
|-------|-----------------|
| Sends | Result (number) |
|-------|-----------------|

Scale and offset (Number)

| | |
|---------|---------------------------------------|
| Purpose | Scales and offsets a numerical value. |
|---------|---------------------------------------|

| | |
|----------|--|
| Receives | Five numerical values: a maximum clamping number (Clamp Max), a minimum clamping number (Clamp Min), an offset |
|----------|--|

Scale and offset (Number)

(Offset), a scaling factor (Scale Factor), and the original value (x).

Sends

The original value (x) multiplied by the scaling factor (Scale Factor) and offset by an offset value (Offset). If the result is greater than the maximum clamping value (Clamp Max), the maximum clamping value is sent. If the result is lower than the minimum clamping value (Clamp Min), the minimum clamping value is sent. (result) = [(x) multiplied by (Scale) + (Offset)]. (result) is no less than (Clamp Min) and no greater than (Clamp Max).

Sine sin(a)

Purpose

Performs the sine function on a numerical value.

Receives

A numerical value: (a).

Sends

The sine of (a). (result) = sin(a).

sqrt(a)

Purpose

Finds the square root of a numerical value.

Receives

A numerical value: (a).

| | |
|---------------------------------|---|
| sqrt(a) | |
| Sends | The square root of the received value. (result) = sqrt(a). |
| Subtract (a-b) | |
| Purpose | Subtracts two numerical values, (a) and (b). |
| Receives | Two numerical values: (a) and (b). |
| Sends | The result of the first number subtracted by the second number. (result) = (a) - (b). |
| Sum 10 numbers | |
| Purpose | Adds 10 to a numerical value. |
| Receives | Ten numerical values: (a),(b),(c),(d),(e),(f),(g),(h),(i),(j). |
| Sends | Numerical value + 10. (result) = (a)+10 |
| Tangent tan(a) | |
| Purpose | Performs the tangent function on a numerical value. |
| Receives | A numerical value: (a). |
| Sends | The tangent of (a). (result) = tangent(a). |
| Triggered delay (Number) | |
| Purpose | Delays sending a numerical value. |

Triggered delay (Number)

| | |
|----------|---|
| Receives | A delay in time format, the number to be sent following the delay, a panic button, and an "Enabled" button that starts the counter. |
|----------|---|

| | |
|-------|--|
| Sends | The received number after a time delay, which starts counting when the box is enabled. Trigger the panic button to send the number before the time delay is reached. |
|-------|--|

Triggered Delay with Memory (Number)

| | |
|---------|-----------------------------------|
| Purpose | Delays sending a numerical value. |
|---------|-----------------------------------|

| | |
|----------|---|
| Receives | A delay in time format, the number to be sent following the delay, and a toggle switch. |
|----------|---|

| | |
|-------|---|
| Sends | The received number after a time delay. |
|-------|---|

Other

These are miscellaneous operators.

Bezier curve

| | |
|---------|---|
| Purpose | Creates spline behavior, like "Paths" in other 3D applications. One box creates one segment if a spline. Join multiple boxes to create a spline with many segments. Four objects are required to serve as control points. |
|---------|---|

| | |
|----------|--|
| Receives | Four translations (Control points 1-4 and previous segment's result), Position ratio (0-100%. Represents the position on the |
|----------|--|

Bezier curve

curve sent to the result. If you use multiple segments connected to the same source value for every bezier curve boxes), Segment count (the number of segments, or Bezier curve boxes, used), and Segment index (the order of this box when used in a series of segments, starting at 1.

Sends

Result (Number)

Clip trigger

Receives

Three translations (Front, Source, and Target) and a Stop Range.

Sends

Accel, Decel, Forward, Left 45, Left 90, Right 45, Right 90, Turn 180.

Damping (3D)

Purpose

Damps the position of a vector using a specified damping factor.

Receives

A numerical damping factor (Damping Factor) and the vector to be dampened (P).

Sends

A vector after applying damping.

Damp (3D) (Clock-based)

Purpose

Similar to Damp (clock-based), except this relation is based on the Damp (3D) relation.

Damp (3D) (Clock-based)

| | |
|----------|--|
| Receives | P (Point), Damping Factor (Number) and Play Mode (Number). |
|----------|--|

| | |
|-------|------------------|
| Sends | Result (Number). |
|-------|------------------|

FCurve number (%)

| | |
|---------|--|
| Purpose | Right-click and select Edit from the contextual menu to edit the FCurve manually. Shown as a percentage relative to the length of the curve. |
|---------|--|

| | |
|----------|-----------------------------|
| Receives | Percentage 0-100% (number). |
|----------|-----------------------------|

| | |
|-------|-----------------|
| Sends | Value (number). |
|-------|-----------------|

FCurve number (Time)

| | |
|---------|---|
| Purpose | Right-click and select Edit from the contextual menu to edit the FCurve manually. Sends a value relative to the current time. |
|---------|---|

| | |
|----------|----------------------|
| Receives | Position % (number). |
|----------|----------------------|

| | |
|-------|-----------------|
| Sends | Value (number). |
|-------|-----------------|

Triggered plus minus counter

| | |
|---------|---|
| Purpose | Creates a trigger to add the increment/decrement. (You must specify the value of the increment/decrement.) Also contains a Loop option. |
|---------|---|

| | |
|----------|---|
| Receives | Increment, Max, Min (numbers) and Loop, Trigger Increase, Trigger Decrease (Boolean). |
|----------|---|

Triggered plus minus counter

| | |
|-------|----------------------------------|
| Sends | Number. (result) = (a)+ or (a)-. |
|-------|----------------------------------|

Triggered random

| | |
|---------|--------------------------------------|
| Purpose | Generates a random number on demand. |
|---------|--------------------------------------|

| | |
|----------|--|
| Receives | Max, Min, Precision, Seed (number) and Trigger Get Number (Boolean.) |
|----------|--|

| | |
|-------|---------|
| Sends | Number. |
|-------|---------|

Rotation

The Rotation operators are used specifically for rotation values. All rotation values are vectors.

Add (R1 + R2)

| | |
|---------|-------------------------------------|
| Purpose | Adds two rotation vectors together. |
|---------|-------------------------------------|

| | |
|----------|--------------------------------------|
| Receives | Two rotation vectors: (Ra) and (Rb). |
|----------|--------------------------------------|

| | |
|-------|---------------------------------------|
| Sends | A vector sum. (result) = (Ra) + (Rb). |
|-------|---------------------------------------|

Angle difference (Points)

| | |
|---------|---|
| Purpose | Calculates the angle between two vectors, or points, using a supplied radius. |
|---------|---|

| | |
|----------|---|
| Receives | Two vectors for the position of each point: (P1) and (P2), and the radius (Radius). |
|----------|---|

Angle difference (Points)

| | |
|-------|---------------------------------|
| Sends | The angle as a numerical value. |
|-------|---------------------------------|

Angle difference (Rotations)

| | |
|---------|---|
| Purpose | Calculates the difference between the rotation of two objects. The result can be scaled and offset. |
|---------|---|

| | |
|----------|---|
| Receives | The scaling factor (Mult. Factor) and numerical offset (Offset) followed by the two rotations to be compared (R1 and R2). |
|----------|---|

| | |
|-------|--|
| Sends | The angle difference between the two rotations, scaled and offset. |
|-------|--|

Angular acceleration

| | |
|---------|--|
| Purpose | Returns the angular acceleration of a rotation vector. |
|---------|--|

| | |
|----------|---------------------|
| Receives | Rotation value (R). |
|----------|---------------------|

| | |
|-------|------------------|
| Sends | Result (vector). |
|-------|------------------|

Angular speed

| | |
|---------|---|
| Purpose | Returns the angular speed of a rotation vector. |
|---------|---|

| | |
|----------|---------------------|
| Receives | Rotation value (R). |
|----------|---------------------|

Angular speed

| | |
|-------|------------------|
| Sends | Result (vector). |
|-------|------------------|

Damp (Rotation)

| | |
|---------|---------------------------------------|
| Purpose | Applies damping to a rotation vector. |
|---------|---------------------------------------|

| | |
|----------|---|
| Receives | Damping (number), Maximum acceleration (Max acc), Maximum speed (Max speed), and rotation vector (R). |
|----------|---|

| | |
|-------|---------------------------|
| Sends | Dampened rotation vector. |
|-------|---------------------------|

Global to local

| | |
|---------|--|
| Purpose | Converts a rotation vector from global to local coordinates. |
|---------|--|

| | |
|----------|--|
| Receives | A base rotation vector (Base) and a Global rotation vector (Global Rot). |
|----------|--|

| | |
|-------|-------------------------------|
| Sends | The converted local rotation. |
|-------|-------------------------------|

Interpolate

| | |
|---------|-------------------------------------|
| Purpose | Interpolates between two rotations. |
|---------|-------------------------------------|

| | |
|----------|--|
| Receives | A numerical ratio (c) and two rotation vectors: (Ra) and (Rb). |
|----------|--|

Interpolate

| | |
|-------|---|
| Sends | The difference between rotation vectors (Ra) and (Rb). The difference is sent as a vector. $(\text{result}) = (\text{Ra}) + c[(\text{Rb}) - (\text{Ra})]$. |
|-------|---|

Local to global

| | |
|---------|--|
| Purpose | Converts a rotation vector from local to global coordinates. |
|---------|--|

| | |
|----------|---|
| Receives | A base rotation vector (Base), and Local rotation vector (Local Rot). |
|----------|---|

| | |
|-------|--------------------------------|
| Sends | The converted global rotation. |
|-------|--------------------------------|

Rotation scaling

| | |
|---------|--|
| Purpose | Scales a rotation vector based on a numerical ratio. |
|---------|--|

| | |
|----------|--|
| Receives | A numerical ratio (b) and the rotation vector to be scaled (Ra). |
|----------|--|

| | |
|-------|--|
| Sends | A scaled rotation vector. $(\text{result}) = (b)(\text{Ra})$ |
|-------|--|

Sensor rotation helper

| | |
|----------|--|
| Receives | A rotation vector from the model (Model), a rotation offset (Offset), the rotation vector from the sensor (Sensor), and a numerical scaling factor for each coordinate (X factor, Y factor, and Z factor). |
|----------|--|

Sensor rotation helper

| | |
|-------|--------------------|
| Sends | A rotation vector. |
|-------|--------------------|

Subtract(R1 - R2)

| | |
|---------|---------------------------------|
| Purpose | Subtracts two rotation vectors. |
|---------|---------------------------------|

| | |
|----------|--------------------------------------|
| Receives | Two rotation vectors: (Ra) and (Rb). |
|----------|--------------------------------------|

| | |
|-------|--|
| Sends | The result of the first rotation vector subtracted by the second rotation vector. (result) = (Ra) - (Rb). |
|-------|--|

Three-point constraint

| | |
|---------|--|
| Purpose | Creates a rotation from three vectors. |
|---------|--|

| | |
|----------|---|
| Receives | Three position vectors: (Pa, Pb, and Pc). |
|----------|---|

| | |
|-------|--|
| Sends | A rotation vector based on the three received vectors. |
|-------|--|

Shapes

Shape operators are special operators for use with models that have shape animations (also known as morph targets).

Select exclusive

| | |
|---------|--|
| Purpose | Calculates the shape's values relative to the ratio (percent / [SUM shape n]) only when [SUM shape n] is greater than (Percent). |
|---------|--|

| | |
|----------|---|
| Receives | A percentage (Percent) and six shapes as well as a Default Shape. |
|----------|---|

Select exclusive

| | |
|-------|---|
| Sends | Result (shapes) = (percent / [SUM shape n]) x (shape n). Result (Default Shape) = (percent - [SUM shape n]). For example, (percent = 80), (Shape 1= 60), (Shape 2= 50) and (Shape 3= 90). Result is (Shape 1= 24), (Shape 2= 20) and (Shape 3= 36). |
|-------|---|

Select exclusive 24

| | |
|-------------------|---|
| Purpose | Same as Select exclusive, except it offers twenty-four shapes. |
| Shape calibration | Calculates the percentage of a value interpolated between a minimum and a maximum value. |
| Receives | A maximum numerical value (Max), a minimum numerical value (Min), a Boolean reverse value (0 or 1), and the value to be calibrated (Value). |
| Sends | A percentage. If (reverse) is 1, the result is reversed. (result) = 100 - (result). |

Sources

You can use source operators to create automatic movement, rotation, and shape animation by providing an oscillating data source. For example, the Sine Ramp creates a sine wave that can be used to make a model's eyes blink.

Counter with play pause

| | |
|---------|--|
| Purpose | Similar to Counter with Start Stop, this source operator also lets you create a counter. |
|---------|--|

Counter with play pause

| | |
|----------|--|
| Receives | Bounce (bool), Loop (number), Max (number), Min (number), Play Mode, Speed, Trigger (Bool), and Trigger Reset. |
| Sends | Count (number). The counter begins counting when the Trigger connector receives a non-zero value. The counter increases from the Start value to the Stop value. If the Bounce connector is set to true (1), the counter decreases back to the Start value. Use the Freq value to set the number of times the count is performed. |

Counter with start stop

| | |
|----------|--|
| Purpose | This source operator lets you create a counter. |
| Receives | Bounce (bool), Freq (number), Start (number), Stop (number), and Trigger (Bool). |
| Sends | Count (number). The counter begins counting when the Trigger connector receives a non-zero value. The counter increases from the Start value to the Stop value. If the Bounce connector is set to true (1), the counter decreases back to the Start value. Use the Freq value to set the number of times the count is performed. |

Half circle ramp

| | |
|---------|---|
| Purpose | Applies the input values to a half circle ramp. |
|---------|---|

Half circle ramp

| | |
|----------|--|
| Receives | Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %). |
| Sends | A half circle ramp based on the received amplitude, frequency, and phase percentage. |

Isosceles triangle ramp

| | |
|----------|--|
| Purpose | Applies the input values to an isosceles triangle ramp. |
| Receives | Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %). |
| Sends | An isosceles triangle ramp based on the received amplitude, frequency, and phase percentage. |

Pulse

| | |
|----------|---|
| Purpose | Sends an alternating stream of zeroes and ones at the specified frequency. For example: 010101010101. Use the Enabled connector to activate and disable the Pulse constraint. |
| Receives | Enabled (Bool), Freq Hz (number), Play Mode. |

| | |
|----------------------------|---|
| Pulse | |
| Sends | Result (number). |
| Ramp | |
| Purpose | Applies the input values to a ramp. |
| Sends | A numerical count. Starts at zero when the Ramp operator is first added to the Relations window and continues counting upwards. |
| Random | |
| Purpose | Creates a stream of random numbers at a specified frequency. |
| Receives | Freq, Max, Min, Play Mode, Precision, Seed (number). |
| Sends | Result (number). |
| Right triangle ramp | |
| Purpose | Applies the input values to a right triangle ramp. |
| Receives | Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %). |

Right triangle ramp

| | |
|-------|---|
| Sends | A right triangle ramp based on the received amplitude, frequency, and phase percentage. |
|-------|---|

Sine ramp

| | |
|---------|--|
| Purpose | Applies the input values to a sine ramp. |
|---------|--|

| | |
|----------|--|
| Receives | Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %). |
|----------|--|

| | |
|-------|--|
| Sends | A sine wave ramp based on the received amplitude, frequency, and phase percentage. |
|-------|--|

Square ramp

| | |
|---------|--|
| Purpose | Applies the input values to a square ramp. |
|---------|--|

| | |
|----------|--|
| Receives | Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %). |
|----------|--|

| | |
|-------|--|
| Sends | A square wave ramp based on the received amplitude, frequency, and phase percentage. |
|-------|--|

System

System operators let you use a time code and the play or record state in your Relations constraints.

Current time

| | |
|---------|-----------------------------|
| Purpose | Uses the current time code. |
|---------|-----------------------------|

Current time

| | |
|-------|------------------------|
| Sends | The current time code. |
|-------|------------------------|

Local time

| | |
|---------|---------------------------|
| Purpose | Uses the local time code. |
|---------|---------------------------|

| | |
|-------|---|
| Sends | The local time code shown in the Local Time code field. |
|-------|---|

Play Mode

| | |
|---------|--|
| Purpose | Verifies that MotionBuilder is in playback mode. |
|---------|--|

| | |
|-------|---|
| Sends | A Boolean value: true (1) if MotionBuilder is in playback mode. Otherwise, sends false (0). |
|-------|---|

Reference Time

| | |
|---------|-------------------------------|
| Purpose | Uses the reference time code. |
|---------|-------------------------------|

| | |
|-------|---|
| Sends | The reference time code shown in the Reference Time code field. |
|-------|---|

System Time

| | |
|---------|-----------------------------------|
| Purpose | Uses the computer's system clock. |
|---------|-----------------------------------|

| | |
|-------|-------------------------------------|
| Sends | The system time in SMPTE time code. |
|-------|-------------------------------------|

Transport Control

| | |
|---------|--|
| Purpose | Acts like buttons on the Transport Controls. |
|---------|--|

Transport Control

| | |
|----------|--|
| Receives | Play (Bool), Play Backward (Bool), Record (Bool), Step Forward (Bool), Step Backward (Bool), Goto Beginning (Bool), Goto End (Bool), Goto Position Trigger (Bool), and Goto Position Value (Time). |
| Sends | Play (Bool), Play Backward (Bool), and Record (Bool). |

Time

Use the Time operators to compare two different times expressed in either SMPTE time code or frames per second. These operators can be used, for example, to trigger rotations, translation, or animation based on the current time code.

If Cond Then T1 Else T2

| | |
|----------|---|
| Purpose | Evaluates an If, Then, Else statement based on Time (T1). |
| Receives | Three values: Cond (bool) and T1 and T2 (Time). |
| Sends | If Cond is non-zero, the (T1) input is output as the Result. If the Cond is zero, the (T2) input is output as the Result. |

Is Different (T1!= T2)

| | |
|----------|---|
| Purpose | Checks if Time (T1) is different than (T2). |
| Receives | Two time values: (T1) and (T2), measured in frames per second or SMPTE. |

Is Different ($T1 \neq T2$)

| | |
|-------|--|
| Sends | A Boolean value: true (1) if (T1) does not equal (T2) and sends false (0) if (T1) equals (T2). |
|-------|--|

Is Greater ($T1 > T2$)

| | |
|---------|---|
| Purpose | Checks if Time (T1) is greater than (T2). |
|---------|---|

| | |
|----------|---|
| Receives | Two time values: (T1) and (T2), measured in frames per second or SMPTE. |
|----------|---|

| | |
|-------|--|
| Sends | A Boolean value: True (1) if (T1) is greater than (T2) or sends false (0) if (T1) is less than or equal to (T2). |
|-------|--|

Is Greater or Equal ($T1 \geq T2$)

| | |
|---------|---|
| Purpose | Checks if Time (T1) is greater than or equal to (T2). |
|---------|---|

| | |
|----------|---|
| Receives | Two time values: (T1) and (T2), measured in frames per second or SMPTE. |
|----------|---|

| | |
|-------|---|
| Sends | A Boolean value: True (1) if (T1) is greater than and equal to (T2) or sends false (0) if (T1) is less than (T2). |
|-------|---|

Is Identical ($T1 == T2$)

| | |
|---------|---------------------------------------|
| Purpose | Checks if Time (T1) is equal to (T2). |
|---------|---------------------------------------|

| | |
|----------|---|
| Receives | Two time values: (T1) and (T2), measured in frames per second or SMPTE. |
|----------|---|

Is Identical (T1 == T2)

| | |
|-------|--|
| Sends | A Boolean value: True (1) if (T1) is equal to (T2) or sends false (0) if (T1) does not equal (T2). |
|-------|--|

Is Less (T1 < T2)

| | |
|---------|--|
| Purpose | Checks if Time (T1) is less than (T2). |
|---------|--|

| | |
|----------|---|
| Receives | Two time values: (T1) and (T2), measured in frames per second or SMPTE. |
|----------|---|

| | |
|-------|--|
| Sends | A Boolean value: True (1) if (T1) is less than (T2) or sends false (0) if (T1) is greater than or equal to (T2). |
|-------|--|

Is Less or Equal (T1 <= T2)

| | |
|---------|--|
| Purpose | Checks if Time (T1) is less than or equal to (T2). |
|---------|--|

| | |
|----------|---|
| Receives | Two time values: (T1) and (T2), measured in frames per second or SMPTE. |
|----------|---|

| | |
|-------|--|
| Sends | A Boolean value: true (1) if (T1) is less than or equal to (T2). Sends false (0) if (T1) is greater than (T2). |
|-------|--|

Vector

The Vector operators evaluate vector mathematics and other calculations involving vectors. All translation, rotation, and scaling values for models and assets are expressed as vectors.

Acceleration

| | |
|---------|---|
| Purpose | Calculates the acceleration of a vector (Position) based on how fast the vector's |
|---------|---|

Acceleration

values change over time. You can use this operator to calculate, for example, how fast an object is translated or rotated.

Receives

A vector (Position).

Sends

A vector indicating the acceleration of the supplied vector (Position).

Add (V1 + V2)

Purpose

Adds two vectors.

Receives

Two vectors: (V1) and (V2).

Sends

Sum of two vectors. (result) = (V1) + (V2).

Angle

Purpose

Creates the angle between two vectors. (Expressed in degrees.)

Receives

Two vectors (V1) (V2)

Sends

Number. (result) = (V1) - (V2)

Damp position

Purpose

Applies damping to a position vector.

Receives

A numerical damping factor (Damping), a numerical maximum acceleration (Max acc), a numerical maximum speed (Max speed), and a position vector (T).

Damp position

| | |
|-------|------------------|
| Sends | Dampened vector. |
|-------|------------------|

Derive

| | |
|---------|---|
| Purpose | Derive with reset. The Reset connector only accepts Boolean values (either 0 or 1). Send 1 to the Reset connector to reset the Derive operator to its original vector (Initial Vector). |
|---------|---|

| | |
|----------|---|
| Receives | Reset (Bool), V1 (Initial vector), and V2 (vector). |
|----------|---|

| | |
|-------|--|
| Sends | A vector derived from the two vectors. If the Reset (bool) connector is sent a 1, Derive is reset to its original vector (Initial Vector). |
|-------|--|

Determinant

| | |
|---------|---|
| Purpose | Gives the determinant of a 3x3 column (I, J, K) matrix. |
|---------|---|

| | |
|----------|-----------------------------|
| Receives | Three vectors: I, J, and K. |
|----------|-----------------------------|

| | |
|-------|-----------|
| Sends | A number. |
|-------|-----------|

Distance

| | |
|---------|--|
| Purpose | Calculates the distance between two positions. |
|---------|--|

| | |
|----------|-----------------------------|
| Receives | Two vectors: (V1) and (V2). |
|----------|-----------------------------|

Distance

| | |
|-------|---|
| Sends | The distance between the two vectors, expressed as a numerical value. |
|-------|---|

Dot product ($V1 \cdot V2$)

| | |
|---------|--|
| Purpose | Calculates the dot product of two vectors. |
|---------|--|

| | |
|----------|-------------------------------------|
| Receives | Two vectors: ($V1$) and ($V2$). |
|----------|-------------------------------------|

| | |
|-------|---|
| Sends | Dot product of two vectors, expressed as a numerical value. $(\text{result}) = (V1) \cdot (V2)$. |
|-------|---|

Gravity

| | |
|---------|---------------------|
| Purpose | Returns a position. |
|---------|---------------------|

| | |
|----------|---|
| Receives | Three vectors: (Acceleration, Position and Speed) |
|----------|---|

| | |
|-------|---|
| Sends | A number. $(\text{result}) = (a)(b)(c)$ |
|-------|---|

If cond then A else B

| | |
|---------|--|
| Purpose | Evaluates an If, Then, Else statement. |
|---------|--|

| | |
|----------|--|
| Receives | Two vectors: (a) and (b), and a condition (bool). |
|----------|--|

| | |
|-------|---|
| Sends | If Cond is non-zero, the first vector (a) is output as the Result. If the Cond is zero, |
|-------|---|

If cond then A else B

the second vector (b) is output as the Result.

Is different (V1 != V2)

Purpose Checks if vector (V1) is different than vector (V2).

Receives Two time values: (V1) and (V2), measured in frames per second or SMPTE.

Sends A Boolean value: True (1) if (V1) does not equal (V2) and sends false (0) if (V1) equals (V2).

Is identical (V1 == V2)

Purpose Checks if vector (V1) is equal to vector (V2).

Receives Two time values: (V1) and (V2), measured in frames per second or SMPTE.

Sends A Boolean value: True (1) if (V1) is equal to (V2) and sends false (0) if (V1) does not equal (V2).

Length

Purpose Calculates the distance between a vector and the world zero point.

Receives A vector: (V1).

| | |
|-----------------------------|---|
| Length | |
| Sends | The distance between the vector and the world zero point, expressed as a numerical value. |
| Memory (V1 when REC) | |
| Purpose | Use this operator to send a vector when a trigger is received (REC). |
| Receives |]A vector (V1) and a Boolean value (REC, which is either 0 or 1). |
| Sends | (result) = (V1) when (REC) is true (1). |
| Middle point | |
| Purpose | Interpolates between two vectors relative to a given ratio. |
| Receives | Two vectors: (V1) and (V2), and a ratio (Ratio) between 0 and 1. |
| Sends | An interpolated vector. (result) = $V1 + \text{ratio}[(V2) - (V1)]$. |
| Normalize | |
| Purpose | Normalizes a vector. |
| Receives | A vector. |

Normalize

| | |
|-------|--|
| Sends | A normalized vector where each coordinate is normalized between 0 and 1. |
|-------|--|

Orbit attraction

| | |
|---------|---------------------|
| Purpose | Returns a position. |
|---------|---------------------|

| | |
|----------|---|
| Receives | A number (Acceleration) and three vectors: (Origin, Position, and Speed.) |
|----------|---|

| | |
|-------|----------------------------------|
| Sends | A vector. (result)= (a)(b)(c)(d) |
|-------|----------------------------------|

Precision vectors

| | |
|---------|--|
| Purpose | Use this constraint to apply a precise value to every component of the vector: X, Y, and Z can each have different precision values. |
|---------|--|

| | |
|----------|------------------------------------|
| Receives | A (number) and Precision (number). |
|----------|------------------------------------|

| | |
|-------|------------------|
| Sends | Result (number). |
|-------|------------------|

Pull vector

| | |
|---------|---|
| Purpose | Continuously pulls the value from the input parameter and stores it in the internal buffer, which is then used as the Result value. This gives you the value of the last evaluation. This is useful when you need to constrain an object with its own data. |
|---------|---|

| | |
|----------|-------------|
| Receives | V (Vector). |
|----------|-------------|

Pull vector

| | |
|-------|------------------|
| Sends | Result (Vector). |
|-------|------------------|

Scale (a x V)

| | |
|---------|---------------------------------------|
| Purpose | Scales a vector by a numerical value. |
|---------|---------------------------------------|

| | |
|----------|--|
| Receives | A scaling factor (number) and a vector (Vector). |
|----------|--|

| | |
|-------|--|
| Sends | The scaled vector. (result) = (number) x (Vector). |
|-------|--|

Scale and offset (Vector)

| | |
|---------|------------------------------|
| Purpose | Scales and offsets a vector. |
|---------|------------------------------|

| | |
|----------|--|
| Receives | A maximum clamping vector (Clamp Max), a minimum clamping vector (Clamp Min), an offset vector (Offset), a scaling factor expressed as a numerical value (Scale), and the original vector (x). |
|----------|--|

| | |
|-------|---|
| Sends | The original vector (x) multiplied by the scaling factor (Scale) and offset by the offset vector (Offset). If the result is greater than the maximum clamping vector (Clamp Max), the maximum clamping vector is sent. If the result is lower than the minimum clamping vector (Clamp Min), the minimum clamping vector is sent. (result) = (x) multiplied by [(Scale Factor) |
|-------|---|

Scale and offset (Vector)

+ (Offset)]. (result) is no less than (Clamp Min) and no greater than (Clamp Max).

Scale damping

| | |
|---------|--------------------------------------|
| Purpose | Applies damping to a scaling vector. |
|---------|--------------------------------------|

| | |
|----------|--|
| Receives | A numerical damping factor (Damping), a numerical maximum acceleration (Max acc), a numerical maximum speed (Max speed), and a scaling vector (S). |
|----------|--|

| | |
|-------|-------------------------------|
| Sends | A scaled vector with damping. |
|-------|-------------------------------|

Speed

| | |
|---------|---|
| Purpose | Calculates the speed of a vector based on its change of position over time. |
|---------|---|

| | |
|----------|----------------------|
| Receives | A vector (Position). |
|----------|----------------------|

| | |
|-------|--|
| Sends | The speed of the vector expressed as a vector (Translation). |
|-------|--|

Subtract (V1 - V2)

| | |
|---------|------------------------|
| Purpose | Subtracts two vectors. |
|---------|------------------------|

| | |
|----------|-----------------------------|
| Receives | Two vectors: (V1) and (V2). |
|----------|-----------------------------|

Subtract (V1 - V2)

| | |
|-------|---|
| Sends | The result of the first vector subtracted by the second vector. (Result) = (V1) - (V2). |
|-------|---|

Sum 10 vectors

| | |
|---------|-------------------------------|
| Purpose | Adds 10 to a numerical value. |
|---------|-------------------------------|

| | |
|----------|--|
| Receives | Ten vectors: (a),(b),(c),(d),(e),(f),(g),(h),(i),(j). |
|----------|--|

| | |
|-------|--------------------------------|
| Sends | Vector + 10. (result) = (a)+10 |
|-------|--------------------------------|

Triggered delay (Vector)

| | |
|---------|--------------------------------|
| Purpose | Delays sending a vector value. |
|---------|--------------------------------|

| | |
|----------|---|
| Receives | A delay in time format, the vector to be sent following the delay, a panic button, and an "Enabled" button that starts the counter. |
|----------|---|

| | |
|-------|--|
| Sends | The received vector after a time delay, which starts counting when the box is enabled. Trigger the panic button to send the vector before the time delay is reached. |
|-------|--|

Triggered delay with memory (Vector)

| | |
|---------|--------------------------------|
| Purpose | Delays sending a vector value. |
|---------|--------------------------------|

| | |
|----------|---|
| Receives | A delay in time format, the vector to be sent following the delay, and a toggle switch. |
|----------|---|

Triggered delay with memory (Vector)

| | |
|-------|---|
| Sends | The received vector after a time delay. |
|-------|---|

Vector product ($V1 \times V2$)

| | |
|---------|-------------------------|
| Purpose | Multiplies two vectors. |
|---------|-------------------------|

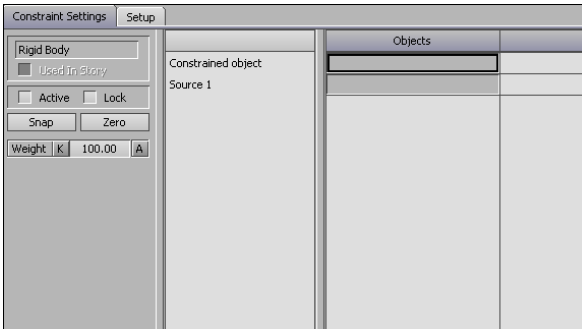
| | |
|----------|-----------------------------|
| Receives | Two vectors: (V1) and (V2). |
|----------|-----------------------------|

| | |
|-------|--|
| Sends | The product of two vectors. (result) = (V1) \times (V2). |
|-------|--|

Rigid Body constraint

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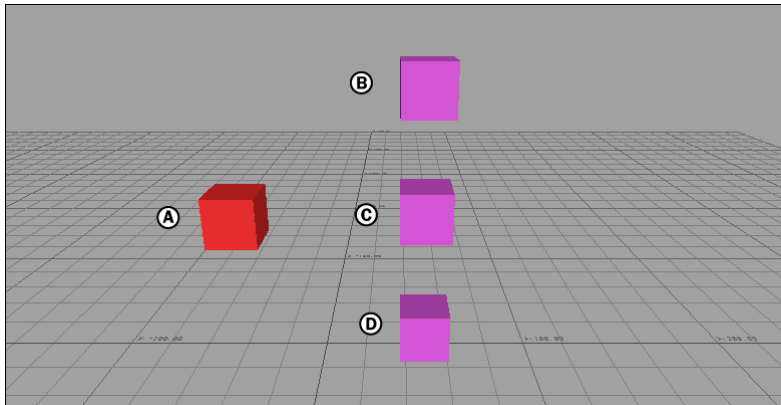
The Rigid Body constraint creates a Rigid body using the specified sources. This is the same as creating Rigid bodies in the Optical settings, only the constrained object is placed at the center of the source objects. The positions of two or more objects are used to adjust the translation and rotation of a constrained object.



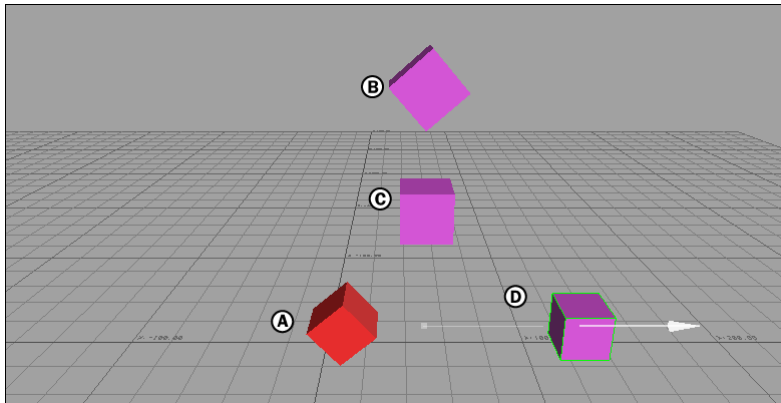
Rigid Body constraint

When you drag an object into the Source 1 cell, another source is added to the Objects pane. If you drag a second source into Source 2, the position and rotation of the constrained object is derived from the position of the two source objects.

The Rigid Body constraint is similar to the Position constraint, except that rotation is also applied to the constrained object. For example, if the Source 1 marker is translated, the constrained object is rotated ().



Rigid Body constraint with three source objects. Before activation, the constrained object (A) does not move B, C, and D.



The constrained object (A) and Source objects B and C are automatically translated and rotated based on the new position of Source object D.

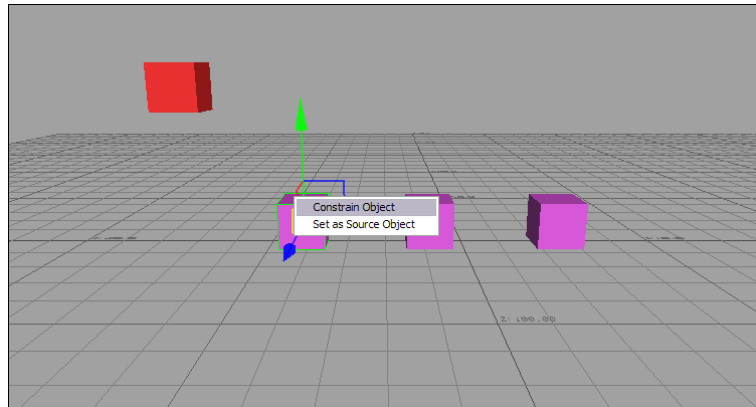
- [Rigid Body constraint settings](#) on page 1005
- [Damping the speed of Rigid body transformation](#) on page 1004

Using a constraint to create a Rigid Body

You can use the position of two or more objects to adjust the translation and rotation of a constrained object with the Rigid Body constraint.

To use a constraint to create a rigid body:

- 1 Select a Rigid Body constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
 - If you drag it into an empty area of the Viewer window, the Rigid Body constraint template appears in the Constraint settings.
 - If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constrained or source object .



Constraint contextual menu

- 2 Assign the object that you want to position and translate in the scene based on the position and movement of one or multiple source objects to the Constrained object (child object) cell.
- 3 Assign the object that you want to derive the translation information from for the constrained object to the Source 1 (parent object) cell.

When you drag an object into the Source 1 cell, another source (Source 2), is added to the Objects pane. If you drag a second source into Source 2, the position of the constrained object is derived from the position of the two source objects.

You can have as many sources as you want, so you can create complex Position constraints.

NOTE When you specify more than one source, the constrained object appears at the middle point between all source objects.

- 4 Click Active to activate the constraint.

Damping the speed of Rigid body transformation

You can use the Rigid Body setup pane to create delays or to smooth jerky movements in animation created by constraints.

To damp (or slow) the rotation/translation speed that the constrained object transforms the parent object:

- 1 Create a Rigid Body constraint. See [Using a constraint to create a Rigid Body](#) on page 1003 for more information.
- 2 Once you have assigned Source and Constrained objects to a Rigid Body constraint, click the Setup tab in the Constraint settings.



Rigid Body Setup pane

- 3 Enter a value in the Time Before Recovery field.
- 4 Enter a value in the Recovery Damping Time field.

NOTE MotionBuilder measures these fields in frames per second or timecode format, depending on the settings in the Global Controls.

Rigid Body constraint settings

The Rigid Body constraint creates a Rigid body using the specified sources.

The Rigid Body constraint requires the following objects:

Constrained object

An asset, model, or other object to be placed at the center of all source objects. This is also known as the “Child” object.

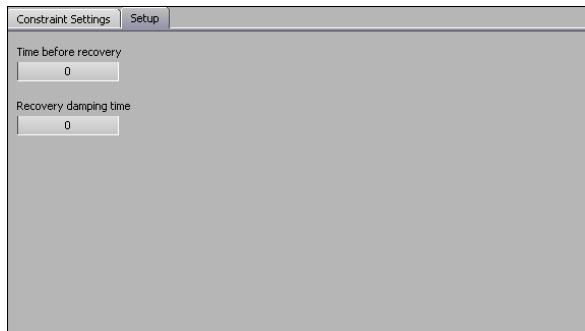
Source 1

Sends translation information to the constrained object. This is also known as the “parent” object.

When more than one source is specified, the constrained object is placed at the mid-point between all source objects. Although the sources do not send rotation information, the placement of each source affects the translation and rotation of the constrained object.

Rigid Body Setup pane

The Rigid Body constraint is the only constraint that has a Setup pane . To access it, create a Rigid Body constraint and click the Setup tab in the Constraint settings.



Rigid Body Setup pane

There are two fields found in the Rigid Body Setup pane:

- Time Before Recovery

■ Recovery Damping Time

These fields let you damp (or slow) the speed at which the constrained object rotates and translates with its sources. Use them to create delays or to smooth jerky movements in animation created by constraints.

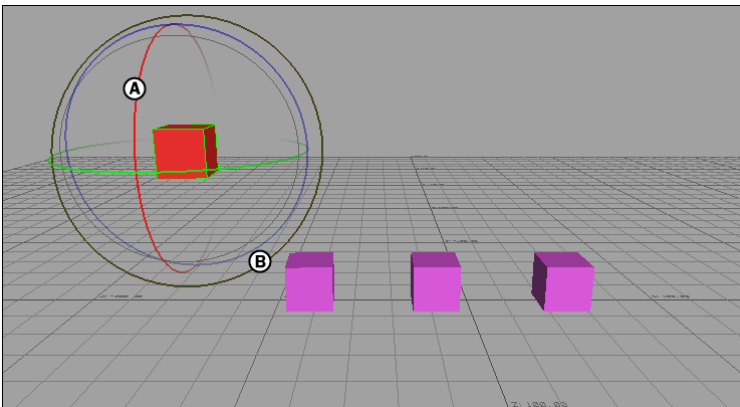
■ [Damping the speed of Rigid body transformation](#) on page 1004

Rotation constraint

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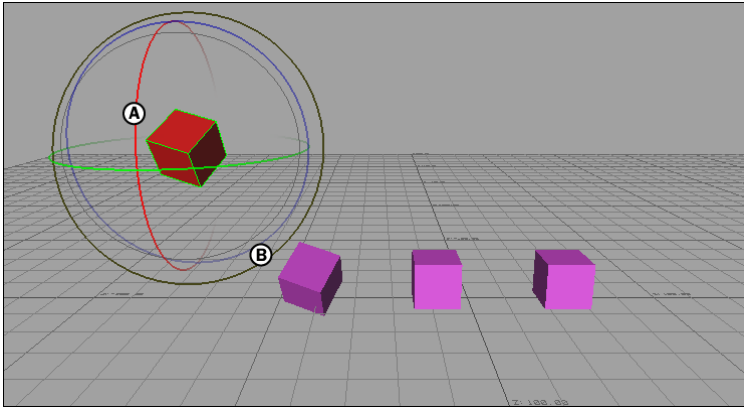
The Rotation constraint transfers rotation between two objects. This constraint uses the position of a source object or objects to constrain the rotation of another object.

For example, in the following pictures, one cube (source) rotates and the other cube (constrained object) rotates with it.



Rotation constraint A. Source object B. Constrained object

The constraint source rotates with the constrained object.



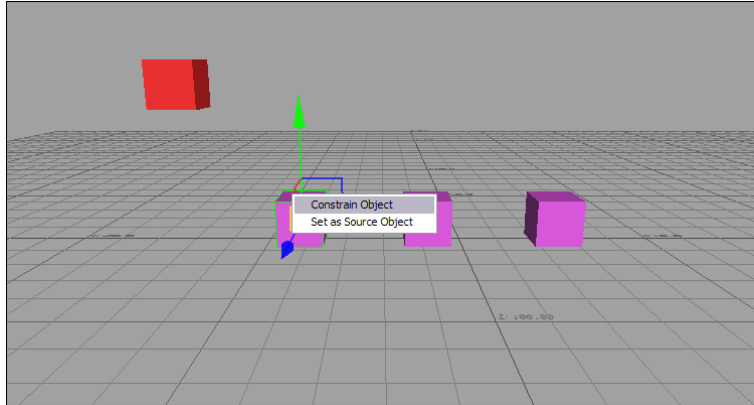
When the Source (A) is rotated, the constrained object (B) rotates with it.

- [Transferring rotation between objects](#) on page 1008

Transferring rotation between objects

To transfer rotation between objects:

- 1 Select a Rotation constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
 - If you drag it into an empty area of the Viewer window, the Rotation constraint template appears in the Constraint Settings.
 - If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as one of the constraint's operators.



Constraint contextual menu

- 2 Assign the object that you want the rotation of another object to affect into the Constrained object cell.
- 3 Assign the object that will send rotation information to the constrained object to the Source cell.

NOTE The limit is a radius centered on the pulling object.

- 4 Click Lock in the Constraint settings to lock the position of the objects to be constrained.

■ [Rotation constraint](#) on page 1007

Constraining a single axis (Rotation constraint)

You can use the Rotation constraint to constrain an object's individual axis. For example, you can make an object rotate only on its Y-axis, no matter which way the source object spins.

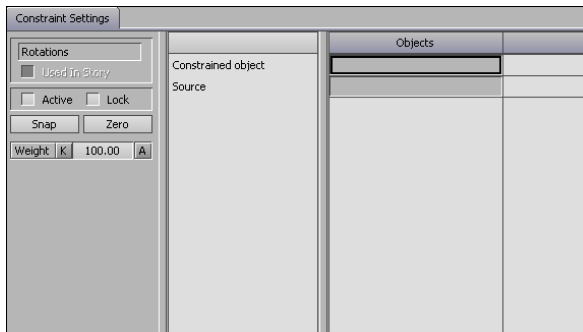
To constrain a single axis:

- 1 Create a Rotation constraint. See [Transferring rotation between objects](#) on page 1008 for steps on how to do this.
- 2 Double-click the Rotation constraint in the Scene browser to select it.

- 3 Open the Properties window. The Rotation constraint settings display.
- 4 Expand Constraint Axes and disable the axis (X, Y, or Z) for the translation effect you want to inhibit.
- 5 To reactivate the unconstrained axes, activate the X, Y, or Z axis option(s).

Rotation constraint settings

The Rotation constraint transfers the rotation between two objects.



Rotation constraint

The Rotation constraint requires the following objects:

Constrained object

An asset, model, or other object whose rotation is based on the rotation from a single source object. Also known as the “Child” object.

Source

Sends rotation information to the constrained object. You can have multiple source objects for this constraint. Also known as the “Parent” object.

Properties window settings

The following Rotation constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

Rotation X/Y/Z

Use these fields to offset the constrained object from the Source object(s). You can set key animation on any of these settings.

These fields are disabled if the Lock option is activated.

Constraint Axes

Activating or disabling these axes affects whether the constrained object is affected by the source objects' movement in this direction.

| Axis | Description |
|----------|---|
| Affect X | When active, the constrained object moves along the X-axis when the source object is rotated. |
| Affect Y | When active, the constrained object moves along the Y-axis when the source object is rotated. |
| Affect Z | When active, the constrained object moves along the Z-axis when the source object is rotated. |

(SourceObject).Weight

Use this setting to give different amounts of influence to source objects.

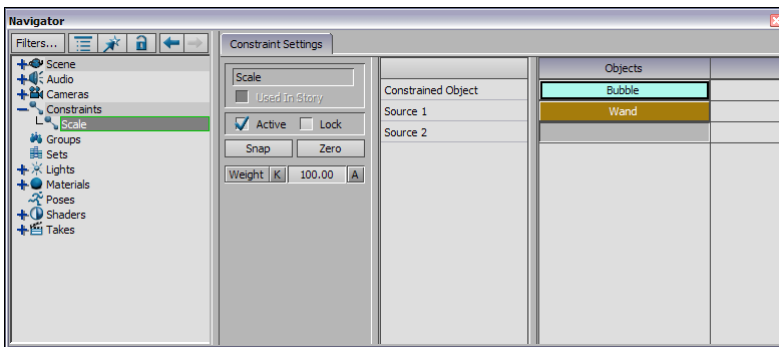
NOTE You no longer have to drag the same object in the source field to create weighting with this setting. If you are working on an earlier version of the positions constraint where this has been done, this is compensated.

- [Rotation constraint](#) on page 1007
- [Transferring rotation between objects](#) on page 1008

Scale constraint

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Use the Scale constraint to transfer the scaling from one or more objects to another.



Scale constraint

This is done by using the scaling coordinates of the Source object to calculate the scale of another object.

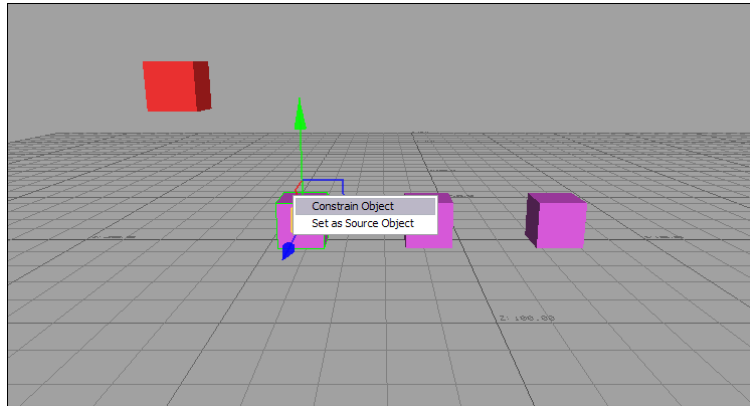
- [Scaling a constrained object](#) on page 1013
- [Constraining individual axes \(Scale constraint\)](#) on page 1015

Scaling a constrained object

You can use the Scale constraint to transfer the scaling from one or more objects to another.

To scale a constrained object:

- 1 Select a Scale constraint from the Asset browser's Constraints folder and drag it into the Viewer window.
 - If you drag it into an empty area of the Viewer window, the Scale constraint template appears in the Constraint settings.
 - If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source (parent) or Constrained (child) objects .



Constraint contextual menu

- 2 Assign the object that you want affected by the scaling to the Constrained Object cell.
- 3 Assign the object that you are using to create the scaling effect to the Source 1 cell.

NOTE You can have more than one object provide the scaling information to the constrained object by assigning new objects to the resulting Source cells.

- 4 Adjust the size of the Constrained object, if necessary, with the Scale fields.

NOTE Disable the Lock option to activate the Scale settings.

- 5 Click Lock in the Constraint settings to lock the position of the objects to be constrained and click Snap.

- 6 Click Active to activate the constraint.
 - 7 Deactivate the Affect XYZ options in the Properties window Scale constraint settings to disable the scaling effect per axis.
 - 8 Weight the effect of the individual Source objects, if necessary, with the Sale constraint's Source Weight slider(s).
 - 9 Select either Geometric or Average as the Blend Method from the Properties window Blend Method menu.
- [Scale constraint settings](#) on page 1015
 - [Constraining individual axes \(Scale constraint\)](#) on page 1015

Constraining individual axes (Scale constraint)

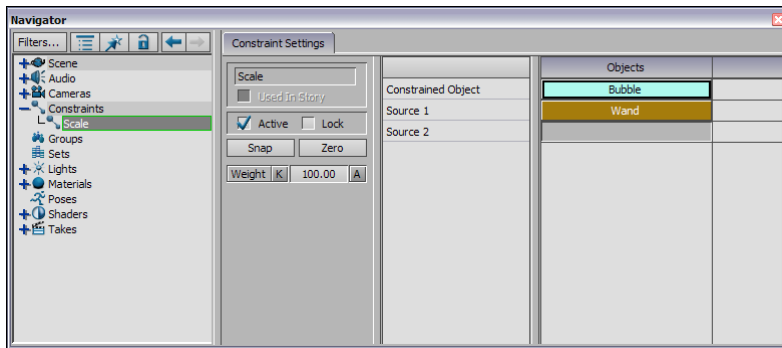
You can constrain an individual axis with the Scale constraint. For example, you can scale only an object's Y-axis.

To constrain a single axis:

- 1 Double-click the Scale constraint in the Scene browser to select it.
- 2 Open the Properties window. The Scale constraint settings display.
- 3 Expand Constraint Axes and disable the X, Y, or Z axis for the desired translation effect you want to inhibit.
- 4 To reactivate the unconstrained axes, activate the option.

Scale constraint settings

The Scale constraint lets you constrain the scaling of one object relative to the scaling of one or many other objects.



Scale constraint

Constrained Object

An asset, model, or other object whose orientation derives its size from the Source object(s). Also known as the “child” object.

Source

Sends scaling information to the constrained object. You can have multiple source objects for this constraint. Also known as the “parent” object.

Properties settings

The following Scale constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

| Property | Description |
|---------------------|---|
| Scaling Offsets XYZ | Use these fields to move the constrained object from the Source object(s). You can set key animation on any of these settings. These fields are disabled if the Lock option is activated. |
| Blend Method | The Blend Method menu lets you specify a way in which the Scaling is calculated when you are using multiple Source objects. There are two options: Geometric: a logarithmic method compatible with Maya’s scaling constraints. Average: which |

| Property | Description |
|------------------------|--|
| | calculates based on the average scale of the objects. |
| Constraint Axes | Activating or disabling these axes affects whether the constrained object is affected by the source objects' movement on this axis. Affect X: When active, the constrained object is transformed along the X-axis with the constrained object. Affect Y: When active, the constrained object is transformed along the Y-axis with the constrained object. Affect Z: When active, the constrained object is transformed along the Z-axis with the constrained object. |
| (Source Object) Weight | Use this setting to give different amounts of influence to source objects. |

- [Scaling a constrained object](#) on page 1013
- [Constraining individual axes \(Scale constraint\)](#) on page 1015

Animating with Devices

A device is either a special software component (such as the Voice and Sound devices) or a separate piece of hardware (joystick, mouse, or keyboard) that connects to your computer using a serial, ethernet, or other connection.

Devices react to either recorded data or live input directly from the device itself. An input device feeds data to MotionBuilder, and an output device receives data from MotionBuilder.

For example, the keyboard and the mouse are input devices, and the MIDI device is both an input and output device.

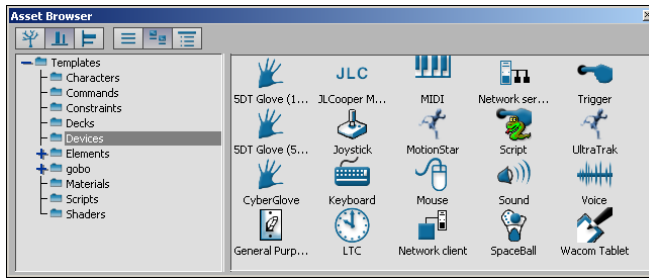
To find information on specific software components and hardware that are used with MotionBuilder, see [MotionBuilder devices](#) on page 1027.

Only devices developed by Autodesk and shipped with either MotionBuilder are documented in this chapter. For information on devices developed by third party vendors, consult their Web site or documentation.

- [MotionBuilder devices](#) on page 1027
- [Viewing device settings](#) on page 1020
- [Adding a device](#) on page 1021

Device assets

In the Asset browser, the Device folder contains devices supported by MotionBuilder .



Asset browser, Devices folder

See [Adding a device](#) on page 1021 for more information.

- [Animating with Devices](#) on page 1019
- [Assets](#) on page 225
- [Viewing device settings](#) on page 1020
- Asset browser

Viewing device settings

To view the settings for a device:

- 1 Select the device in the Scene browser. The active device's settings display in the Navigator window letting you configure the device, record takes, and set recording options.

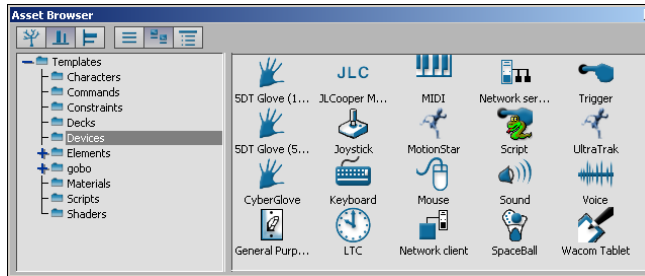
These Device Settings vary according to the device you select in the Scene browser and are covered their corresponding device topics.

To view information for all devices:

- 1 Click on the Devices folder in the Scene browser to see the Device Statistics pane.
- Deck Statistics pane
 - [Animating with Devices](#) on page 1019

Adding a device

Drag a device asset from the Asset browser into the Viewer window or Scene browser. All added devices display in the Scene browser in the Devices folder. The device's settings display in the Navigator window.



You can add a device to the scene by dragging it from the Asset browser.

■ [MotionBuilder devices](#) on page 1027

Device Settings

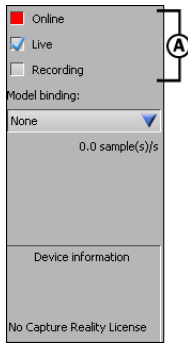
The Device Settings contain information required to configure, monitor and run the selected device, and displays whenever you select a device in the Scene browser.

The Device Settings are split into two areas, the Record and Play options, and the device's specific Settings area.

The Record and Play options are described in this topic, while each device's specific Settings area is described in the topic that corresponds with it in the [MotionBuilder devices](#) on page 1027 section of the help.

Record and Play Options

Devices behave relative to live data or recorded takes. When a device is active, the Record and Play options display with the device's settings, letting you set the device's online, live, and recording state .



A. Record and Play options in the Device settings.

These options determine whether the device is being used live, is being recorded, or is using previously recorded data. You can set options for an entire device, or for selected properties of a device.

NOTE We recommend that you also read the section about the specific device you are using for more precise information about recording.

Online

Use the Online option to activate and disable each device. When a device is Online, it is active and ready to be used by MotionBuilder.

Disabled devices do not send live data to MotionBuilder. If a device keeps switching off when you are trying to turn it on, it means that MotionBuilder cannot find the device, or its port is being used by another device.

Live

There are two different types of play modes: Live and Recorded. Disabling the Live mode sets the play mode to Recorded, and takes the data from the current take, from the device, or its bound model. The current take displays in the Transport Controls window.

Activating the Live mode sets the play mode to Live, and inputs data directly from the device instead of a recorded take.

NOTE The Live and Recording play modes are not available to devices designated as output only.

Recording

When the Recording option for a device is active, you can record the data from the device to the current take. You can record all the data from a device, or you can choose individual attributes to record.

For example, if you are recording data from a mouse device and you only want to capture the data from the Y-axis, activate Recording for the Y-coordinate, and disable Recording for the X-coordinate.

Model Binding

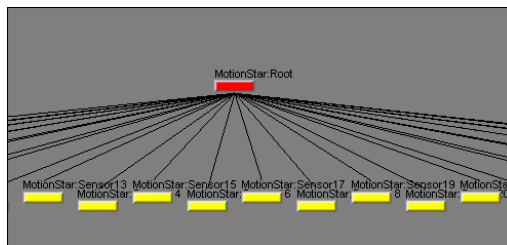
The Model binding area appears below the Record and Play options for certain devices.

Some devices let you link the device to a special model, which is referred to as device binding. If the selected device supports device binding, the heading “Model binding” and a menu appear beneath the Record and Play options .

When you bind a device, all the data recorded from the device applies to the bound model. Each device that supports device binding includes similar options for binding. Setting these options is the same, regardless of the device you are using.

To bind a selected device, select an existing bound model from the Model binding field, or choose Create to create a new model. Choosing Create creates and selects a new binding model as the bound model. This model is named for the device and is sequentially numbered.

Depending on the device, the bound model displays as a group of sensors, as a single null, or as a skeleton structure in the Viewer window. The bound model displays as a hierarchy in the Schematic view .



Bound model in the Schematic view.

Sample(s)

Shows the sample rate (per second) of each device. If the number of samples is zero, then either the sample line is not applicable for the connected device, or the device is not sending data.

Delay

Shows the delay between the time when the device sends the data and when the results are received by MotionBuilder.

Error Count

Gives the number of time-outs and other errors related to device input and output. If you have an error count, check your devices to make sure they are connected properly.

For a successful capture session, the error count must remain at zero.

The Error Count columns in the Device Statistics pane indicate whether the device is initialized and working properly. If the device cannot be found, it sends an initialization error.

Status

Shows the status of the connected device. If an error occurs or a device cannot be found, the appropriate message appears in this column.

The Status column is important when attempting to connect to external hardware devices since it gives feedback on any errors, time-outs, licensing conflicts, and so on.

The messages in the Status are device-specific and are read from the device, not generated by MotionBuilder.

NOTE Some devices use the Device Information area in the Device Settings to provide constant feedback. See [Device Information](#) on page 1024 for more information.

MotionBuilder devices

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MotionBuilder supports the following devices:

- [Decks](#) on page 1028
- [JLCooper MCS-3800](#) on page 1036
- [Joystick Device](#) on page 1036
- [Keyboard Device](#) on page 1037
- [LTC device](#) on page 1037
- [MIDI device](#) on page 1038
- [Mouse Device](#) on page 1042
- [Network Client device](#) on page 1043
- [Network Server device](#) on page 1045
- [Sound device](#) on page 1045
- [SpaceBall Device](#) on page 1046
- [Trigger device](#) on page 1054
- [Wacom Tablet](#) on page 1055

In addition to the devices mentioned in this list, MotionBuilder includes the Open Reality SDK, a developer's kit for creating your own devices. For more information, see the Open Reality SDK documentation.

For information on devices developed by third party vendors not listed in this section, contact either Autodesk or the third party vendor.

- [MotionBuilder devices](#) on page 1027
- [Adding a device](#) on page 1021

Decks

Decks let you control, monitor, and synchronize the recording or playback of a VTR (Video Tape Recorders) from within MotionBuilder. You can use the Deck settings to record rough takes or video backups of a capture session to a VTR, or play video from a VTR during a capture session.

MotionBuilder supports two decks:

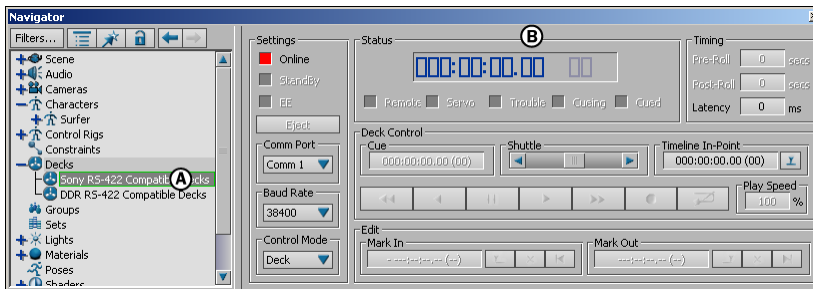
- DDR RS-422 Compatible
- Sony RS-422 Compatible

To use decks in MotionBuilder, drag a deck into the Viewer window from the Asset browser Decks folder.

- Decks Limitations
- Deck Settings
- Deck Statistics pane
- [MotionBuilder devices](#) on page 1027

Deck Settings

The Deck settings contain the various controls for your external VTR. The selected VTR can be Online and/or set to Remote Control mode.



Navigator window A. Selected deck B. Deck settings

When the selected VTR is set to Online, the VTR is being controlled outside of MotionBuilder. The status and mode indicators as well as the VTR time codes are displayed.

When the selected VTR is in Remote Control mode, the Decks Transport Controls are active and MotionBuilder controls the VTR.

NOTE Many Deck settings cannot be edited; they are only status or mode indicators and are specific to the selected VTR. In addition, some Master specific settings, such as Time In and Time Out, are disabled when in Slave mode.

Settings area

The Settings area lets you change the selected deck’s settings. The following table lists the settings that can be changed.

| Setting | Description |
|---------|---|
| Online | Sets the communication with the VTR to on or off. |
| Standby | Switches the VTR to Standby mode. |
| EE | Sets the VTR to EE (electronics-to-electronics) mode. |
| Eject | Ejects the tape. |

Comm Port Menu

Lets you select an available Serial Port. The Comm port is the port used to communicate with the VTR.

Control Mode

Lets you specify whether the current VTR is in Slave or Deck mode. Slave mode is synchronized to MotionBuilder, while Deck mode is used for independent control.

Status Area

The Deck settings Status area lets you see the status of the deck and view the timecode.

Timecode

At the top of the Status area is the Deck timecode display. This indicates the timecode given from the deck and cannot be altered.

Deck Status Indicators

A row of status indicators provides feedback concerning the status of your VTR. Each status indicator is described in the following table:

| Indicator | Description |
|-----------|--|
| Remote | Indicates that your VTR is in Remote mode. When your VTR is in Remote mode, Motion-Builder controls the VTR. If the Remote indicator is red, it indicates that the VTR is in local mode. |
| Servo | Indicates that your VTR tape has reached the exact speed (frames per second) and the reading head is locked in. |
| Trouble | Indicates that your VTR is malfunctioning. The malfunction is VTR model dependent; consult your VTR manual. |
| Cueing | Indicates that your VTR is currently cueing. Cueing occurs during the time in which your tape is catching up to the time indicated by a changed timecode in Motion-Builder. |
| Cued | Indicates that your VTR is cued. This occurs when the video reaches the timecode specified in MotionBuilder and is awaiting a new command. |

Timing

The Timing area of the Deck settings lets you set the Pre- and Post-roll for the deck and specify a Latency setting to compensate for the data transfer speed.

Pre/Post Roll fields

Lets you specify the amount of pre-roll and post-roll when controlling your VTR (expressed in seconds).

Latency

Lets you set an additional time offset (in milliseconds) to synchronize your VTR and MotionBuilder. Latency depends on tape speed, your VTR model, hardware response time/inertia and other device-related factors.

Deck Control Area

The Deck Control area contains the controls for operating the deck from MotionBuilder.

Cue Field

Use the Cue field to navigate through the tape. To move quickly to different areas of the tap, double-click the timecode and enter the time that you want to cue the tape.

Shuttle Slider

Drag the Shuttle slider to the right to move forward through the timecode and to the left to move backward through the timecode.

The shuttle speed is determined by how far you move the slider in either direction.

Click the arrow keys at either end of the Shuttle slider to jog. Click and hold the slider to continue jogging.



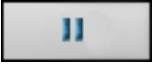




Timeline In Point

The Timeline In Point field lets you enter a different In point for the Timeline, rather than using the take's start point.

Click the Set button to set the Timeline In Point to local (software) time.

Transport Controls

The following table lists and describes the function of each VTR Transport button:

| Button | Function |
|---|--|
|  | Rewind. |
|  | Play the VTR backward. |
|  | Still. Pauses the VTR. |
|  | Play the VTR forward. |
|  | Fast forward. |
|  | Record. (Disabled). |
|  | Loops the VTR between the Time In and Time Out time codes. (Not available on all decks.) |

Play Speed

Indicates the VTR play speed (in percent). The number and its meaning depends on your VTR. Consult your VTR documentation for more information. (Not available on all decks.)

Edit Area

The Edit Area contains the Mark In and Out fields, where you can perform editing functions, such as wiping the data from audio tracks or setting in and out marks for the tape.

Edit Commands

Select the Edit commands to wipe out audio or video data from a specific track:

| Command | Function |
|----------|----------------------------------|
| Assemble | Wipes all data from all tracks. |
| V | Wipes data from the video track. |
| A1 | Wipes data from Audio 1 track. |
| A2 | Wipes data from Audio 2 track. |
| A3 | Wipes data from Audio 3 track. |
| A4 | Wipes data from Audio 4 track. |

Start/Edit






Click Start/Edit to activate the wiping of audio or video from a track.

Mark In/Out fields

The Mark In/Out fields let you set the Time In and Time Out time codes for a section of VTR tape. Once the tape is in position, click the Mark In/Out buttons to set a Mark In or Mark Out timecode.

Mark In/Out Buttons

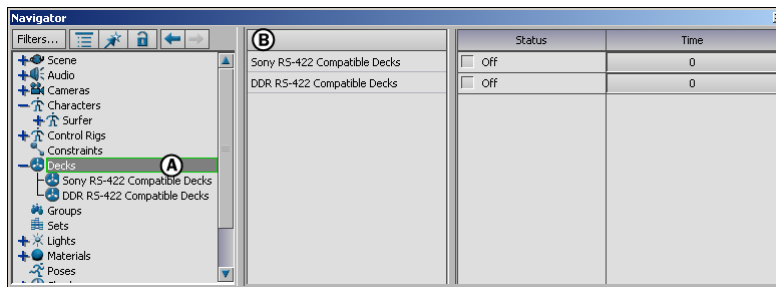
The following table lists and describes the function of each Mark In/Out button:

| Button | Function |
|---|---------------------------------|
|  | Set the Mark In point. |
|  | Clear the Mark In/Out timecode. |
|  | Cue tape to the Mark In point. |
|  | Set the Mark Out point. |
|  | Cue tape to the Mark Out point. |

Deck Statistics pane

Click the Decks folder in the Scene browser to open the Statistics pane. The Statistics pane contains additional information about each VTR that has been added to the Decks list.

The Statistics pane lets you set a selected VTR status on or off and set the time offset for each VTR. You can also distinguish each VTR by entering a description.



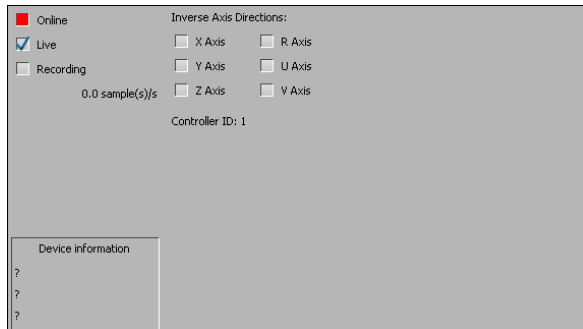
Navigator window A. Decks folder B. Statistics pane

| Option | Function |
|-------------------|---|
| Status option | Click to activate the VTR. When disabled, the VTR is not controlled by MotionBuilder. |
| Time field | Use the Time field to set a time offset for the VTR. |
| Description field | Use this field to enter a description that distinguishes each VTR. |

Decks Limitations

Before using the Deck settings, you should be aware of the following limitations:

- Only one deck can be controlled at a time.
- Only Sony 9-Pin compatible VTRs are supported.
- The VTR does not cue at a negative timecode. The minimum timecode allowed is 00:00:00.00.
- The maximum end point for recording is 23:59:59:01.
- Tape must be striped with CONTINUOUS timecode.
- The VTR can be in slave mode or independent.
- MotionBuilder cannot drive the VTR unless the VTR is set to Remote Control mode.



Joystick device settings

Consult the documentation that accompanies the joystick for installation, calibration, and driver information pertaining to your system.

- [MotionBuilder devices](#) on page 1027

Keyboard Device

Use the Keyboard device to configure your keyboard as an input device. There is no additional configuration for the Keyboard device since it is automatically configured by your computer system. The Keyboard device uses the following keys:

- Numerical keys: zero (0) through nine (9)
- Function keys: F1 through F12
- Up, Down, Left, and Right arrow keys
- Escape, Space, and Return
- Home, End, Page Up, and Page Down

Each keystroke acts as a trigger that can be used by a Relational constraint to change cameras or trigger movement.

LTC device

Use the LTC (Longitudinal Timecode) device to synchronize MotionBuilder to an external timecode source. To activate the LTC as a timecode source, you

must add the LTC device, then select it as the reference timecode source in the Timing Controls. You must have the LTC card installed to use the LTC device.

Add the LTC device and select the sound card connected to your computer from the InputDevice pull-down menu. The longitudinal timecode automatically becomes the reference timecode.

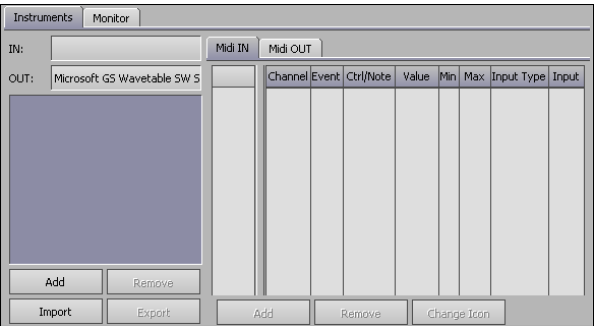


LTC device settings A. Select a sound card from the Input device menu

■ [MotionBuilder devices](#) on page 1027

MIDI device

The MIDI device supports MIDI In and MIDI Out for connecting with MIDI hardware (slider boxes, MIDI mixers, synthesizers, and so on). The MIDI device is both an input and an output device, as it sends and receives data.



MIDI device

MotionBuilder sends and receives MIDI data on 16 MIDI channels. The following table lists supported and unsupported MIDI events:

| Supported | Not supported |
|--|---|
| Note on, Note off, Velocity, and Continuous controllers 0 through 127. | System exclusive messages, Program change messages, MIDI start, stop, and continue. |

In a studio, there can be many devices receiving and sending MIDI data. For example, you could have a MIDI mixer that controls audio levels, a MIDI slider for controlling a character within MotionBuilder, and a synthesizer for creating music using MIDI.

Each external MIDI device can send and receive MIDI data, and must be connected to your computer using a MIDI interface and MIDI cables.

Within MotionBuilder, you need to add at least one MIDI device to connect to external MIDI hardware. Each piece of external MIDI hardware is represented in the MIDI device as an instrument.

To control external MIDI hardware from MotionBuilder or to control models, lights, and cameras in your scene using external MIDI hardware, you need to add a MIDI device, add instruments (Instrument list), then add and define inputs and outputs (MIDI IN and MIDI OUT panes).

■ MIDI device settings

MIDI device settings

This topic describes the Instruments pane and the Monitor pane of the MIDI device settings.

Instruments pane

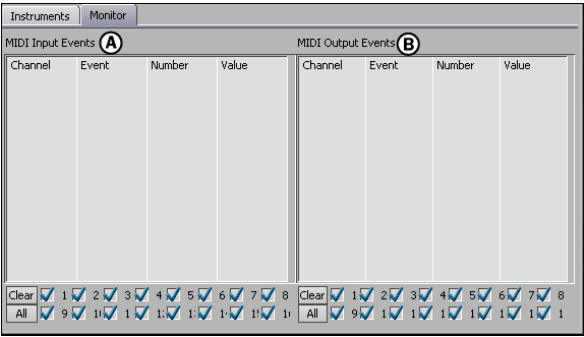
The following describes the columns in the Midi IN and Midi OUT tabs found on the Instruments pane of the MIDI device settings.

| Column | Description |
|-------------|--|
| Channel | MIDI IN: Selects the channel (between 1 and 16) on which the MIDI data is received. MIDI OUT: Selects the channel (between 1 and 16) sending the MIDI data. |
| Event | Selects the type of event being received (MIDI IN) or sent (MIDI OUT). |
| Ctrl/Note | MIDI IN: Sets either the Controller number (when Event is set to Ctrl) or Note number (when Event is set to Note) being received. MIDI OUT: Sets either the Controller number or Note number to be sent out the MIDI Out port. |
| Value | MIDI IN: Displays the controller value (when Event is set to Ctrl) or the note's velocity (when Event is set to Note) being received. MIDI OUT: Sets either the Controller value or the note's velocity. |
| Min and Max | MIDI IN: Scales the value received to fit within a minimum and maximum value. For example, if you set Min to 50 and Max to 100, the input value (between 0 and 127) is adjusted to a value between 50 and 100. MIDI OUT: Adjusts the range of the value sent (Value column). For example, if you set Min to 50 and Max to 100, and a value of 200 is sent, the value is clamped to 100. The adjusted value is then scaled to fall within acceptable MIDI values (0-127) before being output. |

| Column | Description |
|-------------------|--|
| Input/Output Type | Value: Receives (MIDI IN) or sends (MIDI OUT) controller value for Ctrl events, or Velocity for Note events. Number: Receives (MIDI IN) or sends (MIDI OUT) the controller number for Ctrl events, or Note number for Note events. N&V: Receives (MIDI IN) or sends (MIDI OUT) both the Value and Number. Two connectors are added to the MIDI instrument's relation box. |
| Input/Output | Shows the result of scaling the Value field using the Min and Max settings. This is the value input. |

Monitor pane

The Monitor pane shows MIDI data as it is received and sent. Two separate tables show the MIDI data being received (MIDI Input Events) and sent (MIDI Output Events). Each table contains similar columns.



Monitor pane A. MIDI Input filtering options B. MIDI Output filtering options

Channel

Displays the channel number of the received or sent event.

Event

Displays the event type. An event type can be either Note On or Control:

- **Note On:** An event containing note data. The Number column displays the note number between 0-127 and the Value column shows the note's velocity. Each Note On event is immediately followed by a Note Off event which is equivalent to, and shown as, a Note On event with a velocity of zero.
- **Control:** An event containing controller data. The Number column displays the controller number, (0-127) and the Value column provides the controller value.

Number

The value shown in the Number column changes depending on whether the event is a controller or a note. If the event is a controller, the Number column shows the controller number. If the event is a note, the Number column shows the note number. Each note is assigned a number between 0 and 127. For example, C4 (C octave 4) displays as 60.

Value

The value shown in the Value column changes depending on whether the event is a controller or a note. If the event is a controller, the Value column displays the controller value. If the event is a note, the Value column displays the note's velocity.

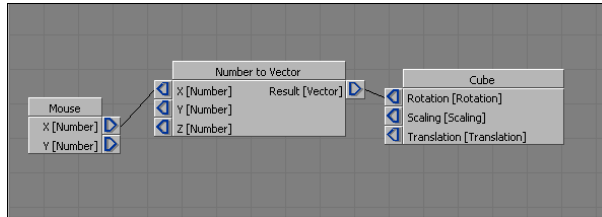
- [MIDI device](#) on page 1038

Mouse Device

Use the Mouse device to configure your mouse as an input device. There is no additional configuration for the Mouse device since it is automatically configured by your computer system.

The Mouse device tracks the movement of the mouse; it gives an X-coordinate for horizontal movement, and a Y-coordinate for vertical movement. These coordinates can be used in the Relations pane to control models, cubes, lights, shaders, and so on.

For example, to use the mouse device to change the X and Y position of a cube, you can use a converter (Number to Vector) to change the single X- and Y-coordinates of the mouse position into a vector for the cube.

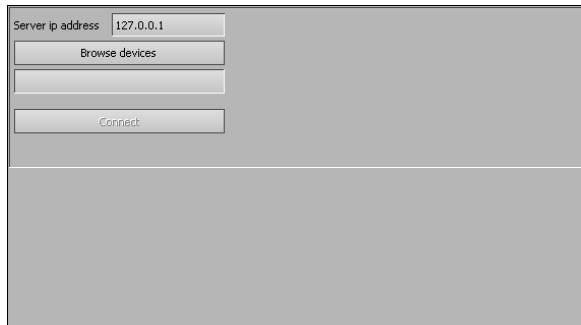


Mouse device used in a Relations constraint.

- [MotionBuilder devices](#) on page 1027

Network Client device

Add the Network Client device to connect MotionBuilder to another computer that has MotionBuilder running with a Network Server device.



Network Client device

Once the Network Client device is added, you can use devices from other MotionBuilder applications running Network Servers.

- [Connecting to a network server](#) on page 1044
- [Network Client device settings](#) on page 1044

Connecting to a network server

To connect to a network server:

- 1 In the Network Client device settings, enter the IP address of the server and click Online.

If the connection is successful, the Online indicator turns yellow and the message “Server found” appears in the Device information area.

To connect to more than one device:

- 1 Create a separate Network Client for each device you want to use.

Network Client device settings

This topic explains the options in the Network Client device area and their uses.

| Option | Description |
|-------------------|---|
| Server IP address | Address of the machine running MotionBuilder with the Network Server device. |
| Browse devices | Click to view a list of all the devices added to the MotionBuilder Network Server. |
| Device menu | Click Browse devices to list all the Network Server’s devices in this menu. Select the device to which you want to connect this Network Client. |
| Connect Device | Connects the device selected in the Device menu to the Network Client. |
| Reset | Re-establishes the connection. (Click Reset if you lose the connection.) |

■ [Network Client device](#) on page 1043

Network Server device

Add the Network Server device to use MotionBuilder as a server to which you can connect other computers running MotionBuilder. The devices connected to the Network Server computer can be used by all other computers that are connected and running MotionBuilder.

| | IP | Port | |
|--|----|------|--|
| | | | |

Network Server device settings

For the Network Server to function properly, MotionBuilder must be running on a computer connected to a LAN or another network with an IP address.

■ [MotionBuilder devices](#) on page 1027

Sound device

The Sound device lets you trigger sounds using another device, such as the Keyboard device.

| Audio Clips | Destination | Trigger | Trigger | Style |
|----------------|-------------|---------|---------|----------|
| French48.wav | <None> | Play | Stop | Continue |
| down_voice.wav | <None> | Play | Stop | Continue |

Sound device

The file path and name of loaded sound files appears in the Audio Clips column. You can specify a .wav file by typing the file name and path in the Destination field. The default entry <None> means that no destination is specified, and the path is taken from the Audio Clips column entry.

The Sound device supports up to twelve different .wav files for use in MotionBuilder. If you need more sounds, add a second Sound device.

- [MotionBuilder devices](#) on page 1027

SpaceBall Device

Use the SpaceBall device as a simple input device to manipulate cameras and selected objects in the Viewer window.

In order to use the SpaceBall device in MotionBuilder, the SpaceBall device and its driver must be installed.

SpaceWare software is installed with the SpaceBall driver and has settings that can override MotionBuilder. Be sure that the SpaceWare settings do not conflict with the SpaceBall device settings in MotionBuilder.

- [MotionBuilder devices](#) on page 1027
- [Manipulating Objects with a SpaceBall Device](#) on page 1046
- [Playing Recorded Spaceball data](#) on page 1047
- [Recording with a Spaceball](#) on page 1047
- Spaceball Recording Limitations
- SpaceBall Settings

Manipulating Objects with a SpaceBall Device

Hold the SpaceBall in your left hand, select an object in the Viewer window with your mouse in your right hand, then rotate the object using the SpaceBall device. When no objects are selected, you can move the camera freely in the Viewer window.

Consult the SpaceBall documentation for more information about configuring the SpaceWare software.

- [SpaceBall Device](#) on page 1046

Playing Recorded Spaceball data

To play data recorded with Spaceball as a device:

- 1 Disable Live.
- 2 Create a new Relations constraint using the SpaceBall device box.
- 3 Connect the connectors to your other boxes in the relation.
- 4 Click Play to preview the animation.
- 5 Select Animation > Plot All (All Properties) from the menu bar to apply the animation to the constrained objects.

To play data recorded with Spaceball as a manipulator:

- 1 Disable Live.
- 2 Select the object or camera to receive the recorded data.
- 3 Click the “Constrain selected object with recorded data” button.
This is the same as creating a new Relations constraint and connecting the connectors of the selected object with the SpaceBall connectors. Clicking this button again removes the constraint.
- 4 Click Play to preview the animation.
- 5 Select Animation > Plot All (All Properties) from the menu bar to apply the animation to the constrained object.

■ [SpaceBall Device](#) on page 1046

■ [Manipulating Objects with a SpaceBall Device](#) on page 1046

Recording with a Spaceball

To record as a device:

- 1 Make sure the SpaceBall device is Online, and activate Live and Recording.
- 2 Disable Use SpaceBall to manipulate the camera and objects in the viewer options.
- 3 Click Record, then click Play to start recording.
- 4 Move the SpaceBall, and click Stop to end the recording.

To record as a manipulator:

- 1 Activate the Online, Live, and Recording options.
 - 2 Activate either Use SpaceBall to manipulate camera in Viewer, or Use SpaceBall to manipulate objects in Viewer
 - 3 Select an object. Select none if you want to manipulate the current camera.
 - 4 Make sure there are no constraints connected to the selected object or camera.
 - 5 Click Record, then click Play to start recording.
 - 6 Move the SpaceBall, and click Stop to end recording.
- [SpaceBall Device](#) on page 1046
 - Spaceball Recording Limitations

Spaceball Recording Limitations

You can record data from a Spaceball as a device or as a manipulator. The way each method records data is outlined in the following topic.

Recording data as a device

When using the SpaceBall as a device, the data is only recorded in the following connectors.

| Connector | Function |
|------------------------------------|---|
| ButtonX (Bool) | The state of the button (0 is Up, 1 is Down). |
| Device Rotation Offset (Vector) | The rotation offset given by the SpaceBall. |
| Device Translation Offset (Vector) | The rotation offset given by the SpaceBall. |
| Device Total Lcl Rotation (Vector) | The total rotation computed with all the rotation offsets since the last reset. |

| Connector | Function |
|---------------------------------------|---|
| Device Total Lcl Translation (Vector) | The total translation computed with all the translation offsets since the last reset. Note: You can reset the Total values by pressing Button 3 of the SpaceBall. The button numbers shown in MotionBuilder correspond to "Function" numbers from the SpaceWare Configuration User Interface. |

Recording Data as a Manipulator

When using the SpaceBall as a manipulator, the data is also recorded in the following connectors.

| Connector | Function |
|---|---|
| Manipulator Camera Rotation (Vector) | Rotation vector applied to the manipulated camera. |
| Manipulator Camera Translation (Vector) | Translation vector applied to the manipulated camera. |
| Manipulator Camera Lcl Rotation (Vector) | Local rotation vector applied to the manipulated camera. |
| Manipulator Camera Lcl Translation (Vector) | Local translation vector applied to the manipulated camera. |
| Manipulator Camera Roll (Number) | Roll value applied to the manipulated camera. |
| Manipulator Interest Translation (Vector) | Translation vector applied to the interest of the manipulated camera. |
| Manipulator Interest Lcl Translation (Vector) | Local translation vector applied to the interest of the manipulated camera. |

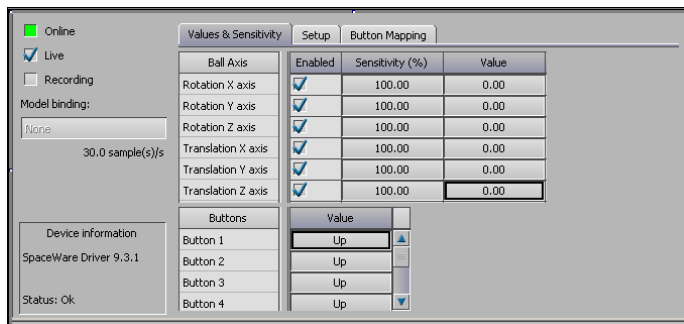
| Connector | Function |
|--|--|
| Manipulator Model Rotation (Vector) | Rotation vector applied to the manipulated model. |
| Manipulator Model Translation (Vector) | Translation vector applied to the manipulated model. |
| Manipulator Model Lcl Rotation (Vector) | Local rotation vector applied to the manipulated model. |
| Manipulator Model Lcl Translation (Vector) | Local translation vector applied to the manipulated model. |

SpaceBall Settings

Aside from the standard device settings, the Spaceball device Settings include three different panes.

Values & Sensitivity Pane

The Values & Sensitivity pane contains the following options:

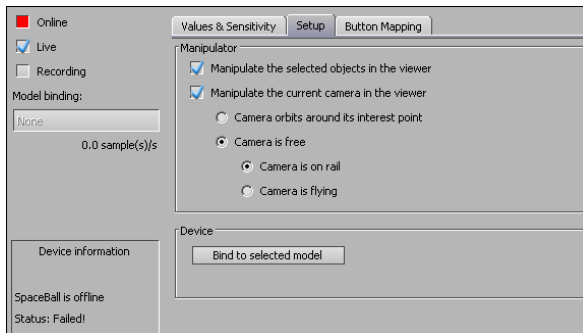


SpaceBall device settings, Values & Sensitivity pane

| Column | Description |
|-----------------|---|
| Enabled | Use the Enabled column in the Ball Axis area to activate or disable the selected axis. |
| Sensitivity (%) | Use the Sensitivity fields to adjust the sensitivity of the selected axis. A negative sensitivity value inverts the current axis. |

Setup Pane

The Setup pane contains the following camera options:



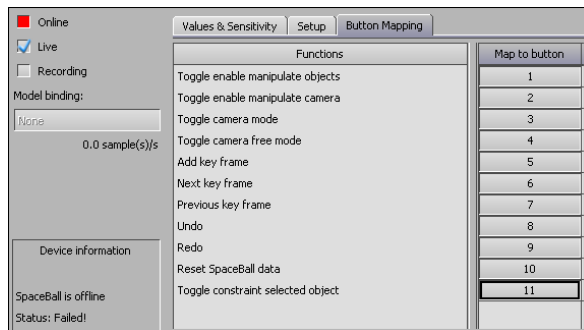
SpaceBall device settings, Setup pane

| Option | Description |
|--|--|
| Manipulate the selected objects in the Viewer window | Lets you manipulate selected objects with the SpaceBall device. To manipulate objects, make sure the device is Online, activate this option, select an object, then move the SpaceBall device. Make sure there are no constraints connected to this object. |
| Manipulate the current camera in the Viewer window | Lets you manipulate the camera when no objects are selected. To manipulate the current camera with the SpaceBall device, make sure the SpaceBall is Online, activate the Online option, set camera mode options, then move the device to manipulate the current camera in the Viewer window. |
| Camera orbits around its interest point | The camera moves around its interest point. If the camera has no interest point (except for the default perspective camera), it behaves as in the “Camera is free” mode. |
| Camera is free | The camera and camera interest, if any, move together. |

| Option | Description |
|-------------------|--|
| Camera is on rail | The camera moves like a camera on a rail (dolly track), in which it can move forward with the head down. |
| Camera is flying | The camera moves forward in the direction it is facing. |

Button Mapping Pane

Use the Functions column in the Button Mapping pane to map special functions to the SpaceBall buttons by assigning a button number to each function.



SpaceBall device settings, Button Mapping pane

■ [SpaceBall Device](#) on page 1046

NOTE If you bind a Producer camera, such as the Producer Perspective camera, to the Spaceball device, MotionBuilder crashes. You can work around this problem if you create a custom camera and bind it to the Spaceball device instead.

Trigger device

The Trigger device lets you map a keyboard or joystick to another device for triggering motion clips using the Animation Trigger window. For more information, see [Animation Trigger window](#) on page 1692.

- Trigger device settings
- [MotionBuilder devices](#) on page 1027

Trigger device settings

Source Name

Lets you choose the trigger source, which can be a keyboard or one of 16 joysticks. The Rename button lets you enter a new name for the source.

Trigger (List)

Displays the name of the trigger associated with the control.

Trigger (Edit)

Edits the name of the trigger selected in the Trigger (List) column.

Type

Displays the action to perform to activate the corresponding trigger. There are five types of actions:

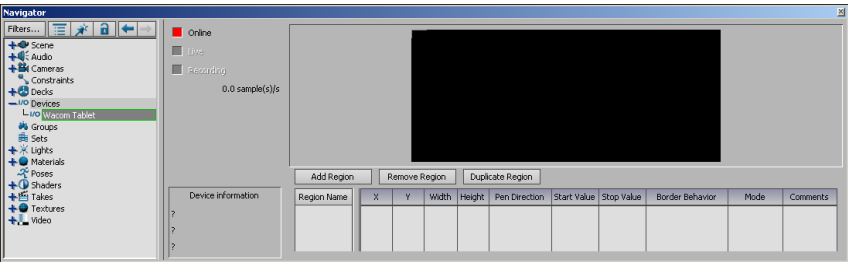
| Action | Description |
|----------|--|
| Off | No triggering action is defined. |
| Activate | Control is activated once (for example, when a joystick button is pressed and released). |

| Action | Description |
|-------------------|--|
| Deactivate | Control is disabled once (for example, when a joystick button is released and pressed). |
| Activate Repeat | Control is activated and remains activated (for example, when a joystick button is pressed and held down). |
| Deactivate Repeat | Control is disabled and remains disabled (for example, when a joystick button is released and remains released). |

■ [Trigger device](#) on page 1054

Wacom Tablet

Use the Wacom Tablet device to connect Wacom tablets and Wintab compatible tablets (Windows version only) to MotionBuilder. Adding the Wacom Tablet device displays the Device Settings and a representation of the tablet, referred to as the Virtual Tablet, in the Navigator window.



Device Settings for the Wacom Tablet device

Use this representation to divide the tablet into different regions for specific uses. For example, you can set a region to adjust the intensity of lights when dragging the pen left and right. Values are taken from the region and applied to an object connected through a Relations constraint.

Each region is shown as a white outline and the region’s properties display in the Regions table. When the pen is dragged or pressed in a region, its outline

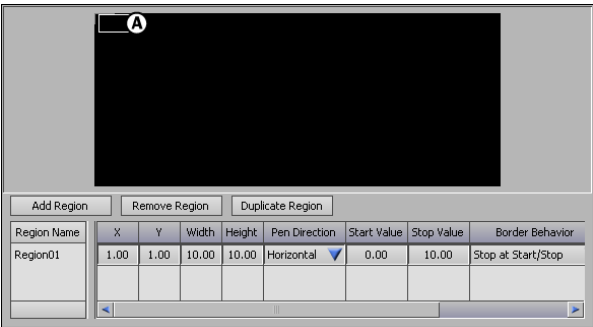
displays in red. The location of the pen is shown using gray crosshairs. When the pen makes contact with the tablet, the crosshairs are drawn in red.

- [MotionBuilder devices](#) on page 1027
- [Adding a Region for a Wacom tablet](#) on page 1056
- [Duplicating a region for a Wacom tablet](#) on page 1057
- [Removing a region from a Wacom Tablet](#) on page 1057
- [Wacom Tablet Devices in Relations](#) on page 1060
- [Wacom Device Settings](#) on page 1057

Adding a Region for a Wacom tablet

To add a region for a Wacom tablet:

- 1 In the Wacom Settings, click Add Region.
- 2 Select the added region in the Regions table, then set up the selected region using the fields in the Regions table.



Wacom Tablet settings A. Added region

When you add a region, it is automatically named, numbered, and drawn in blue. Its name cannot be changed.

- [Wacom Tablet](#) on page 1055
- [Duplicating a region for a Wacom tablet](#) on page 1057
- [Wacom Device Settings](#) on page 1057

Duplicating a region for a Wacom tablet

To duplicate a region for a Wacom tablet:

- 1 Select the Region to be duplicated from the Regions table in the Wacom Settings.
- 2 Click Duplicate Region to add a copy of the selected region to the table. Change the location of the duplicated region unless you want to assign separate behavior to the same region.
For example, do this when you want to have the same space send values for both horizontal and vertical pan movement. Set up the region using the fields in the Regions table.

■ [Wacom Tablet](#) on page 1055

■ [Wacom Device Settings](#) on page 1057

Removing a region from a Wacom Tablet

To remove a region from a Wacom tablet:

- 1 Select the region to be removed from the Regions table in the Wacom Settings, then click Remove Region.

The selected region is removed from the table, and remaining regions are automatically renumbered. If you remove a region that is used in a relation, it is automatically disconnected when removed.

■ [Wacom Tablet](#) on page 1055

■ [Wacom Device Settings](#) on page 1057

Wacom Device Settings

The Device Settings for Wacom tablets consist of the Regions table, which lets you set the following properties for each region you create for your Wacom tablet.

| Property | Function |
|----------|---|
| X, Y | Use the X and Y fields to define the top-left corner of the region. The top-left corner of the tablet is 0,0. |

| Property | Function |
|--------------------------|--|
| Width | Width of the region, measured starting from the X-coordinate and continuing right. Measured as a percentage of the entire tablet. |
| Height | Height of the region, measured starting from the Y-coordinate and continuing down. Measured as a percentage of the entire tablet. |
| Pen Direction | The direction in which the pen must be dragged for the region to register a value. For example, if set to horizontal, a value is registered only when the pen is dragged horizontally. Pen Direction can be horizontal or vertical. If you want a region to send both horizontal and vertical values, define two regions for the same space but with different Pen Directions. |
| Start Value | The minimum value for the region. When dragging or pressing in the region, the value sent does not go below the Start value unless Border Behavior is set to "Continue past Start/Stop". |
| Stop Value | The maximum value for the region. When dragging or pressing in the region, the value sent does not go above the Stop value, unless Border Behavior is set to "Continue past Start/Stop". |
| Border Behavior | The behavior of the sent value when the pen contacts the edge of the region. There are two settings. |
| Continue past Start/Stop | Value is registered for the region even after the pen drags out of the region. The bor- |

| Property | Function |
|--------------------|---|
| | ders of the region are not observed. Start and End values are not used as limiting values. |
| Stop at Start/Stop | When the pen contacts the border of the region, the value is set to either the Start Value or Stop Value. |
| Mode | Use Mode to select how the region reacts to pen presses and pen dragging. There are two modes: Relative and Absolute. See Relative and Absolute regions on page 1059. |
| Comment | Use the Comment field to add your own comments or descriptions. |

Relative and Absolute regions

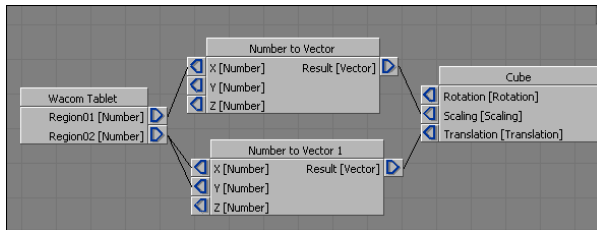
Use the Mode setting in the Wacom Device Settings to select how the region reacts to pen presses and pen dragging.

| Region | Definition |
|----------|---|
| Relative | The region is assigned values from the Start Value to the Stop Value. When you press the pen in the region, the current value is replaced with the value associated with where you pressed. When you lift the pen and press again, the value is replaced. |
| Absolute | The region is not assigned values. The Start value and Stop value act as minimum and maximum values. When you press the pen in the region, the value of where the pen is pressed is added to the current value for the region. |

Wacom Tablet Devices in Relations

The Wacom Tablet device can be used in a Relations constraint to drive the position, scale, or rotation of an object. It can also be used to control animation such as blinking eyes, eyebrow movement, or other facial expressions.

For example, shows the Wacom Tablet device used to scale and rotate a cube. Region 1 controls the X rotation and Region 2 controls both the X and Y scale. Separate Number to Vector converters change the Region 1 and Region 2 values into vectors.



Wacom Tablet device in a Relations constraint

To use the Wacom Tablet device in a relation, drag it from the Asset browser to the Relations settings pane. It is automatically added as a Sender because it cannot receive data.

Each connector in the Wacom Tablet device corresponds with a defined region. You can add and remove regions after the Wacom Tablet device is added to the Relations settings.

Animating Characters

When you have brought a character model into MotionBuilder and set it up for animation, there are three different types of motion sources you can use to animate the character: A Control rig, an Actor connected to motion data, or another character.

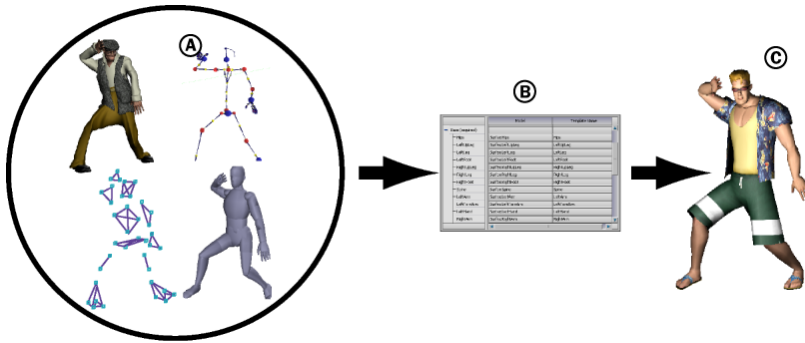
For more information on characters and setting up a character for animation, see [Character setup](#) on page 1079.

The overall workflow for animating characters in MotionBuilder can be summarized in the following steps:

- 1 Create a character model in your 3D package of choice and save it using the *.fbx* file format. (To do this, you need to have the appropriate FBX plug-in installed.)
- 2 Load your character model in MotionBuilder.
- 3 Complete the Character mapping process and characterize the character model. See [Character mapping](#) on page 1082 and [Characterizing](#) on page 1085.
- 4 Select the type of source you want to drive the character model. The motion source can be a Control rig, another character, or motion data attached to an Actor asset. See [Selecting a motion source](#) on page 1063.
- 5 Edit the animation by creating a Control rig and plotting the animation from the motion source to the Control rig. See [Creating a Control rig](#) on page 1245 and [Plotting animation to a Control rig](#) on page 1662.
You can also use the Control rig alone to create poses and set keyframes to animate it.
- 6 Refine your animation data with editing and filtering. See [Refining Animation](#) on page 695.
- 7 Plot animation from the Control rig to your model's skeleton to prepare it for export. See [Plotting animation to a character's skeleton](#) on page 1662.
- 8 Save the animated character model as an *.fbx* file.

Motion sources

Motion sources are the various types of data that you can use to drive the motion of a character model. They are the data that tells a model how to move. Without a motion source, your character could only stand around in a neutral rest pose. Character models are linked to motion sources through the Character asset.



Motion source data flow A. Motion sources B. Character asset C. Animated character model

There are three main motion sources available in MotionBuilder, including:

- Actors linked to motion capture data
- Control rigs
- Retargeting from another character

To link each of these motion sources to your character model, you must first create a map of your character model using a Character asset, then select the motion source as the Input Type for your character.

The Input Type menu in the Character Settings pane lets you choose from the following sources of motion data for animating your character.

- [Selecting a motion source](#) on page 1063
- [Actor assets](#) on page 1163
- [Character Settings pane](#) on page 1324
- [Actor settings](#) on page 1169
- [Creating a Control rig](#) on page 1245

- [Plotting animation to a Control rig](#) on page 1662
- [Retargeting animation character-to-character](#) on page 1067
- [Character mapping](#) on page 1082
- [Connecting an Actor to a character](#) on page 1166

Selecting a motion source

Once you have a characterized character, you can choose the type of motion source you want to drive the character.

To select a motion source:

- 1 In the Scene browser, double-click a characterized character to select it as the current character and open the Character Settings.
- 2 Do one of the following:
 - In the Character Settings, open the Input Type menu.
 - In the Character Controls, select Edit > Input.
- 3 Select one of the following motion sources from the Input Types menu:
 - **Actor Input:** Only available when there is an Actor in the scene. Links the character to an Actor, which is connected to motion capture data.
 - **Character Input:** Only available when there is another animated character in the scene. Links the current character to the character specified in the Input Source field.
 - **Control Rig Input:** Creates a Control rig for the character, if there is no existing Control rig, and lets you animate the character by manipulating the rig, creating poses, and setting keyframes.
 - **Control Rig Output:** If there is existing animation on your character's skeleton, transfers animation from the skeleton to the Control rig for editing.
 - **Stance Input:** Resets a selected character to its stance pose.

Whichever type of motion source you choose is connected to your character. You can adjust the way your character reacts to this motion source using the Reach properties. See [Reach and Pull area](#) on page 1380 for more information.

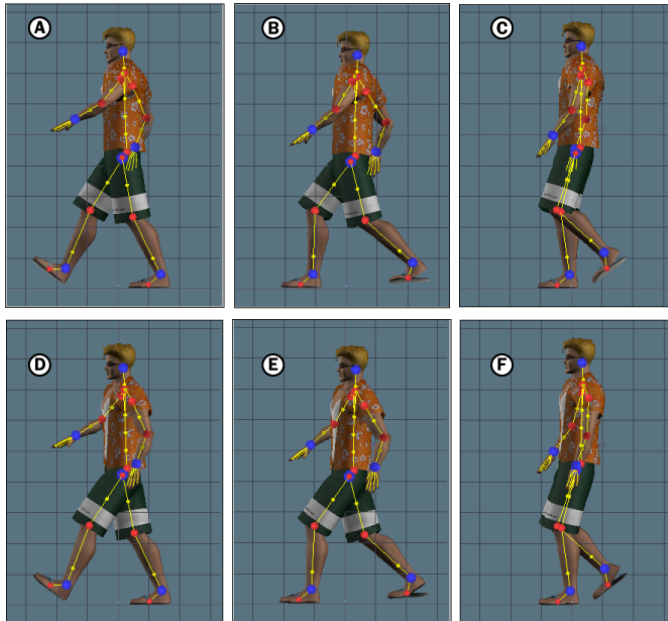
- [Animating Characters](#) on page 1061
- [Retargeting animation character-to-character](#) on page 1067
- [Plotting character animation](#) on page 1660
- [Character keyframing workflow](#) on page 1064
- [Control rigs](#) on page 1239
- [Customizing the Control rig hierarchy](#) on page 1289
- [Pinning](#) on page 1267

Character keyframing workflow

The basic process for animating characters involves changing the position and orientation of a character at different points in time, then marking those points with keyframes.

To animate a character, you choose where in time to change the position and orientation of your character, then set a keyframe on the character's position at that time. MotionBuilder then interpolates the movement between your keyframes, creating animation.

For example, in the following illustration, six keyframes were set on different positions of a character in a walk cycle. Playing the animation gives the impression of a continuous walking motion because of the interpolation.

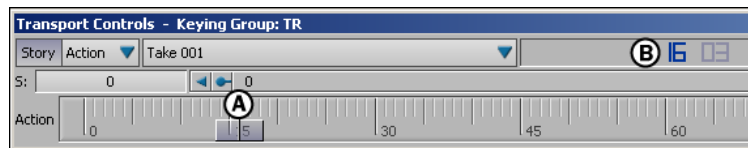


Poses in a keyframe animation cycle A. Frame 0 B. Frame 5 C. Frame 10 D. Frame 15 E. Frame 20 F. Frame 25

Changing the current time

Changing the current time involves choosing the frame on which to perform a key transformation. Setting the current time can be done in a number of places that display the current timecode and a timeline. You can change the current time in various places, such as the Transport Controls window, the FCurves window, and the Dopesheet window.

The following illustration, shows the current time at frame 16 in the Current time field and at the location of the Timeline indicator.



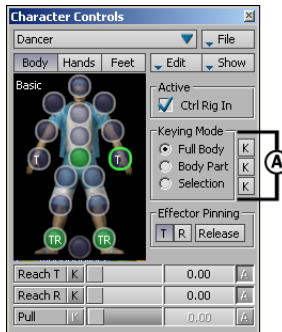
Transport Controls A. Timeline indicator B. Timecode field

Setting a keyframe

To mark the transformations, or changes you make to the character over time, you set a keyframe. There are various ways you can set keyframes, including pressing K, or using other keyboard shortcuts. The [Key Controls window](#) on page 661 contains the main keyframing options, but you can also set keyframes in the Character Controls window.

The Keyframe (K) buttons that display next to each Keying Mode in the Character Controls let you choose whether you want to key the character's entire body, or only selected body parts. The parts of the character that are available for transformation are also determined by the mode you select.

You can also click the Keyframe (K) buttons in the Character Controls to set keys without switching Keying modes. For example if you are in Full Body mode, you can click the Body Part K button to set a key on only the selected body part.



Character Controls A. The Keying Mode area lets you select what you want to key.

When Show Key Hint is active in the Transport Controls, keyframes set in Body Part Keying mode display with a green tip, keyframes set in Full Body mode display with a red tip, and when a Character Extension is keyed, the keyframe displays with a yellow tip. See [Keyframing a Control rig](#) on page 1067 for more information.



Transport Controls A. Body Part keyframe B. Character Extension keyframe C. Full Body keyframe

When you set more than one keyframe of the character's position over time, you have created character animation. When you play this animation,

MotionBuilder interpolates the position of the character between the keyframes you have set, giving the impression of smooth continuous motion.

For general information on keyframing, see [Setting keyframes](#) on page 639 for more information. For more information about the basic animation process, see [Basic Keyframe Animation](#) on page 567.

- [Animating Characters](#) on page 1061
- [Showing and hiding visual keyframes](#) on page 656

Keyframing a Control rig

To set keyframes on a Control rig

- 1 Position the character.
- 2 Choose a timecode.
- 3 Select the keying mode.
- 4 Set a keyframe.

For more information, see:

- Keyframing characters
- Refining character animation (Edit and Filter)
- Plotting character animation

Retargeting animation character-to-character

Retargeting is the process of taking animation developed for one character and using it to drive another character without plotting (or baking) the animation onto either character's skeleton. You can retarget both keyframe animation and motion data.

Animation can be retargeted from one characterized character to another in the same scene, or you can save takes of animation to be retargeted onto any character.

Using generic biped or quadruped skeletons lets you reuse animation on different characters.

The main options that let you quickly retarget animation between characters are found in the [Character Controls](#) on page 1357.

NOTE Depending on the number of spine bones defined in the source character and the target character, the way animation is mapped from spine to spine can differ. See [Defining a spine](#) on page 1093 for more information.

Retargeting keyframe animation

When you retarget keyframe animation, the Reach properties are also retargeted to the target character. This means you can take the precise keyframe animation you have developed for one character and reuse it on another character.

When you select Retarget in the Character Controls Edit menu, keyframes are copied directly from one Control rig to the other, without plotting. The Character dialog box that appears lets you select how you want the retargeting to be done.

The quality of your animation is preserved and adjustments for any difference in size between the characters are made automatically.

In order to retarget keyframe animation properly, you must have an equivalent setup on both characters. The best way to achieve this is to create identical Control rigs for both the ‘source’ character (the character you want to retarget from) and the ‘target’ character (the character you want to retarget to).

- [Bipeds and quadrupeds](#) on page 1096
- [Retargeting animation between characters in the same scene](#) on page 1068
- [Character Controls](#) on page 1357

Retargeting animation between characters in the same scene

To retarget keyframe animation from one character to another in the same scene:

- 1 Load two character models into the scene, one ‘source’ character with a Control rig and keyframe animation, and one ‘target’ character with no Control rig attached.
- 2 Save a copy of the source character’s Control rig, then apply it to the target character. See [Saving a Control rig](#) on page 111.

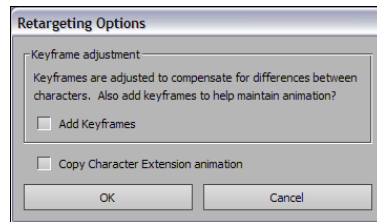
This creates the identical setup on both characters necessary for retargeting keyframe animation.

- 3 Double-click the target character in the Scene browser to open the Character Settings.
- 4 Select Character Input as the Input Type, and select the source character as the Input Source.
- 5 Activate the Active option.

The target character is now set up to be driven by the keyframe animation of the source character. You can use the various character properties such as Retargeting, Pull, Floor Contact and so on to modify the way the animation is retargeted.

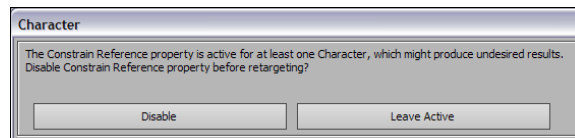
- 6 Select Retarget from the Edit menu in the Character Controls.
- 7 In the Retargeting Options dialog box that appears, activate or disable any options you choose.

For example, activate the Add Keyframes option if you are concerned with retargeting your original animation as precisely as possible. See Retarget in [Load Technique area](#) on page 1387 for more detailed information.



Retargeting Options dialog box

If the Constrain References property for one of the characters is active, a Character dialog box appears asking if you want to disable the Constrain References property. Click Disable if you want to turn off the active Constrain References property. See [Constrain References](#) on page 1339 for more information on this property.



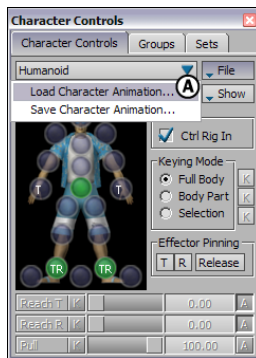
Character dialog box asking if you want to disable the Constrain References property.

The keyframe animation from the source character is copied to the target character, and MotionBuilder makes the necessary adjustments for any differences in the size and shape of the two characters. The exact dynamic of your original keyframe animation is preserved on the target character.

Retargeting saved animation onto a character

After you have saved motion data or keyframe animation using the File > Save Character Animation option in the Character Controls, you can retarget that animation onto any character.

- 1 In the Character Controls, select a character in the Current Character menu.
- 2 Still in the Character Controls, select File > Load Character Animation.



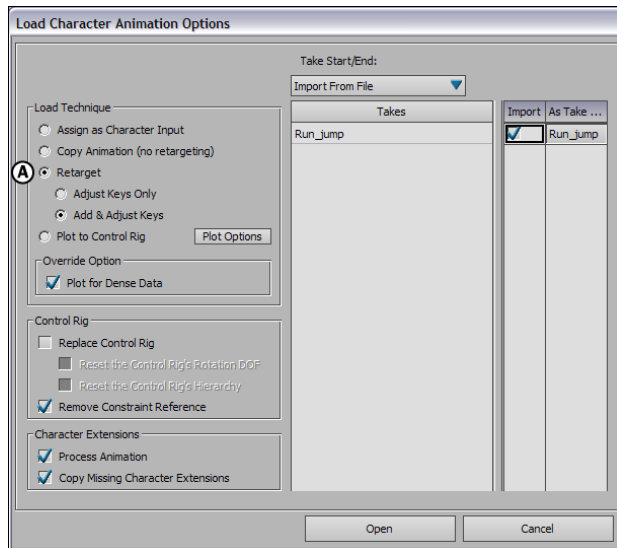
Character Controls A. Select the Load Character Animation option

The Open File dialog box appears.

- 3 Browse and select the *.fbx* file containing the animation you want to load.

NOTE For best results, use *.fbx* files saved using the Save Character Animation option. See [Saving character animation](#) on page 115.

- 4 Click Open.
- 5 The Load Character Animation Options dialog box appears.



Load Character Animation Options dialog box A. Retarget option

- 6 In the Load Technique area, select the Retarget option.
- 7 In the Key adjustment dialog box that appears, select either the Adjust Keys Only option or the Add & Adjust Keys option.
If you want to keep the same number of keyframes as in the source file, select the Adjust Keys Only option. This option works best when all keyframes are on the Base Layer. It adjusts all keyframe values to fit the current character.
If you want to help preserve the original animation when using multiple layers, select the Add & Adjust Keys option. This option adds keyframes as well as adjusts all keyframe values to fit the current character.
- 8 Make sure the take you want to retarget is selected in the Take list.
- 9 Click Open.

The animation from the file you selected is retargeted onto the current character in the scene.

- [Saving a Control rig](#) on page 111
- [Attaching a Control rig to a character](#) on page 1247
- [Load Character Animation Options dialog box](#) on page 1386

Character motion capture workflow

In order to connect recorded motion data to a character, you need to use an Actor asset. Once this process is complete, the character can move according to the motion data defined in the Actor's Marker set.

When you are satisfied with your mapping, you can drive the character independently of the recorded data by transferring (plotting) the data to your character's skeleton. You can then export your plotted character and open it in other 3D software.

The following steps summarize the process of connecting a character to motion capture data:

- 1 Add an Actor asset to the scene. See [Creating an Actor](#) on page 1164.
 - 2 Merge your motion data file into the scene.
 - 3 Create a Marker set. See [Creating a Marker set](#) on page 1185.
 - 4 Connect the Actor to your character. See [Connecting an Actor to a character](#) on page 1166.
 - 5 Adjust the connection between the Actor and character. See [Adjusting a character connected to an Actor](#) on page 1167.
 - 6 Optional: Plot the motion data to the character. See [Plotting animation to a character's skeleton](#) on page 1662.
- [Motion sources](#) on page 1062
 - [Selecting a motion source](#) on page 1063

Refining character animation

Once your character is animated, you can refine its movement by editing and filtering the animation data.

For precise control over keyframes, you can modify the function curves in the FCurves window.

To speed up or slow down the entire animation, you can manipulate your entire animation by adding and manipulating points on a Timewarp curve. See [Timewarp curves](#) on page 756.

In the Character Settings pane, there are various filtering options available. For example, the Floor Contact option makes sure that your character's feet do not go through the floor.

Loading character animation

After you have saved character animation using the Save Character Animation option in the Character Controls, you can load that animation onto any character.

To load character animation:

- 1 In the Character Controls, select a character in the Current Character menu.
- 2 Still in the Character Controls, select File > Load Character animation.
- 3 In the File Open dialog box, navigate to select an *.fbx* file (or multiple *.fbx* files) containing motion data or keyframe animation saved with the Save Character Animation option, then click Open.
- 4 In the Load Character Animation dialog box that appears, select any options you need. See [Load Character Animation Options dialog box](#) on page 1386 for detailed information.

If you selected more than one *.fbx* file to load at the same time, the files are loaded in alphabetical order.

- [Saving character animation](#) on page 115
- [Troubleshoot loading character animation](#) on page 1073

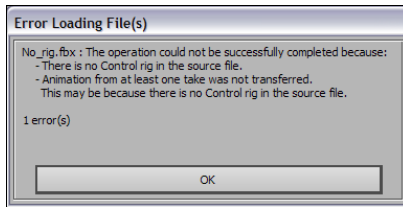
Troubleshoot loading character animation

As you load character animation using the File > Load Character Animation option in the Character Controls, a dialog box may appear to warn you that the operation was not completed successfully.

Depending on the options you selected in the Load Character Animation Options dialog box and the contents of the source file you selected, you may encounter one or more of the following messages in the Error Loading File(s) dialog box.

No Control rig in the source file

If the Replace Control Rig option is active, but there is no Control rig in the source file, this error message displays.



Error Loading Files dialog box: There is no Control rig in the source file.

To correct this problem, disable the Replace Control Rig option, or make sure there is a Control rig in the source file you select, then try again.

No character in the source file

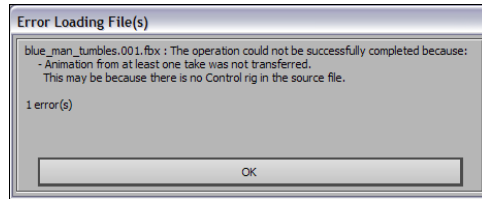
If there is no character in the source file you have selected, this message displays.

To correct this problem, make sure there is a character in the source file you select, then try again.

Animation was not transferred

This message can display for one or more of the following reasons:

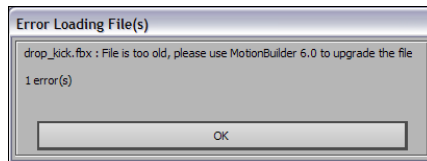
- The plot operation failed, because there is not character in the source file.
- There was no character in the source file.
- There was no Control rig in the source file.
- There was no character in the current scene.
- There was no Control rig in the current scene.
- The Control rig in the source file was not connected to the Control rig in the current scene. Either there is no character in the source file, or there is another problem.



Error Loading Files dialog box: Animation was not transferred.

File is too old

If the file you have selected was created in MB version 6.0 or earlier, it is not compatible with the Load Character Animation feature.



Error Loading dialog box: File is too old

- [Character motion capture workflow](#) on page 1072
- [Character Controls](#) on page 1357

Creating realistic human movement

MotionBuilder provides you with many tools that make it easy to create realistic movement for a character.

For the sake of simplicity, this topic discusses how the MotionBuilder character engine works with biped or human skeletons. There are special conditions and exceptions when animating quadrupeds that are beyond the scope of this section.

Before you can successfully animate a character within MotionBuilder, it is important to understand how skeletons move and how MotionBuilder can help you recreate believable motion.

Studying the human skeleton

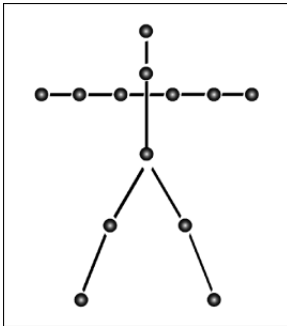
In order to create believable human movement, you must first look at the human skeleton and how it operates.

A human skeleton is basically composed of a series of joints. The joints are connected by bones which are moved by muscles and tendons.

In order to create realistic movement in animation, 3D skeletons mimic the movement of human skeletons using a series of joints, rather than actually replicating the complex system of muscles, tendons, and bones.

A simple 3D skeleton is composed of the main joints, such as the shoulder, elbow, wrist, knee, and so on. Since muscles and tendons move the joints that move a real skeleton, we can achieve an accurate recreation on a model by manipulating the joints directly, without replicating muscles and tendons.

Each point is placed in 3D space and connected together to resemble the joints of a human skeleton. For example, is a very simplistic skeleton created with dots representing the joints, and lines representing the bones. What is drawn between the joints is not important at this stage.



A simple skeleton

We now have a series of dots representing joints that are connected with lines (representing bones). The next section discusses the relationships and rules needed to make this series of points act like a human skeleton.

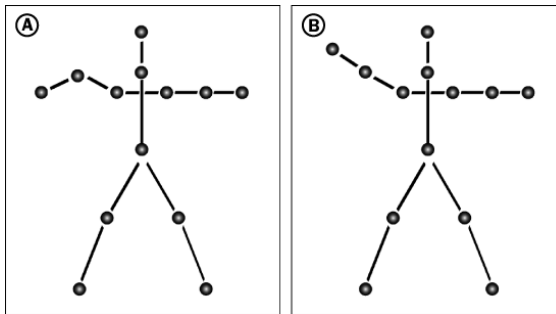
Basic rules of creating human movement

When you characterize a character in MotionBuilder, the character engine automatically defines a group of settings that govern human movement, so you won't need to create your own. Still, it is important to have a good idea of what's involved in creating realistic human movement.

Making a series of points act like a human skeleton involves setting up rules to determine the ways in which the points can interact with each other. For proper interaction, it is necessary to create relationships to govern how each point influences the other. Otherwise, when the series of joints moves, it does not behave like a human skeleton.

Refer again to which uses dots to represent joints. With no relationships established, each joint moves independently.

For example, if you move the dot representing an elbow, only the elbow moves and the wrist and hand do not move. On a human skeleton, if you move your elbow, the wrist and hand move as well.



A. If no relationships are established to define the movement of the right arm on the simple skeleton, it moves in an unnatural fashion. B. A rule is created to make the wrist and hand move when the elbow moves, resulting in natural movement.

To create natural movement, you need a rule that says “when the right elbow moves, the right wrist and hand must also move”.

You also need a rule to govern the rotation of joints. Through studying human movement, it is obvious that when, for example, the right elbow moves, the wrist and hand also move, and the right shoulder rotates. So you create a rule that says “when the right elbow moves, the right shoulder rotates.”

After studying all of the movements of a human skeleton, you can discover hundreds of rules governing translation and rotation. Fortunately, MotionBuilder already has most of these rules figured out for you.

- [Interpolation](#) on page 697
- [Dynamic Editor](#) on page 713
- [Floor contact](#) on page 1131

Character setup

This section includes all of the topics involved when bringing a character model into MotionBuilder and preparing it to be animated.

Before you can animate a character, you have to map out its structure and characterize it. The essential tool in the MotionBuilder character setup process is the Character asset, which helps you map out your character, characterize it, then link the character model to a motion source.

The main topics in this section include:

- [Character assets](#) on page 1081
- [Models](#) on page 1095
- [Skeletons](#) on page 1117
- [Floor contact](#) on page 1131
- [Character Extensions](#) on page 1151
- [Setting up a character](#) on page 1079

Setting up a character

This topic provides a general overview of the steps required when bringing a character model into MotionBuilder and preparing it for animation.

To set up a character:

- 1 Create a character model in external software and save it as an *.fbx* file. (To do this, you need to have the appropriate FBX plug-in installed.)

It is recommended that you use the bone-naming conventions recognized by MotionBuilder as you build your model and name its bones. See [Bone naming conventions](#) on page 1125.

- 2 Load the *.fbx* file containing your character model in MotionBuilder. See [Opening a file](#) on page 79.
- 3 Add a Character asset to the scene. See [Adding a Character asset](#) on page 1081.
The Character asset provides you with a template you can use to map out your character for MotionBuilder.
- 4 Link your character to the Character asset by completing a character map. See [Character mapping](#) on page 1082.
- 5 Characterize the character. See [Characterizing](#) on page 1085.
If you have named your character's bones according to MotionBuilder's naming conventions (as discussed in step 1), you can complete steps 4 and 5 automatically. See [Automatically mapping and characterizing a character](#) on page 1086.

Your character is now set up and ready to be animated in MotionBuilder.

- [Character assets](#) on page 1081
- [Control rigs](#) on page 1239
- [About the Mapping List](#) on page 1083
- [Character mapping](#) on page 1082
- [Characterizing a character model](#) on page 1086
- [Skins window](#) on page 1109

Character assets

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The MotionBuilder Character asset helps you create a complete map of your character model's structure and link it to a motion source for animation. The topics in this section include information on working with the Character asset to bring your character models into MotionBuilder and animate them.

NOTE MotionBuilder also includes a Character asset designed specifically for 3ds Max Bipeds.

Before you can animate a model, you use the Mapping List in the Character asset to introduce the different bones of your model's skeleton to MotionBuilder. This process is called Character mapping.

In the Asset browser, the Templates > Characters folder contains the Character asset. You can add a Character asset to the scene to begin creating a map of your character model, or you can use it to automatically map and characterize your character. See [Characterizing](#) on page 1085 for more information.

When you add a Character asset to the scene the Character Settings you need display in the Navigator window.

- [Models](#) on page 1095
- [Bone naming conventions](#) on page 1125
- [Animating Characters](#) on page 1061

Adding a Character asset

To add a Character asset to the scene:

- 1 From the Templates > Characters folder in the Asset browser, drag a Character asset into the Viewer window or Scene browser.

The Character Settings display in the Navigator window.

NOTE If you drag the Character asset over a model with a skeleton that follows MotionBuilder naming conventions, you can automatically define and characterize your character.

To add a Character asset for 3ds Max Bipeds to the scene:

- 1 From the Templates > Characters folder in the Asset browser, drag the 3ds Max Bipeds Template asset into the Viewer window or Scene browser.

NOTE The 3ds Max Bipeds Template supports up to 10 neck bones where Bipeds created in 3ds Max support up to 25 neck bones.

The Character Settings display in the Navigator window.

NOTE If you drag the Character asset over an imported 3ds Max Bipeds skeleton, this template automatically defines and characterizes your character.

- [Character assets](#) on page 1081
- [Character settings](#) on page 1309
- [Bone naming conventions](#) on page 1125
- [Automatically mapping and characterizing a character](#) on page 1086

Viewing Character settings

To display the Character settings, double-click an existing Character asset in the Scene browser. The Character settings for the selected Character asset display in the Navigator window.

- [Character settings](#) on page 1309

Character mapping

When you bring a character model into MotionBuilder, you must define that character's structure by completing the Mapping List. This process is referred to as Character mapping.

Essentially, Character mapping tells MotionBuilder that on this character's skeleton, these are the arms, these are the legs, this is the head, and so on. Once you have completed the Mapping List, you can link your character model to a motion source to animate it.

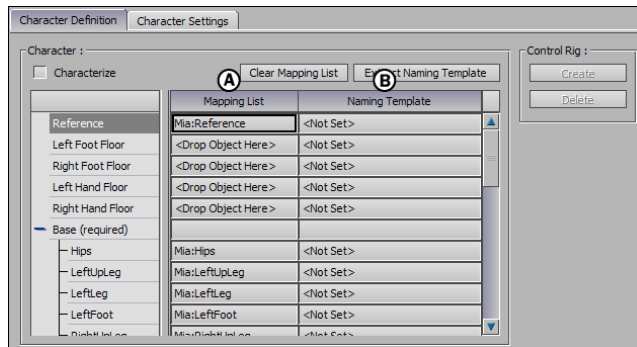
There are two ways to map out a character model and prepare it for animation: automatic and manual. Both methods use a Character asset to help you complete the Mapping List.

Whether you can automatically map your character depends on the naming of its bones. If you have named the bones using the naming conventions found in the Mapping List, you can automatically complete the mapping. If you have a character with bones that are named differently, you must manually map out the bones.

If you plan to use several characters with bones that do not follow MotionBuilder naming conventions, you can create a naming template of your own bone names. See [Creating a bone-naming template](#) on page 1127.

About the Mapping List

The Mapping List in the Character Definition pane includes required and optional slots that let you define the skeleton of your model. The Character asset uses the objects defined in this list to link your character model to a motion source.



A. Mapping List B. Naming Template column

Essentially, the Mapping List contains all of the data that MotionBuilder needs to understand the structure of your character and how it can move. It contains the list of bone names that MotionBuilder understands.

For any skeleton that you introduce, MotionBuilder requires that you map a minimum of fifteen objects to the Base group of slots.

After you have completed the character mapping, you can characterize your character model to ready it for animation.

See [Mapping List](#) on page 1311 for a detailed description of all the slots in the Mapping List.

- [Character assets](#) on page 1081
- [Character settings](#) on page 1309
- [Characterizing a character model](#) on page 1086
- [Manually mapping and characterizing a character](#) on page 1087
- [Automatically mapping and characterizing a character](#) on page 1086
- [Bone naming conventions](#) on page 1125

Spine mapping behavior

Depending on the number of spine bones defined in a motion source and its target character, the way animation is mapped from spine to spine can differ.

When you retarget animation from one character to another, and the target and source characters have the same number of spine bones, the animation is mapped directly from spine bone to spine bone. The source spine animation is reproduced exactly on the target spine.

If the source character has fewer spine bones than the target character, the source spine animation is solved evenly over all the target spine bones. The reproduced animation is not exactly the same, but is adjusted so the spine still moves naturally based on the source character.

This same behavior is available when targeting animation from an Actor to a character. Actor assets have two spine bones, while characters may have many. When you use an Actor as the motion source for a character, the spine animation is mapped directly if the character also has two spine bones. If the character has more than two spine bones, the animation is solved evenly over all the spine bones.

- [Defining a spine](#) on page 1093

Defining toe behavior

If you want a character's big toes to have thumb-like movement, map the toe bones to the “LeftFootThumb” and “RightFootThumb” slots of the Mapping List. You might want this behavior if, for example, you have a quadruped with opposable thumbs on their feet, you should use the thumb. You can also use the thumb for dew claws.

If you want the character's big toes to have normal toe movement, map the toe bones to the “LeftFootExtraFinger” and “RightFootExtraFinger” slots in the Mapping List.

NOTE If your character model has bones named using naming conventions from previous versions of MotionBuilder, the toe bones are named “LeftFootThumb,” “RightFootThumb” and so on. When you map and characterize this model, the toes will use thumb-like behavior unless you rename them or manually map them to the “LeftFootExtraFinger” or “RightFootExtraFinger” slots.

Characterizing

The action of activating the Character map you have defined is called characterizing. When you characterize a model, it is no longer just mesh and a skeleton, MotionBuilder recognizes it as a character that can be animated.

Once you have a characterized character, you can select what type of motion source you want to control it, such as a Control rig, Actor, or other character.

NOTE You cannot edit the Mapping List for a characterized character. If you need to edit the Mapping List, for example to add an object to define the floor, you must temporarily disable the characterization.

There are two ways to characterize a character: manually and automatically. The way you set up and characterize a character depends on how you named the bones of your character model's skeleton.

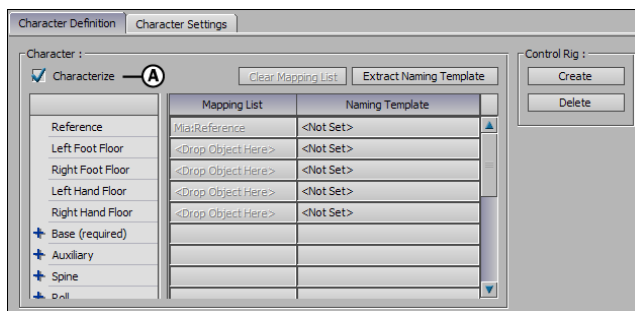
- [Bone naming conventions](#) on page 1125
- [Character mapping](#) on page 1082
- [Manually mapping and characterizing a character](#) on page 1087
- [Automatically mapping and characterizing a character](#) on page 1086

Characterizing a character model

After you have finished the character mapping process, linking your character model to a MotionBuilder Character asset, you can characterize the model to activate it in MotionBuilder and make it ready for animation.

To characterize a character model:

- 1 Complete the character mapping process, manually or automatically. See [Character mapping](#) on page 1082.
- 2 In the Character Definition pane of the Character Settings, activate the Characterize option.



Character Definition pane A. Characterize option

- 3 A dialog box appears to remind you that your model must be in a stance pose facing the positive Z-axis. Choose between two types of postures for your character (Biped or Quadruped).

Once it is characterized, your character is ready to be attached to a motion source.

- [Character mapping](#) on page 1082
- [Troubleshoot characterizing a character](#) on page 1090

Automatically mapping and characterizing a character

If you have a model with bones that are named according to the same naming conventions as the Mapping List, you can automatically map out the character

model for MotionBuilder and characterize it. If your model uses different bone naming conventions, you must manually map out the character.

To automatically map and characterize a character:

- 1 Load a character model.
- 2 Drop a Character asset from the Asset browser (Templates > Characters folder) onto your model in the Viewer window. If you have a 3ds Max Biped, drop the 3ds Max Biped Template onto your model.
- 3 Select Characterize in the menu that appears.
- 4 A dialog box appears to remind you that your model must be in a stance pose facing the positive Z-axis. Choose between two types of postures for your character (Biped or Quadruped) to continue.

The Character mapping is automatically completed in the Mapping List, and the character is characterized and ready for animation.

After characterizing your character, you cannot make any changes to the Mapping List. To make changes, you must disable the Characterize option to remove characterization.

- [Characterizing a character model](#) on page 1086
- [Troubleshoot characterizing a character](#) on page 1090
- [Manually mapping and characterizing a character](#) on page 1087
- [About the Mapping List](#) on page 1083

Manually mapping and characterizing a character

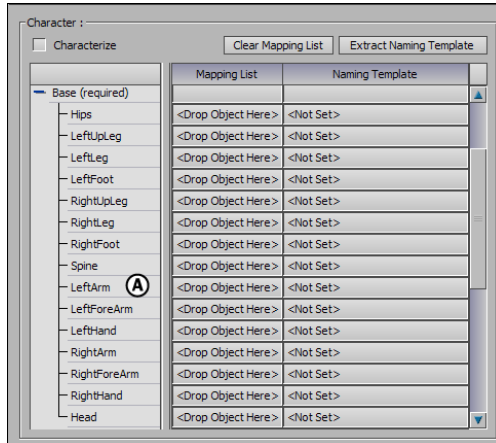
When a model's bones are named differently from the names recognized by MotionBuilder, you need to map out each bone manually before the model can be characterized.

To manually map and characterize a character:

- 1 Load a character model into the scene.
- 2 From the Templates > Characters folder of the Asset browser, drag a Character asset into the scene.

A Character asset is added in the Scene browser and the Character Settings open in the Navigator window.

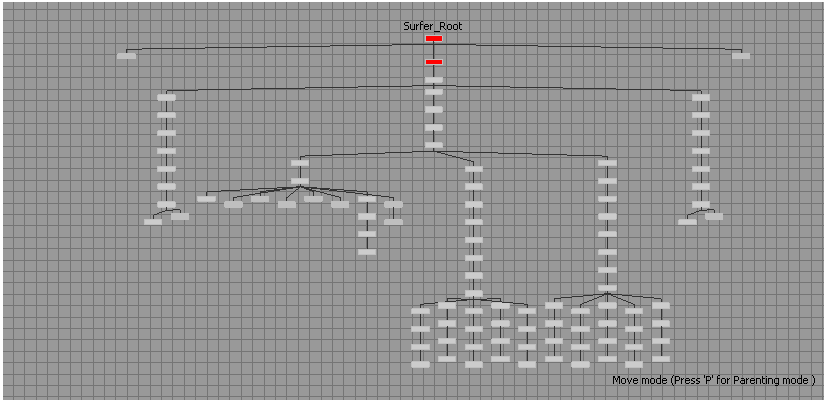
- 3 Activate the Lock option in the Scene browser to keep the Character Settings open for the duration of this procedure.
- 4 Switch to the Character Definition pane and view the Mapping List. Expand the Base (required) group of slots.



Character Definition pane A. Base (required) objects

The words <Drop Object Here> currently display for each required slot in the Mapping List because the model's bones have not yet been mapped.

- 5 In the Viewer window, switch to the Schematic view (Ctrl-W), then press A to frame the hierarchy . Each of the bones in your character's hierarchy are represented by rectangular nodes.



Character hierarchy in the Schematic view

You may find it easier to select bones using these nodes in the Schematic view.

- 6 Select a bone, then Alt-drag it into the Mapping List of the Mapping List. Drop each of the character's bones into the corresponding slot of the Mapping List.

For example, if you select your character model's left thigh bone, you would Alt-drag it into the LeftUpLeg field in the Mapping List.

Repeat this step until you have dragged all of the required bones into the Mapping List. The Character mapping is now complete.

- 7 Activate the Characterize option at the top of the Mapping List.
- 8 A dialog box appears to remind you that your model must be in a stance pose facing the positive Z-axis. Choose between two types of postures for your character (Biped or Quadruped) to continue.

After characterizing your character, you cannot make any changes to the Mapping List. To make changes, you must disable the Characterize option to remove characterization.

- [About the Mapping List](#) on page 1083
- [Character mapping](#) on page 1082
- [Stance pose](#) on page 1098
- [Characterizing a character model](#) on page 1086

- [Bone naming conventions](#) on page 1125
- [Character Definition pane](#) on page 1310
- [Troubleshoot characterizing a character](#) on page 1090

Troubleshoot characterizing a character

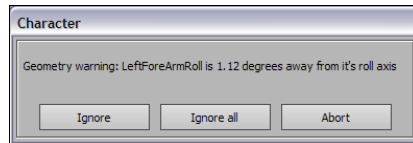
This topic discusses common error messages that can occur when you attempt to characterize a character model.

NOTE You can only characterize a model that has a completed Character map. See [Character mapping](#) on page 1082.

Depending on your model and the objects defined in the Mapping List, you may encounter errors when you attempt to characterize a character. You can ignore some of these errors, while other errors prevent your model from becoming characterized.

Roll Axis error

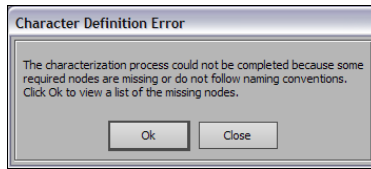
For example, shows a warning that occurs when the roll axis of a certain bone on your skeleton is not where it should be for accurate roll. If you do not think the difference in roll axis location affects your animation, choose one of the Ignore options.



Roll axis warning

Missing required nodes error

If you did not define objects in all of the slots required to successfully characterize your model, the following error dialog appears and the characterize operation is not completed.

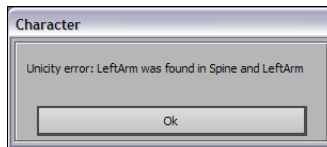


Character Definition error dialog box

You must define objects in all the slots of the Base group of the Mapping List before you can characterize the character. Click Ok in the Character Definition Error dialog box to view a list of required objects.

Unicity error

If you have used the same bone in more than one slot of the Mapping List, a dialog box similar to appears.



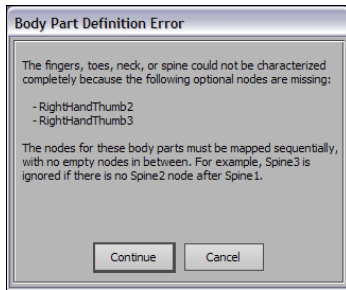
Character unicity error dialog box

Each bone can only be mapped to a single slot in the Mapping List, and the dialog box indicates which bone is currently duplicated. In , the dialog box indicates that the “LeftArm” bone is mapped in both the LeftArm slot and the Spine slot. The “LeftArm” bone can only appear in one of those slots.

To avoid this problem, make sure that each bone is mapped to only one slot in the Mapping List, then characterize your character model.

Body Part Definition error

This warning message appears if you have left empty slots between the objects mapped for any body part composed of a single continuous hierarchy, such as the fingers, toes, neck, or spine. As the dialog box explains, the objects defining these body parts must be mapped sequentially with no empty slots in between.



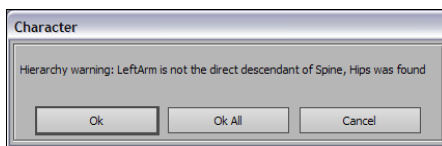
Body Part Definition error

For example, if a character's spine is made up of three objects, those objects must be mapped to the Spine1, Spine2, and Spine3 slots. If the objects are mapped to Spine1, Spine3, and Spine4, the empty slot at Spine2 causes the objects in Spine3 and Spine4 to be ignored.

Because these slots are optional, you do not have to correct the problem to characterize your character. However, the affected body part may not react as expected when manipulated. Click Continue if you want to characterize your character anyway, or click Cancel to stop the operation and change the mapping.

Hierarchy warning

The Hierarchy warning dialog box appears when MotionBuilder recognizes the naming conventions on your character's bone objects, but the bone objects are not in the expected hierarchical order. For example if a LeftArm bone is detected but it is not a child of the Spine object, not below the Spine... Click Ok to ignore the first warning message, or click Ok All to ignore all warning messages concerning the character hierarchy. Click Cancel to stop the characterization process and adjust the mapping or hierarchy.



Hierarchy warning dialog box

- [Characterizing a character model](#) on page 1086
- [Character mapping](#) on page 1082

Defining a spine

As part of the Character mapping process, you have the option of defining a spine with up to nine additional objects (besides the required Spine object mapped in the Base group). If you define additional spine objects, rotation data is accurately split between all of them.

For best results, when creating your model's skeleton, space the joint or bone of each vertebrae a similar distance apart.

To specify a spine:

- 1 Double-click a character in the Scene browser to open the Character Settings.
 - 2 Switch to the Character Definition pane, and expand the Auxiliary group of slots.
 - 3 Drop the first bone for the spine into the Spine cell (also displays in the Base group).
 - 4 Drop the second bone into the Spine1 cell.
 - 5 Continue dropping your model's spine bones into the Character map's Spine cells in sequential order. For example, the bone for Spine must parent Spine1. The bone of Spine1 must parent Spine2, and so on.
- [Character Definition pane](#) on page 1310
 - [About the Mapping List](#) on page 1083
 - [Resetting character properties](#) on page 1093
 - [Troubleshoot characterizing a character](#) on page 1090

Resetting character properties

To reset properties, click Reset All Properties and then select the appropriate option in the dialog box that appears.

Resetting properties does not affect your animated properties; only non-animated properties are restored to the default settings. All character properties remain unchanged.

To reset all solving and definition properties:

- 1 Click Reset All Properties, then click Reset All.

All Character solving and definition properties are set back to their default values.

To reset only character solving properties:

- 1 Click Reset All Properties, then click Reset Solving.

All solving properties, including Pull, Resist, Reach, and Stiffness are reset to the default.

To reset only character definition properties:

- 1 Click Reset All Properties, then click Reset Definition.

All character definition properties such as Hand Contact Positions and Feet Contact Positions are reset to the default. The Character Type is also reset to Biped.

- [Character settings](#) on page 1309
- [Character Definition pane](#) on page 1310

Character properties

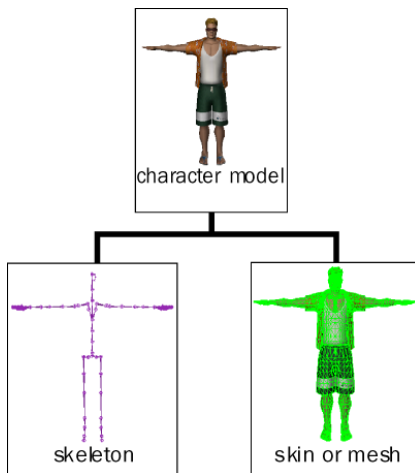
The Character properties display in the Properties window when a Character asset is selected in the Scene browser. These properties also displayed in the Character Settings. See [Character settings](#) on page 1309 for more information.

Character assets are composed of all of the data that defines a character model and links it to a motion source. These Character properties give you ways to adjust the solving, retargeting, floor contacts, pull, stiffness, and many other properties associated with that asset. When you modify a Character property in the Properties window, it is also updated in the Properties area of the Character Settings.

Models

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A 3D model can be any object in a scene, created using geometry to resemble an object we find in real life. Models can represent objects as simple as cubes, objects such as furniture, or they can be more complex objects such as characters .



Components of a character model

A character model is a 3D model that resembles biped, quadruped, or any other type of figure, and is composed of a skeleton covered by a geometric skin or mesh.

What a character looks like, its outer appearance and shape, is determined when the model is built. The geometric skin gives the model its outer appearance, and the underlying skeleton structure moves the geometric skin. The ways a character can move are not determined until you introduce it into MotionBuilder.

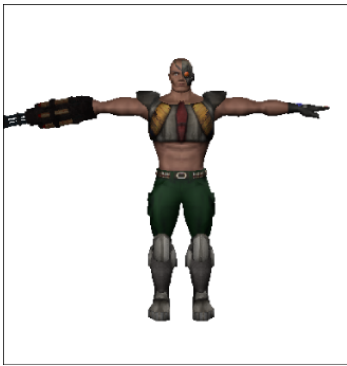
Before importing a character model into MotionBuilder, you should ensure that your model's skeleton follows certain naming conventions, that you have created the appropriate shapes or clusters, and that your model is created in a T-stance. See [Bone naming conventions](#) on page 1125 and [Skins window](#) on page 1109.

In MotionBuilder, a complete character model can be connected to motion data using the Character asset in order to create motion.

- [Bipeds and quadrupeds](#) on page 1096
- [Skin](#) on page 1101
- [Skins window](#) on page 1109
- [Bone naming conventions](#) on page 1125
- [Skins window](#) on page 1109

Bipeds and quadrupeds

Biped character models are humanoid models that walk on two legs and make contact with the floor using only their feet .



Biped character model

A stance pose for a biped model resembles a “T” pose in which the arms are parallel to the floor, the feet are flat on the floor, and the spine is straight. The model should face towards positive Z-axis. This is referred to as a T-stance. See [Stance pose](#) on page 1098 for more information.

If your biped model uses fingers and toes, make sure each hand is open and flat with the fingers and thumb straight. For feet, the ankle should be bent to ensure proper floor contact and the toes should be straight and pointed toward the positive Z-axis.

Quadruped character models are four-legged and make contact with the floor using all four limbs (both hands and both feet). When you create and characterize a four-legged character, select Quadruped if your model is a four-legged animal such as a dog, cat, horse, and so on.

A stance pose for a quadruped model has the front and back limbs and all fingers and toes fully-extended towards the floor. The model should face towards the positive Z-axis. See [Stance pose](#) on page 1098 for more information.

After you characterize your quadruped, you may need to rotate and adjust the hands and feet for proper floor contact.

Quadruped feet are not automatically adjusted like the feet on a biped (T-stance). This is to allow for all possible foot types, such as paws, feet, hooves, claws, and so on.

- [Models](#) on page 1095
- [Characterizing](#) on page 1085

Guidelines for creating a character model

Character models are 3D objects that can resemble bipeds, quadrupeds, or any other type of figure. They are composed of a skeleton covered by a geometric skin or mesh. The geometric skin is what gives a model its outer appearance.

In many production pipelines, characters are modeled in other software such as Maya. This means that the geometric skin that shapes the model, as well as the bones and joints of the model's skeleton are laid out, and the whole model is exported to MotionBuilder.

To take advantage of the character and facial animation features in MotionBuilder, keep the following guidelines in mind when creating character models:

- Name your skeleton using MotionBuilder recognized naming conventions. See [Bone naming conventions](#) on page 1125.
- Create your model in a T-stance to aid the characterization process. See [Stance pose](#) on page 1098.
- After creating your model's geometry, your character model should be properly skinned. See [Skin](#) on page 1101.
- If you intend to take advantage of MotionBuilder's facial animation and voice recognition capabilities, you should also create specific shapes or

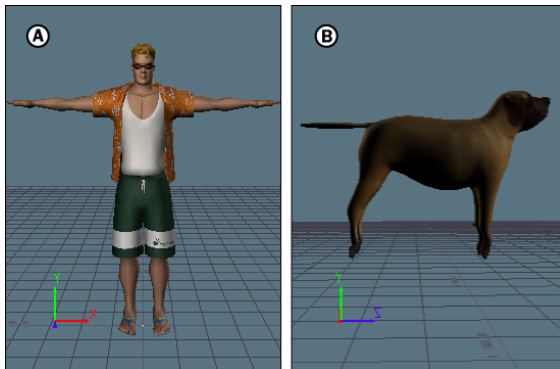
clusters for your model's head. For a complete list of recommended shapes and more information on facial animation, see [Animating Faces](#) on page 1393.

- [Models](#) on page 1095
- [Skeletons](#) on page 1117
- [Stance pose](#) on page 1098

Stance pose

Before you characterize a model, it must be in a T-stance pose or rest pose, and it must be facing the positive Z-axis.

For biped models, the rest pose is a T-stance with all fingers and thumbs out straight. For quadrupeds, it is a stance where the model's four limbs and all toes point towards the floor.



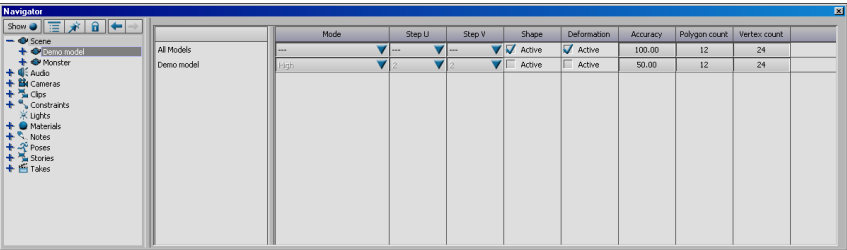
Stance poses A. Biped B. Quadruped

This stance is very important because when you characterize a model, MotionBuilder takes the model's current pose as the starting pose. All future movement is based on this starting pose.

- [Models](#) on page 1095
- [Characterizing](#) on page 1085

Models settings

The Models settings list all the models and model components in your current scene. They let you adjust the level of detail used by a model and activate its shapes or morph targets.



Models settings

The Models settings let you do the following:

- Change a model’s name (Models column)
- Adjust the level of detail (Mode column)
- Activate shape animation (Shape column)

Models are created in other 3D software packages, exported, and loaded into MotionBuilder. Some models, such as cubes and planes, are added from the Elements folder in the Asset browser and are referred to as *assets*.

All models appears in the Scene browser under the Scene heading. The Models settings display in the Navigator window when you select a model in your scene. The Models settings consist of the Models Chart.

Models Chart

The Models Chart lets you modify the properties and details of a model.

The first column in the Models settings lists all of the selected models. Double-click a model name in this column to rename it. Select the All Models entry to change all models.

Use the Mode, Step U, Step V, Shape, Deformation, Accuracy, Polygon Count, and Vertex Count columns to alter models in your scene.

| Column | Description |
|-------------------|--|
| Mode | Use the Mode column to set a model's level of detail using a pre-defined mode. You can choose from five different modes: Raw, Low, Low (no normals), High, and High (no normals). |
| Step U and Step V | Use the Step U and Step V columns to reduce the number of tessellation steps used by the selected model. These columns only work with NURBS and patch-based models and have no effect on polygon-based models. The Step U column affects horizontal NURBS patches. The Step V column affects the vertical NURBS and patches. Ultimately, the manner in which the Step U and Step V settings affect your NURBS and patches depends on how your model was created. |
| Shape | Deactivate the Shape option if your model contains shapes or morph targets and you want to use these different shapes within MotionBuilder. For example, if you are using the Voice device and you have created different shapes for each phoneme, activate Shape to use these shapes. |
| Deformation | Deactivate the Deformation option if your model uses deformations and you want these deformations within MotionBuilder. |
| Accuracy | Use the Accuracy option to set the accuracy of skin deformations. 100% is full accuracy and 1% is a rough estimation of the envelope deformation. Lower accuracy increases the deformation evaluation speed, |

| Column | Description |
|---------------|--|
| | which increases the speed of MotionBuilder. |
| Polygon Count | The Polygon Count column displays the number of polygons used to draw the model. You cannot change or reduce the number of polygons. You can, however, speed up the refresh rate by changing the level of detail used by the selected model. See Mode. |
| Vertex Count | The Vertex Count column displays the number of vertices used to draw the model. You cannot change the number of vertices. |

Model properties

When you select a character model in your scene, many common properties display. If you select a model that includes shapes, such as a face model, the Shapes properties are listed.

Negative Shape Values

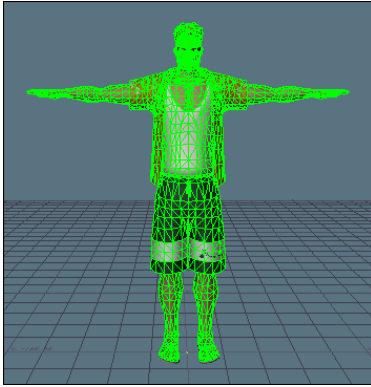
Activate Negative Shape Values if you want to allow a model's shapes to be scaled to negative values.

Shapes

See [Animating Faces](#) on page 1393.

Skin

For all character models, the skeleton provides their underlying structure. The outer appearance of each model is created by a geometric skin (or mesh) on which textures, colors, facial and body features are applied to form the character's body. It is the skin that gives a model its distinct appearance.



The geometric skin gives the model its outer appearance. Model is shown in a T-stance.

Your character model should be properly skinned before being used within MotionBuilder. A properly skinned model has its mesh reacting with its skeleton when the arms, legs, head, and other body parts move.

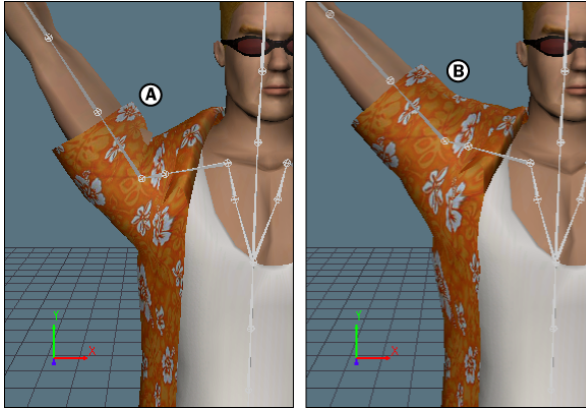
Some modeling software refers to this process as skinning while others refer to it as weighting.

Weighting

Weighting defines to what extent the skin or mesh that envelopes a character follows the movements of its limbs. The skin consists of vertices that control its shape.

The weight applied to vertices determines how the skin or mesh deforms from its original shape as the bones translate or rotate. The goal is to set the weight of each vertex so that the skin or mesh it controls adjusts realistically as the character moves.

For example, in , A, the mesh of the character's shoulder deforms unnaturally as the shoulder is rotated on the Z-axis. In , B, the same character is shown with improved weighting on the shoulder vertices. The shoulder assumes a much more natural position as the shoulder is rotated on the Z-axis.



Mesh deformation A. The shoulder mesh deforms at an unnatural angle. B. The shoulder mesh deforms naturally.

Weight values are measured using a percentage. The higher the percentage, the closer the vertices follow the movements of the bone. For example, with a value set at 100%, the vertex follows the bone exactly. With a value set at 50%, the vertex moves only half as much as the bone.

For deformations to be realistic, you have to associate some vertices with more than one bone. In such a case, any change in the weight percentage relative to one bone adjusts the weighting of the other bones. For example, vertices along the shoulder of a character are influenced by movements of the arms, chest, or spine. To obtain realistic deformations, some shoulder vertices are weighted using arm bones and chest bones, while other vertices are weighted using only arm bones.

The weighting process takes a lot of practice before you can achieve the best balance between vertices. To make it easier to distinguish the influence of different bones on vertices, MotionBuilder indicates weight values using spectral color-coding. Different hues and color blends indicate which bones have the most and least influence.

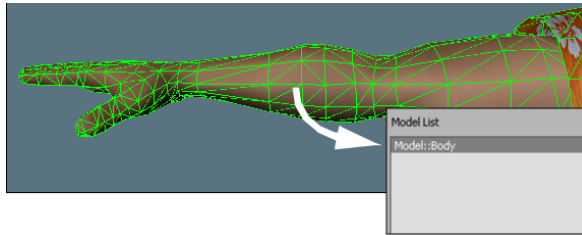
TIP You can minor weighting problems using the Skinning window, but this window is not meant as a full skinning tool. See [Skins window](#) on page 1109.

- [Selecting vertices for immediate weighting](#) on page 1107
- [Preselecting vertices for future weighting](#) on page 1108
- [Skins window](#) on page 1109

Adjusting the weighting of vertices

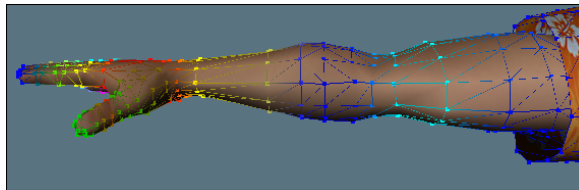
To adjust the weighting of vertices:

- 1 In the Skins window, select Smooth Colors in the Weighting Options pane.
- 2 Add the model you want to adjust to the Skins window by selecting and Alt-dragging it from the Viewer window into the Model List .



Alt-drag the model into the Model List.

The name of the model is added to the Model List, and all the bones associated with the model are listed in the Bones list. In the Viewer window, the vertices of the model display in different colors .



Colored vertices indicate the amount of weighting applied to specific bones.

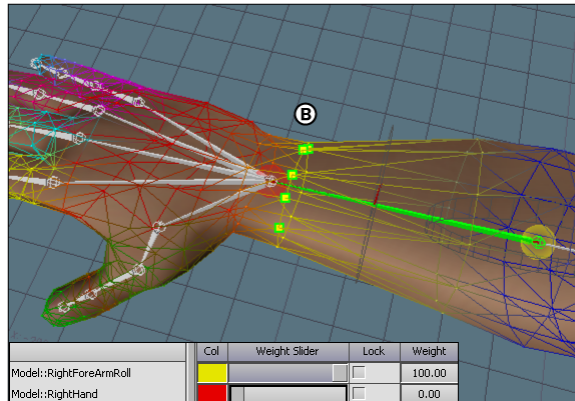
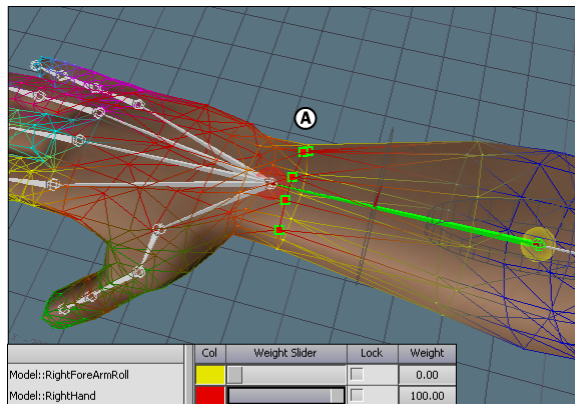
TIP You can also Alt-drag models out of the Skins window to remove them from the list.

- 3 Select the bones in the Bones list, select the vertices on which you want to adjust the weight, then use the weight sliders or fields to change the vertices' weight .

| Weights | | | | |
|-------------------------|--------|---------------|-------------------------------------|----------------|
| | Col | Weight Slider | Lock | Weight |
| Model::RightShoulder | Green | | <input type="checkbox"/> | 0.00 |
| Model::RightArm | Blue | | <input checked="" type="checkbox"/> | 0.00 |
| Model::RightForeArmRoll | Yellow | | <input type="checkbox"/> | 48.08 B |
| Model::RightHand | Red | | <input type="checkbox"/> | 0.00 |

A. Weight slider B. Weight field

For example, A and B show how weighted vertices are modified relative to the right elbow roll, to be weighted relative to the right wrist. The color of the vertices changes from pink to blue to reflect that the vertices are weighted with respect to the right wrist, which displays in blue.



A. Before adjustment B. After adjustment

■ [Skin](#) on page 1101

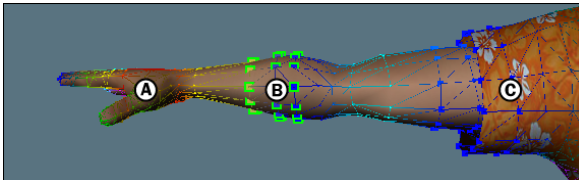
Selecting and preselecting vertices

You can use the following two methods to select vertices:

- [Selecting vertices for immediate weighting](#) on page 1107
- [Preselecting vertices for future weighting](#) on page 1108

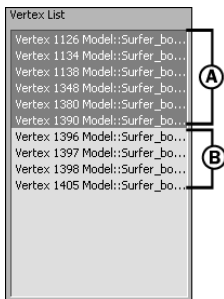
You can also select or deselect vertices directly in the Vertex list of the Skins window.

How vertices display in the Viewer window indicates their status . Vertices selected for weighting display with a green outline. Preselected vertices are bigger than deselected vertices.



A. Deselected vertices B. Selected vertices C. Preselected vertices

In the Vertex list, vertices available for immediate weighting are highlighted in gray, while preselected vertices display with no highlighting. Deselected vertices do not display .



A. Selected vertices B. Preselected vertices

- [Skin](#) on page 1101
- [Skins window](#) on page 1109

Selecting vertices for immediate weighting

Immediate selection is a method of selecting vertices to make them available for weighting in one operation.

To select a vertex:

- 1 Click the vertex.

To select a group of vertices:

- 1 Click-drag across a group of vertices in the Viewer window.

To deselect a vertex:

- 1 Middle-click the vertex.

To deselect a group of vertices:

- 1 Middle-click and drag to create a deselection area.

To deselect all vertices:

- 1 Double-click an empty location in the Viewer window.

To reverse the selection of a vertex:

- 1 Right-click the vertex.

To reverse the selection of a group of vertices:

- 1 Right-click and drag over a group of vertices to create a selected area.

- [Skin](#) on page 1101
- [Adjusting the weighting of vertices](#) on page 1104
- [Selecting and preselecting vertices](#) on page 1106

Preselecting vertices for future weighting

Preselection adds the names of vertices to the Vertex list in the Skins window, without making them available for weighting. You may select the vertices for weighting later. This is useful when you want to select the vertices to be weighted directly from the Vertex list.

To preselect a vertex:

- 1 X-click the vertex.

To preselect a group of vertices:

- 1 X-click and drag in the Viewer window.

To deselect a preselected vertex:

- 1 X-middle-click the vertex.

To deselect a group of preselected vertices:

- 1 X-middle-click and drag to create a deselection area.

To deselect all preselected vertices:

- 1 X-double-click an empty location in the Viewer window.

To reverse the preselection of a vertex:

- 1 X-right-click the vertex.

To reverse the preselection of a group of vertices:

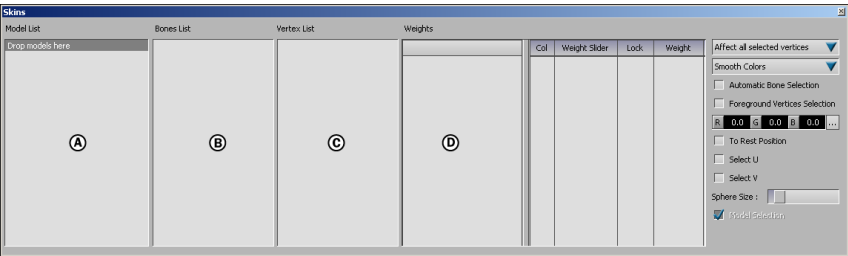
- 1 X-right-click and drag to create an area.

■ [Selecting and preselecting vertices](#) on page 1106

■ [Skins window](#) on page 1109

Skins window

The Skins window lets you adjust the weight of vertices relative to one or several bones of a character. This means you can use the Skins window to modify or correct poor weighting of a character.



Skins window A. Model List B. Bones list C. Vertex list D. Weights list E. Weighting Options pane

While you can set all weighting for a character within MotionBuilder, to obtain the best results, use a character that has weighting already applied by MotionBuilder-compatible 3D software.

To open the Skins window, select Window > Skins in the menu bar.

The Skins window consists of the following main areas:

- [Model List](#) on page 1109
- [Bones List](#) on page 1110
- [Vertex List](#) on page 1110
- [Weights List](#) on page 1110
- [Weighting Options Pane](#) on page 1111

Model List

The Model List contains the names of selected models in the Viewer window. You can select the models in this list for weighting.

Add and remove models in the Model List by Alt-dragging them to and from the Viewer window.

TIP It is easiest to select a model’s skin when in Models Only mode in the Viewer window.

Bones List

The Bones list contains the name of the selected model’s bones.

The bones are automatically included in the Bones list when you select a model name in the Model List. If you select several names, the Bones list displays the name of the bones of all the selected models.

Only the bones that influence the models in the Model List display in the Bones list.

Vertex List

The Vertex list contains the names the vertices for a selected bone. You can choose these vertices for weighting.

Weights List

The Weights list lets you adjust the percentage of weight to apply to each selected vertex, with respect to its associated bone or bones.

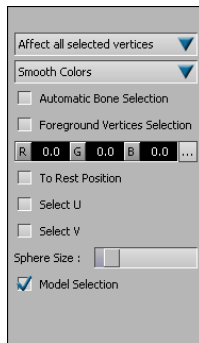
You can use the following options in the Weights list:

| Option | Description |
|---------------|---|
| Col (Color) | Defines the color of the vertices associated with the bone. MotionBuilder uses various colors to identify each set of vertices. See Changing Bone Colors on page 1113. |
| Weight Slider | Determines the weight value of the selected vertex with respect to the associated bone. The weight value automatically updates in the corresponding Weight field. Sliders are only operational when at least one vertex is selected in the Vertex list. |
| Lock | Locks the weight value of the corresponding bone. Consequently, the weights of other selected bones adjust using the remaining percentage of unlocked weight values. For example, if a weight is locked at 20%, the other weights can only be ed- |

| Option | Description |
|--------|--|
| | ited for 80% of the total weight of the selected bones. |
| Weight | <p>Determines the weight value of the selected vertex with respect to the associated bone. The weight value automatically updates in the corresponding weight slider.</p> <p>This field is operational only when one or more vertices are selected in the Vertex list.</p> |

Weighting Options Pane

The Weighting Options pane lets you change the colors for displaying the weight of vertices, change the appearance of the model, select bones automatically, and so on.



**Weighting Options
pane**

Affect Field

The following options in the Affect field let you determine which vertices are affected by the modification of weight values:

| Option | Description |
|------------------------------|---|
| Affect all selected vertices | Applies weighting changes to all the vertices selected in the Vertex list. |
| Affect first selected vertex | Applies weighting changes only to the first vertex selected in the Vertex list. |

Color Options Field

The following options in the Color Options field let you determine the color of selected bones and vertices:

| Option | Description |
|------------------------|---|
| Smooth Colors | Displays vertices with a blend of color from all the bones that influence them. The stronger the color of the bone in the blend, the greater the weight applied on the vertex for that bone. For example, if a red bone and a yellow bone influence a group's vertices, these vertices display in orange. If the orange vertices color shifts closer to red, this indicates that the red bone is applying the greater weight to the vertices. |
| Most Influential Bone | Draws vertices using the color of the bone for which they are most weighted. |
| Least Influential Bone | Draws vertices using the color of the bone for which they are least weighted. This option detects and corrects useless weights, thus optimizing the character's performance. |

Automatic Bone Selection

When activated, Automatic Bone Selection chooses the bones that influence selected non-zero weight vertices. This is an easy method of finding influential bones. When you select vertices with Automatic Bone Selection disabled, the selected bones do not show. NOTE: To use Automatic Bone Selection, at least one selected vertex must have a non-zero weight.

Foreground Vertices Selection

When active, Foreground Vertices Selection lets you choose only the vertices located in the foreground of a scene. When disabled, Foreground Vertices Selection lets you choose both foreground and background vertices.

Color Values

Changes the color of bones using RGB values. These color values determine the color that displays in the Color column of the Weights list.

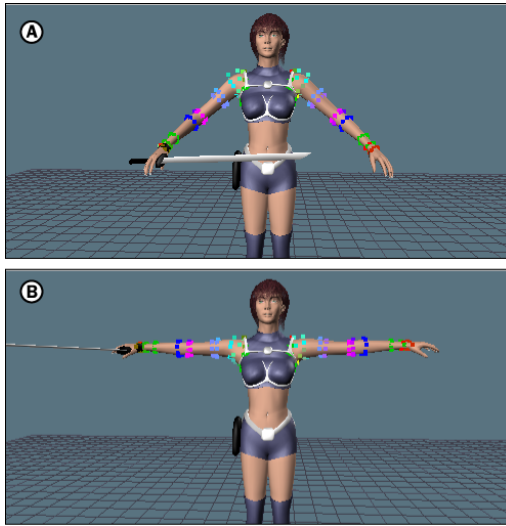
Changing Bone Colors

While adjusting weights, many bones that are close to each other may use the same or similar colors. To clearly distinguish a bone, you may want to change its color. The colors assigned to bones are random, but you can change their color. To change the color of a bone, click the color box in the Weights list corresponding to the bone you want to change. Use the color fields to select a new color for the bone. As you change the color, the color and gradients of its weighted vertices update. This makes it easier to choose the best color for the selected bone.

To Rest Position

When active, To Rest Position displays the selected models in the Model List using the position they were originally created in. This position is referred to as the rest position. Before adding bones to your model's rest position, you must activate To Rest Position.

For example, in the following image, A and B show the position of a character's arms when To Rest Position is active and disabled. If you activate the rest positions of models that do not depend on each other, or if you use the same bone in several different models because they use different resting positions, your results may be unpredictable. This option uses the same name order as names in the Model List.



Rest Position A. To Rest Position disabled B. To Rest Position activated

Select U

When active, Select U selects all the vertices in the Vertex list that belong to the same U coordinate for a given series of control points of a NURBS surface.

Select V

When active, Select V selects all the vertices of the Vertex list that belong to the same V coordinate for a given series of control points of a NURBS surface.

Sphere Size

Adjusting the Sphere Size slider changes the size of joints. This is useful if you are using a model that uses nodes or joints to represent a skeleton instead of bones. Sphere Size only changes the visual representation of your skeleton.

Model Selection

When active, Model Selection lets you choose the surrounding models when selecting a bone. When disabled, Model Selection lets you choose bones without selecting their surrounding models.

For additional information on weighting vertices, see [Skin](#) on page 1101.

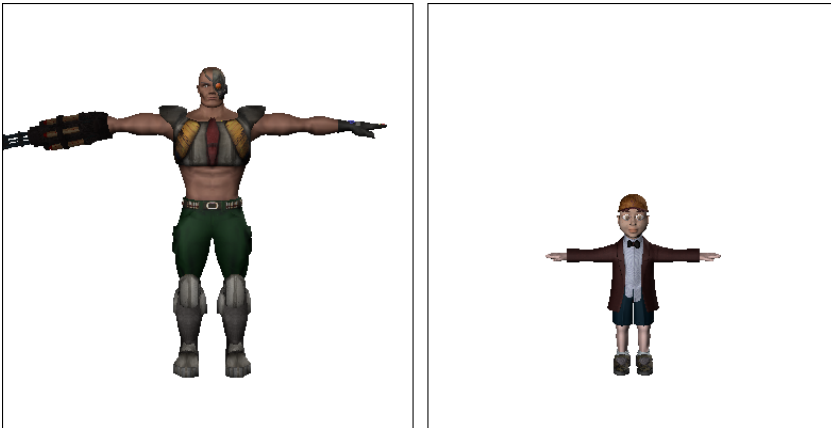
- [Skin](#) on page 1101
- [Adjusting the weighting of vertices](#) on page 1104
- [Preselecting vertices for future weighting](#) on page 1108
- [Selecting vertices for immediate weighting](#) on page 1107

Skeletons

72

All 3D character models have one thing in common: a rigid skeleton as their underlying structure. The skeleton is covered by a skin (or mesh) on which textures, colors, facial, and body features are applied to distinguish the model's appearance.

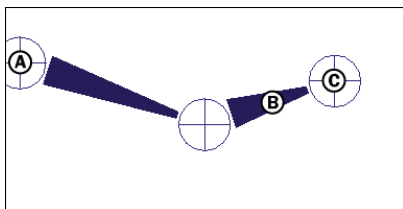
Although the characters in may look quite different, their underlying skeletons are similar.



Two models that look different can have very similar skeletons.

Just like real skeletons, 3D skeletons contain a hierarchy of bones. In a real skeleton, these bones are connected by joints. Skeletal hierarchies allow the figure to rotate around each individual joint.

A skeletal hierarchy chain starts with top-level joints, and finishes with end effectors. For example, shows a common hierarchy for an arm in MotionBuilder.



Arm hierarchy A. Joint B. Bone C. End effector

When you animate a character in 3D software you are always animating the skeleton, regardless of the character's outer appearance.

Animation data for a character is always stored on the model's skeleton. When you import an animated model into MotionBuilder and you want to edit the animation, you must first plot the animation to a Control rig. To export animation, you plot the animation back to the skeleton.

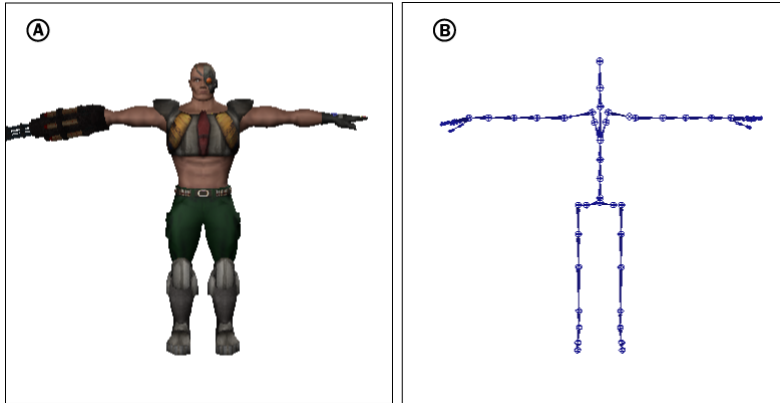
The main topics in this section include:

- [Skeleton types](#) on page 1118
- [Creating a skeleton](#) on page 1120
- [Changing the size of a skeleton](#) on page 1123
- [Adding bones to a skeleton](#) on page 1121
- [Skeleton node and Skeleton root assets](#) on page 1120
- [Plotting character animation](#) on page 1660
- [Bone naming conventions](#) on page 1125
- [Character setup](#) on page 1079

Skeleton types

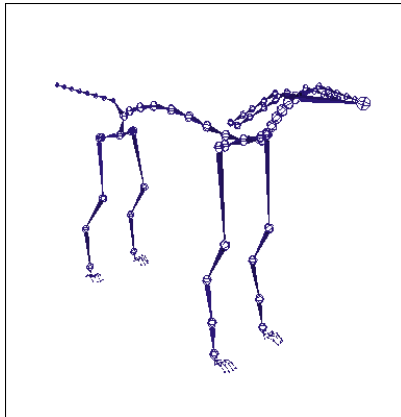
In MotionBuilder you can use two types of skeletons: bipeds or quadrupeds.

A bided skeleton has two limbs that touch the ground. For example, a human biped model displays in the following figure, A. In B, the skeleton of the same model displays with its mesh hidden.



A. Biped model B. Skeleton only

A quadruped skeleton has four limbs that touch the ground.



Quadruped skeleton

- [Skeletons](#) on page 1117
- [Creating a skeleton](#) on page 1120

Skeleton node and Skeleton root assets

Found in the Elements folder of the Asset browser, the Skeleton node and Skeleton root assets let you build skeletons that can be exported and used in other 3D software.

Skeleton node assets represent the bones of a skeleton, and must be joined to a Skeleton root to create a skeleton hierarchy. The Skeleton root must be joined to at least one Skeleton node.

When creating a chain of bones, MotionBuilder automatically finds a vector at the middle joint and sets its rotational limits. For best results, always build your skeleton with bent joints.

MotionBuilder can give more precise limits for bent joints than for straight joints. After creating your skeleton, you can view and adjust its limits (see [Degrees of Freedom \(DOF\)](#) on page 555).

- [Skeletons](#) on page 1117
- [Creating a skeleton](#) on page 1120
- [Adding bones to a skeleton](#) on page 1121
- [Skeleton Node Settings](#) on page 1129

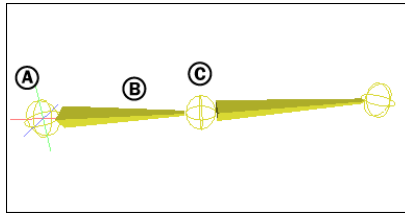
Creating a skeleton

The following steps show how you can create a skeleton.

To create a skeleton:

- 1 From the Elements folder in the Asset browser, drag a Skeleton root into the Viewer window. The root is automatically selected, and a marker resembling a null indicates where your skeleton begins.
- 2 Double-click the Skeleton node asset in the Asset browser.
The cursor changes into a small cross-hair, indicating that wherever you click in the Viewer window, you create a Skeleton node.
- 3 Click in the Viewer window to place the first node, then click to place another node that joins to the preceding one.

Each time you click, another node (or bone) is added to the skeleton in a chain to create a limb. Each successive bone is parented to the preceding bone.



A. Skeleton root B. Skeleton limb C. Skeleton node

- 4 When you are finished inserting Skeleton nodes, press Enter or right-click in the Viewer window. This returns the cursor to normal.

As you create your skeleton, you may want to add more than one limb to the same joint (for example, when creating a hand with fingers). For more information, see [Attaching more than one bone to the same joint on a skeleton](#) on page 1122.

- [Skeletons](#) on page 1117
- [Skeleton node and Skeleton root assets](#) on page 1120
- [Adding bones to a skeleton](#) on page 1121

Adding bones to a skeleton

After creating your skeleton, you may notice one or two missing joints. For example, after creating the upper body of a human skeleton, you might want to add collar bones between the skeleton root and shoulder.

To add bones to a skeleton:

- 1 From the Asset browser, drag a Skeleton node into the Scene.
- 2 Switch to Schematic view in the Viewer window (Ctrl-W) and press F to frame the skeleton hierarchy and the Skeleton node.

- 3 Press P to activate Parenting mode, then drag from the new Skeleton node to an existing node. The existing node you drag to becomes the parent of the new Skeleton node.
For example, if you are adding a collar bone between the skeleton root and the shoulder bone, you would drag the new Skeleton node to the skeleton root, making the root the parent of the new node.
- 4 Drag any child bones of the original node to re-parent them as children of the added node.
For example, you would drag the Shoulder bone (including its children) to be a child of the new collar bone in the above example.

- [Skeletons](#) on page 1117
- [Skeleton node and Skeleton root assets](#) on page 1120

Attaching more than one bone to the same joint on a skeleton

Sometimes you might want to attach more than one bone to a joints on your skeleton.

To attach more than one bone to the same joint:

- 1 Select the joint to which you want to add another bone.
- 2 In the Elements folder of the Asset browser, double-click the Skeleton node asset.
The cursor changes to a small cross-hair, indicating that wherever you click in the Viewer window, you create a Skeleton node.
- 3 Click in the Viewer window where you want to add the bone to the selected joint.
The bone is attached to the selected joint.
- 4 Hit Enter when you are finished adding joints.

- [Skeletons](#) on page 1117
- [Skeleton node and Skeleton root assets](#) on page 1120

Inserting a limb between two joints

You can insert a limb between two existing bones, which can be useful, for example when you need to add another bone in a skeleton's spine for added flexibility.

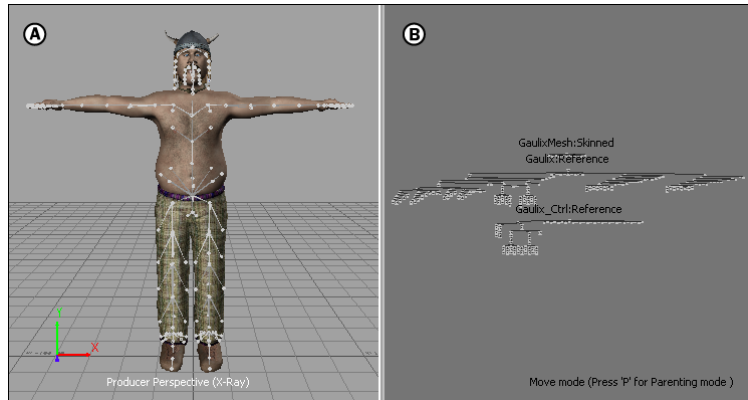
- 1 Switch to Parenting mode in the Schematic view.
- 2 Select the joint where you want to attach a new limb, then drag from the selected joint to the new one.

As you create your skeleton, a parent-child hierarchy develops based on the last selected element.

Changing the size of a skeleton

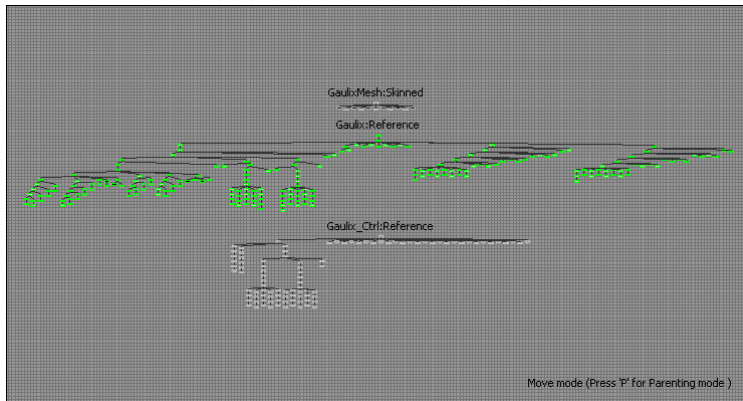
To change the size of a skeleton

- 1 Choose a display mode so that you can see your skeleton clearly, such as the X-Ray display mode.



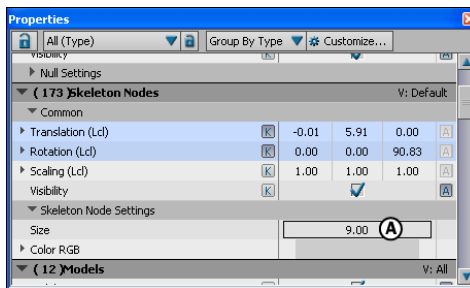
Viewer window A. The camera view in one pane. B. The Schematic view in the other pane.

- 2 Switch to the Schematic view and select all of the nodes representing your character's bones.



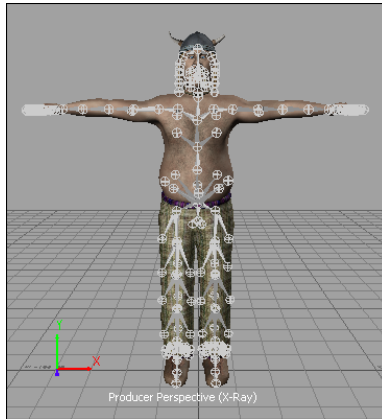
The character's bones are selected in the Schematic view.

- 3 In the Properties window, expand the Skeleton Node Settings and adjust the Size property.



Properties window A. Skeleton Node Settings, Size property

Switch back to the camera view and observe the change in size on your character's bones.



The character's bones appear larger in the Viewer window.

- [Skeletons](#) on page 1117
- [Creating a skeleton](#) on page 1120
- [Adding bones to a skeleton](#) on page 1121
- [Attaching more than one bone to the same joint on a skeleton](#) on page 1122

Bone naming conventions

To better integrate your models with MotionBuilder, create skeletons with bones that follow MotionBuilder's recognized naming conventions. These bone naming conventions can be found in the Mapping List.

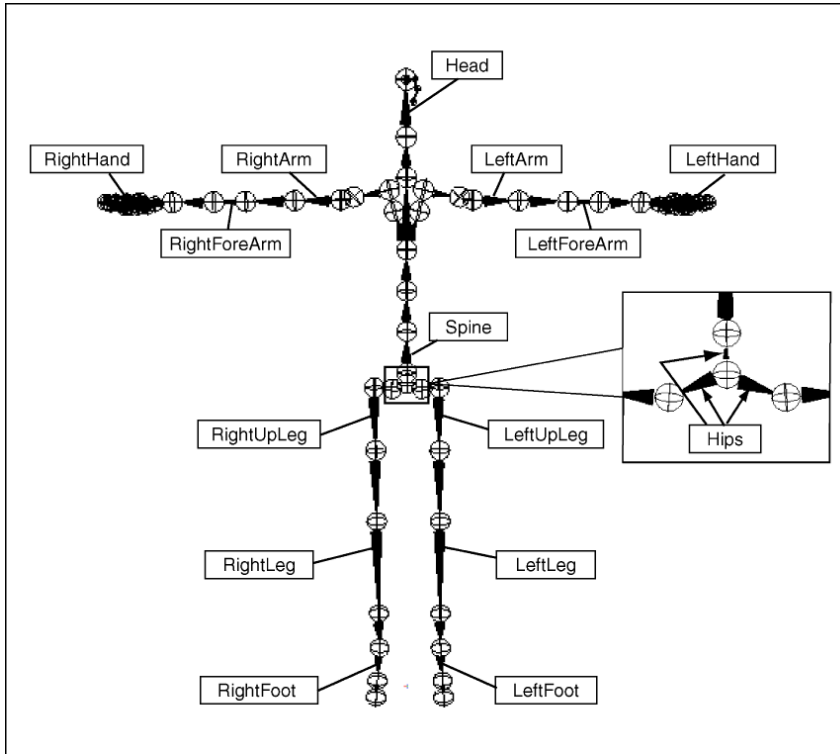
If you follow the MotionBuilder naming conventions when you create a skeleton, even if you create the model using different software, you can automatically map out and characterize your character models.

If you use other bone naming conventions, MotionBuilder cannot automatically recognize your model's structure, and you must manually map out and characterize your character models.

For example, if you have a model with an upper left leg bone named "LeftUpLeg", that bone can be automatically mapped in the Mapping List, because MotionBuilder recognizes the name.

On the other hand, if you have a model with the upper left leg bone named “LeftThigh”, you need to manually map the LeftThigh bone to the LeftUpLeg slot in the Mapping List.

The Mapping List requires that you indicate a minimum of fifteen required bones, as illustrated in the following diagram.



Basic skeleton with Base bones labelled

NOTE You do not have to rename the bone objects on your existing skeletons. Instead, you can create a template of your own naming conventions to use for all of your characters. However when creating new skeletons, you may find it is easier to follow MotionBuilder naming conventions so that the mapping process can be done automatically.

- [Characterizing a character model](#) on page 1086
- [Defining a spine](#) on page 1093
- [Automatically mapping and characterizing a character](#) on page 1086

Creating a bone-naming template

If you have your own bone-naming conventions that you use when creating character models, you can create a template of those naming conventions for MotionBuilder. This template lets you automatically map out other characters for MotionBuilder.

Naming templates are saved as *.fbx* files containing the naming conventions used on a skeleton.

To create a bone-naming template:

- 1 Load a character that uses your naming conventions, and manually map out its bones for MotionBuilder. See [Manually mapping and characterizing a character](#) on page 1087.
 - 2 In the Character Definition pane of the Character Settings, notice that the words <Not Set> display in the Template Name column.
This indicates that there is no template of the naming conventions for the current character's skeleton.
 - 3 Click Extract Naming Template.
 - 4 Click Ok in the dialog box that appears asking if you want to update the naming template using this model's naming conventions.
The names from the set of bones you Alt-dragged into the Mapping List when you manually characterized your character are automatically entered in the Template Name column.
 - 5 Select the character in the Scene browser and select File > Save Selection from the menu bar to save this template.
 - 6 In the Save File dialog box that appears, navigate to the directory of your choice, type a name for this *.fbx* file, and click Save.
The Save Selection Options dialog box opens.
 - 7 Disable the Take 001 check box and click Save.
The template of the naming conventions on this character's skeleton is now saved.
- [Character mapping](#) on page 1082
 - [Applying a bone naming template](#) on page 1128
 - [Bone naming conventions](#) on page 1125

- [Characterizing a character model](#) on page 1086

Applying a bone naming template

After you have created a template of the bone-naming conventions you use on your character models, you can apply that template to other models with the same naming to automatically map them out for MotionBuilder.

To apply a bone-naming template:

- 1 Load a new character model whose skeleton uses the same bone-naming conventions as your template.
- 2 Drag the *.fbx* file containing your naming template into the scene, and select **FBX Merge > Options** from the contextual menu.
- 3 Click **Merge** in the Merge Options dialog box that appears to add the template to the scene.

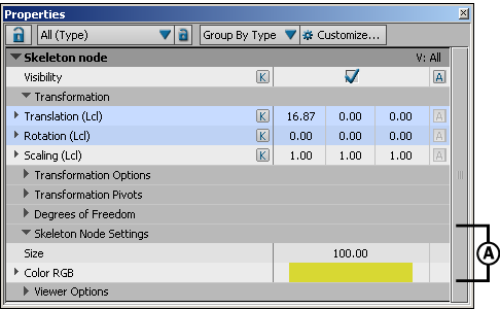
By default, the naming template is listed in the Characters folder named for the character you used to create it. If you find it confusing to work with the template named after the character, rename it.

- 4 Double-click the template in the Scene browser and view the Character Definition pane. The template names you created are listed in the Template Name column. Lock the Navigator window to keep the Character Settings open.
- 5 In the Viewer window, switch to the Schematic view (Ctrl-W) and Ctrl-click to select all of the nodes that you want to automatically map. At a minimum, you must select the fifteen required nodes in the character's skeleton.
- 6 Alt-drag the selected nodes into the Mapping List of the Mapping List. All of the slots are automatically filled based on the naming conventions in your naming template, and the character is ready to be characterized.

- [Creating a bone-naming template](#) on page 1127
- [Characterizing a character model](#) on page 1086
- [Character mapping](#) on page 1082
- [Character settings](#) on page 1309

Skeleton Node Settings

When a Skeleton node is selected in the Viewer window, the Skeleton Node Settings are listed in the Properties window.



All Skeleton node properties A. Skeleton Node Settings

The Skeleton Node settings contain the Size and Color RGB properties, which let you adjust the size and color of the nodes that make up the skeleton.

If you adjust the color of skeleton nodes in the camera view, the changes also appear on the node in the Schematic view. Changing the color of nodes on the skeleton can make it easier to locate them while using the Schematic view.

- [Skeletons](#) on page 1117
- [Creating a skeleton](#) on page 1120

There are two components involved in creating a character that respects the boundaries of a defined floor. First, there are floor contact markers and finger and toe tips that define what parts of a character's hands, feet, fingers, and toes interact with a floor. Second, there is an object assigned to the character that represents the level and orientation of the floor.

Once you have activated and defined the floor contact for the character's hands and feet, you can customize the actual floor those markers come in contact with. If you do not define a floor, the character's hands and feet treat the plane at 0 on the Y-axis as the floor.

- [Defining the floor for characters](#) on page 1131
- [Defining foot floor contact for a character](#) on page 1135
- [Defining hand floor contact for a character](#) on page 1140
- [Defining toe floor contact for a character](#) on page 1145
- [Defining finger floor contact for a character](#) on page 1148

Defining the floor for characters

To define the floor for characters:

- 1 Double-click an uncharacterized character in the Scene browser to open the Character Settings, then activate the Lock option to keep the settings open throughout this procedure.
Your character must be uncharacterized so that you can edit the Mapping List.

2 Do one of the following:

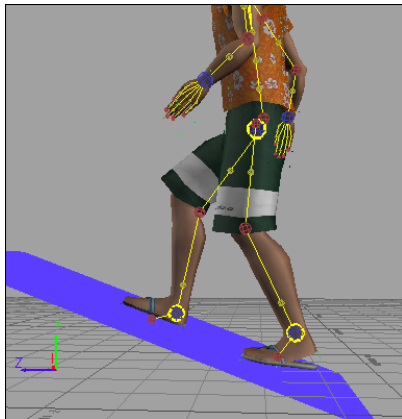
- If you want each hand and foot that contacts the floor to have its own floor defined, drag an object (such as a marker) into the scene for each hand and foot.
- If you want to define only one floor surface for all hands and feet, drag only one object into the scene.

NOTE The type of object that you choose is not important. You can use a plane, marker, null, or another object.

3 Assign the object(s) to represent the floor for the feet and hands by Alt-dragging them into the Left Foot Floor, Right Foot Floor, Left Hand Floor, or Right Hand Floor nodes of the Mapping List.

4 Translate and rotate the floor object(s) to represent the type of terrain you want to your character's feet and hands to respect.

For example, if you want the character to walk on a sloped floor, rotate the floor object to represent the angle you want the character to walk on.



A plane object is defined as the floor and oriented at an angle to create a slope.

5 Characterize the character.

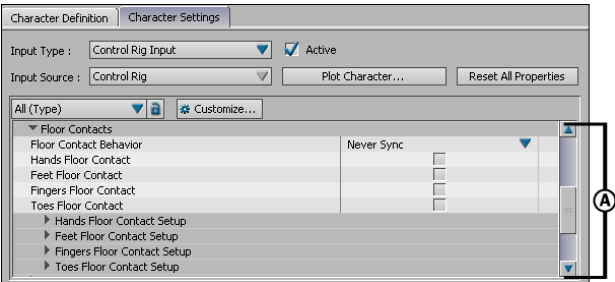
6 Define and activate the floor contact markers for the character's feet and hands in the Character Settings, if you have not already done so.

As you move and animate your character, the feet and hands now respect the level and orientation of the object you defined as the floor.

- [Floor contact](#) on page 1131
- [Defining foot floor contact for a character](#) on page 1135
- [Defining hand floor contact for a character](#) on page 1140
- [Character settings](#) on page 1309
- [Characterizing a character model](#) on page 1086

Floor Contact properties

The settings in the Floor Contacts group let you define how you want a character’s feet, hands, fingers, and toes to react when they come in contact with the floor of your scene.



Character Settings pane A. Floor Contacts group of properties

Floor Contact Behavior

Lets you select which method of solving the Control rig uses when a character’s feet or hands come in contact with the floor.

Floor Contact Behavior lets you choose when the IK and FK Control rigs are synchronized, which affects how hands and feet react to manipulation after floor contact. Floor Contact Behavior includes the following three options:

| Option | Function |
|------------|--|
| Never Sync | Similar to the Automatic toe and finger base features, but lets you manipulate a |

| Option | Function |
|-------------|---|
| | character's fingers and toes as they are lifted after floor contact. The FK and IK Control rigs are not synchronized. |
| Always Sync | Always synchronizes the FK and IK Control rigs and retains the foot or hand position after floor contact, not allowing toe or finger manipulation. |
| Sync on Key | Similar to the Never Sync option, Sync on Key makes the foot or hand retain its position after floor contact if you set a keyframe while it is on the floor. The FK and IK control rigs are synchronized only when a keyframe is set. |

Hands Floor Contact

Activate Hands Floor Contact to prevent your model's hands from going through the floor. The options within the Hands Floor Contact Setup folder let you adjust how hands make contact with the floor. See [Feet Floor Contact Setup properties](#) on page 1136.

Feet Floor Contact

Activate Feet Floor Contact to prevent your model's feet from going through the floor. The options within the Feet Floor Contact Setup folder let you adjust how feet make contact with the floor. See [Toes Floor Contact Setup properties](#) on page 1146.

Fingers Floor Contact

Activate Fingers Floor Contact to prevent your model's fingers from going through the floor. The settings within the Fingers Floor Contact Setup folder let you adjust every aspect of how fingers make contact with the floor. See [Fingers Floor Contact Setup properties](#) on page 1148.

Toes Floor Contact

Activate Toes Floor Contact to prevent your model's toes from going through the floor. The options within the Toes Floor Contact Setup folder let you adjust every aspect of how toes make contact with the floor. See [Toes Floor Contact Setup properties](#) on page 1146.

Defining foot floor contact for a character

To define foot floor contact for a character:

- 1 Select a character in the Scene browser.
- 2 In the Character Controls, activate the Floor Contact option in the Show menu to make the foot floor contact markers on your character visible.

NOTE You must be in X-Ray display mode in the Viewer window to see the floor contact markers.

Green and blue floor contact markers display around your character's hands and feet.

- 3 Expand the Floor Contacts heading in the properties area of the Character settings pane and activate the Feet Floor Contact option.
- 4 Expand the Feet Floor Contacts Setup heading and select the Feet Contact Type that you want to use.
- 5 Use the other Feet Floor Contact Setup properties to make any adjustments to the floor contact that you need.
- 6 In the Viewer window, translate the floor contact markers to position them around your character's feet.

If you are working with a humanoid model, the foot markers should display just under the toe, the ball of the foot, and the heel.

Moving one foot marker adjusts the other markers accordingly. For example, when you adjust the green markers on the character's left foot, the blue markers on the right foot are adjusted as well.

The character's feet are now ready to interact naturally with the defined floor. If you have not defined a floor for the feet, the plane at 0 on the Y-axis is used as the floor.

- [Defining the floor for characters](#) on page 1131

- [Show menu](#) on page 1370
- [Feet Floor Contact Setup properties](#) on page 1136

Resetting Floor Contacts

You can reset or retain any changes made to the Floor Contacts settings during re-characterization.

To reset a characterized character's Floor Contacts:

- 1 In the Character Definition pane, disable the Characterize option. The Reset Floor Contacts window appears.



The Reset Floor Contacts window.

NOTE The Reset Floor Contacts window does not appear when you characterize a new character.

- 2 Select Yes to restore the character's floor contact settings.
- 3 Activate the "Do not ask me again" function, if you never want floor contacts to be reset when you re-characterize.

Feet Floor Contact Setup properties

In the Floor Contact group of character properties, the Feet Floor Contact Setup properties let you adjust how feet make contact with the floor.

The Feet Floor Contact options are similar to the options in the Hands Floor Contact group.

Automatic Toe Base

Corrects the feet but does not let you manipulate each toe base. This option is disabled by default when you create a character so that you can manually manipulate and animate each toe base.

When Automatic Toe Base is active, you cannot animate each toe base, but you can still keyframe the result positions provided by the floor contact.

To take full advantage of the solving from each foot's toe base, it is recommended that when you create your model's skeleton that the toe base should be the parent of each toe. For the big toe, you should use the extra toe.

Feet Floor Pivot menu

Use the Feet Floor Pivot to select the pivot of the foot when it makes contact with the floor. The following table describes the three Feet Floor Pivot options.

| Option | Behavior |
|--------|--|
| Auto | The default option that averages the priority between the ankle and toes. When the foot makes contact with the floor, the ankle is translated backwards and the toes are pushed forwards. |
| Ankle | Gives the ankle priority and uses it as the pivot point. When the toes make contact with the floor, they are translated forward to keep the ankle's trajectory towards the floor constant. |
| Toes | Gives the toes priority and uses them as the pivot point. When the toes make contact with the floor, the ankle is translated backwards to keep the toes firmly planted on the floor. |

Feet Contact Type

The Feet Contact type lets you define the number and orientation of markers used to define the floor contact for your character's feet. The four types of feet contact are described in the following table.

| Option | Behavior |
|---------|---|
| Normal | Six markers define each foot's floor contact. The middle markers should define the ball of the foot, or where the toes begin. |
| Ankle | Four points define each foot's floor contact. The foot markers display around each foot. |
| ToeBase | Four points define each foot's floor contact. The foot floor contact markers display around each foot's toes. |
| Hoof | Four points define each foot's floor contact, but the points are oriented at a 90 degree angle, letting you define the floor contact for animal types with hooves, such as horses. These contact markers allow for 180 degrees of movement. |

Feet Contact Stiffness

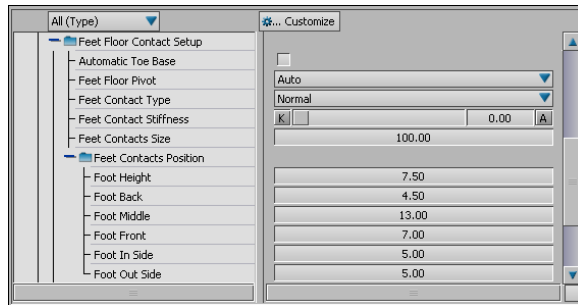
Use the Feet Contact Stiffness setting to define how stiff the foot becomes as soon as any part of the foot contacts the floor.

Feet Contacts Size

Lets you change the size of the contact markers that outline each foot. The center of the contact markers is the point used for floor contact. Increasing the Feet Contacts Size only makes the floor contact markers more visible, it does not affect the way the feet contact the floor. To view the contact markers for both hands and feet, select Show > Floor Contact from the Character Controls window.

Feet Contacts Position

Each setting in the Feet Contacts Position folder lets you define the contact region for the feet numerically. You can also change the region by selecting the foot floor contacts in the Viewer window and translating them.



Feet Contacts position properties

Each Feet Contacts Position setting defines a different aspect of the foot contact area. These settings are described in the following table.

| Setting | Description |
|--------------|--|
| Foot Height | Defines the bottom of the model's foot. Adjust this setting until all markers are at the bottom of a model's foot. |
| Foot Back | Defines the back edge of the model's foot. Adjust this setting until the back markers are behind the heel. |
| Foot Middle | Defines the middle, or ball of the foot. Adjust this setting until the middle markers are where the foot bends. |
| Foot Front | Defines the front part of the model's feet. Adjust this setting until the markers are in front of the foot. |
| Foot In Side | Defines the interior of the foot. Adjust this setting until the markers are at the interior of the foot. |

| Setting | Description |
|---------------|--|
| Foot Out Side | Defines the exterior of the foot. Adjust this setting until the markers are at the exterior of the foot. |

Defining hand floor contact for a character

To define hand floor contact for a character:

- 1 Select a character in the Scene browser.
- 2 In the Character Controls, activate the Floor Contact option in the Show menu to make the hand floor contact markers on your character visible.

NOTE You must be in X-Ray display mode in the Viewer window to see the floor contact markers.

Green and blue floor contact markers display around your character's hands and feet.

- 3 Expand the Floor Contacts heading in the properties area of the Character settings pane and activate the Hands Floor Contact option.
- 4 Expand the Hands Floor Contacts Setup heading and select the Hands Contact Type that you want to use.
- 5 Use the other Hands Floor Contact Setup properties to make any adjustments to the floor contact that you require.
- 6 In the Viewer window, translate the floor contact markers to position them around your character's hands.

If you are working with a humanoid model, the hand markers should display just under the wrist, the base of the palm, and the base of the fingers (not including the thumb).

Moving one hand marker adjusts the other markers accordingly. For example, when you adjust the green markers on the character's left hand, the blue markers on the right hand are adjusted as well.

Your character's hands are now ready to interact naturally with the defined floor. If you have not defined a floor for the hands, the plane at 0 on the Y-axis is used as the floor.

- [Defining the floor for characters](#) on page 1131
- [Defining finger floor contact for a character](#) on page 1148
- [Show menu](#) on page 1370
- [Feet Floor Contact Setup properties](#) on page 1136

Hands Floor Contact Setup properties

In the Floor Contacts group of character properties, the Hands Floor Contact Setup folder let you adjust how hands make contact with the floor.

Automatic Finger Base

Corrects the hands but does not let you manipulate the hand's finger base. This option is disabled by default when you create a character so that you can manually manipulate and animate each finger base.

When Automatic Finger Base is active, you cannot animate the finger base, but you can still keyframe the result positions provided by the floor contact.

To take full advantage of the solving from each hand's finger base, it is recommended that when you create your model's skeleton that the finger base should be the parent of each finger. The thumb should be parented by the wrist.

Hands Floor Pivot menu

Use the Hands Floor Pivot menu to define which part of the hand should be treated as a pivot when the hands make contact with the floor. There are three options for the Hands Floor Pivot, described in the following table.

| Option | Behavior |
|--------|--|
| Auto | The default option that averages the priority between the wrist and fingers. When the hand makes contact with the floor, the |

| Option | Behavior |
|---------|---|
| | wrist is translated backwards and the fingers are pushed forwards. |
| Wrist | Gives the wrist priority and defines it as a pivot point for the hand's floor contact. When the fingers make contact with the floor, they are translated forward to keep the wrist's trajectory towards the floor constant. |
| Fingers | Gives the fingers priority and uses them as the pivot point. When the fingers make contact with the floor, the wrist is translated backwards to keep the fingers firmly planted on the floor. |

Hands Contact Type

The Hands Contact type lets you define the number and orientation of markers used to define the floor contact for your character's hands. The following table illustrates the types of hand contact available.

| Option | Behavior |
|------------|--|
| Normal | Six markers define each hand's floor contact. The middle markers should define where the fingers begin. |
| Wrist | Four points define each hand's floor contact. The hand markers display around each palm. |
| FingerBase | Four points define each hand's floor contact. The hand floor contact markers display around each hand's fingers. |
| Hoof | Four points define each hand's floor contact, but the points are oriented at a 90 |

| Option | Behavior |
|--------|---|
| | degree angle, letting you define the floor contact for animal types with hooves, such as horses. These contact markers allow for 180 degrees of movement. |

Hands Contact Stiffness

Use Hands Contact Stiffness to define how stiff and sudden the hand becomes as soon as any part of the hand contacts the floor.

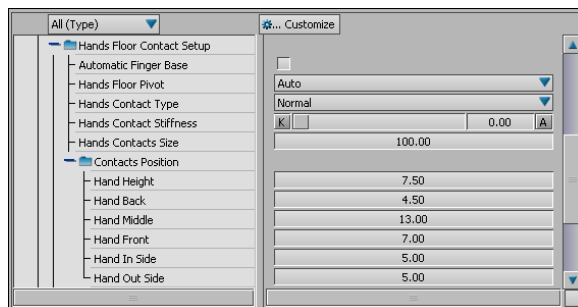
For example, using MotionBuilder default settings but only adjusting the Hands Contact Stiffness to 100%, as soon as the fingers of the hand come into contact with the floor, the hand stops translating. At 50%, the hand translates gradually after coming into contact with the floor.

Hands Contacts Size

Lets you change the size of the contact markers that outline the hands. The center of the contact markers is the point used for floor contact. Increasing the Hands Contacts Size only makes the floor contact markers more visible, it does not affect the way the hands contact the floor. To view the contact markers for both hands and feet, select Show > Floor Contact from the Character Controls window.

Hands Contacts Position

Each setting in the Hands Contacts Position folder lets you define the contact region for the hands numerically. You can also change the region by selecting the hand floor contacts in the Viewer window and translating them.



Hands Contacts Position folder and settings

Each Hand Contacts Position setting defines a different aspect of the hand contact area. These settings are described in the following table.

| Setting | Description |
|---------------|--|
| Hand Height | Defines the bottom of the model's hand. Change this setting until all markers are at the bottom of a model's hand. |
| Hand Back | Defines the back edge of the model's hand. Change this setting until the back markers are behind the hand. |
| Hand Middle | Defines the middle of the hand, where the fingers bend. Adjust this setting until the middle markers are where the fingers bend. |
| Hand Front | Defines the front part of the model's hand. Change this setting until the markers are in front of the hand. |
| Hand In Side | Defines the interior of the hand. Adjust this setting until the markers are at the interior of the hand. |
| Hand Out Side | Defines the exterior of the hand. Change this setting until the markers are at the exterior of the hand. |

NOTE When you adjust the size of the hand, view your scene using the Right camera view for all measurements, except for Hand In Side and Hand Out Side. For these last measurements, view the scene using the Front camera view. To see through your model, switch to X-Ray viewing mode.

Finger and toe tips

Fingers and toes use the outer mesh of each toe and finger tip marker to define the area that makes contact with the floor.

When you characterize your character, finger tip markers are automatically placed at the end of the fingers and toes, specified by the last joint or bone in each finger and toe. To ensure finger tips work properly, you must specify an end joint or bone as the last node in each finger or toe.

- [Viewing finger and toe tips](#) on page 1145
- [Fingers Floor Contact Setup properties](#) on page 1148
- [Toes Floor Contact Setup properties](#) on page 1146

Viewing finger and toe tips

To view the finger and toe tips on your character:

- 1 Select Show > Finger Tips from the Character Controls window.
- 2 To view the finger and toe tips markers, hide the IK and FK markers on your character's Control rig. Do this using Show > IK and Show > FK in the Character Controls.

- [Finger and toe tips](#) on page 1144
- [Fingers Floor Contact Setup properties](#) on page 1148
- [Toes Floor Contact Setup properties](#) on page 1146

Defining toe floor contact for a character

To define toe floor contact for a character:

- 1 Select a character in the Scene browser.
- 2 In the Character Controls, activate the Finger Tips option in the Show menu to make the toe tip markers on the character visible.

In order to see the toe tips markers, you may also have to temporarily hide the FK and IK markers on your character by disabling them in the Show menu.
- 3 In the properties area of the Character Settings pane, expand the Floor Contacts heading and activate the Toes Floor Contact option.

- 4 Expand the Toes Floor Contact Setup heading and select the Toes Floor Contact Mode that you want to use. These options let you decide how you want the toes to react when they come in contact with the floor.
- 5 Adjust any other Toes Floor Contact Setup properties that you require.

If you have no floor defined for the feet, the toes react to the plane at 0 on the Y-axis as the floor.

- [Finger and toe tips](#) on page 1144
- [Viewing finger and toe tips](#) on page 1145
- [Defining foot floor contact for a character](#) on page 1135
- [Character Controls](#) on page 1357
- [Toes Floor Contact Setup properties](#) on page 1146

Toes Floor Contact Setup properties

The options within the Toes Floor Contact Setup folder let you adjust how toes make contact with the floor.

Toes Floor Contact Mode

Lets you choose the behavior of the toes as they contact the floor. The three different behaviors are outlined in the following table.

| Option | Behavior |
|-----------------|--|
| Sticky | Each toe sticks to the floor exactly where contact is made. |
| Spread | Spreads the toes as they make contact with the floor, attempting to keep the position of the toes intact. Rotation is applied to the root of each toe. |
| Sticky & Spread | Averages the toe behavior between both Sticky and Spread. |

Toes Contact Roll Stiffness

Corrects unnatural toe rotation when toe floor markers contact the floor. At 100%, Toes Contact Roll Stiffness attempts to prevent the toes from rotating in impossible directions.

Toe Tips Sizes

The Toe Tip Sizes group lets you adjust the size of each of the floor markers used to outline the toe tips for the left and right feet.

To view the toe tips on your model, select Show > Finger Tips from the Character Controls window. See [Finger and toe tips](#) on page 1144.



Finger tips for right hand

Unlike hand and foot contacts, the outer mesh of each toe tip marker defines the area that makes contact with the floor.

When you characterize your character, toe tips are automatically placed at the end of the model's toes, specified by the last joint or bone. To ensure toe tips work properly, you must specify an end joint or bone as the last node in each toe.

- [Floor contact](#) on page 1131
- [Viewing finger and toe tips](#) on page 1145
- [Defining toe floor contact for a character](#) on page 1145

Defining finger floor contact for a character

To define finger floor contact for a character:

- 1 Select a character in the Scene browser.
- 2 In the Character Controls, activate the Finger Tips option in the Show menu to make the finger tip markers on the character visible.
In order to see the finger tips markers, you may also have to temporarily hide the FK and IK markers on your character by disabling them in the Show menu.
- 3 In the properties area of the Character Settings pane, expand the Floor Contacts heading and activate the Fingers Floor Contact option.
- 4 Expand the Fingers Floor Contact Setup heading and select the Fingers Floor Contact Mode that you want to use. These options let you decide how you want the fingers to react when they come in contact with the floor.
- 5 Adjust any other Fingers Floor Contact Setup properties that you require.

If you have no floor defined for the hands, the fingers react to the plane at 0 on the Y-axis as the floor.

- [Finger and toe tips](#) on page 1144
- [Viewing finger and toe tips](#) on page 1145
- [Defining hand floor contact for a character](#) on page 1140
- [Defining the floor for characters](#) on page 1131
- [Fingers Floor Contact Setup properties](#) on page 1148
- [Character Controls](#) on page 1357

Fingers Floor Contact Setup properties

In the Character Settings pane, the options within the Floor Contacts > Fingers Floor Contact Setup folder let you adjust how fingers make contact with the floor.

Fingers Floor Contact Mode

Lets you choose the behavior of the fingers as they contact the floor. There are three behaviors you can choose from, described in the following table.

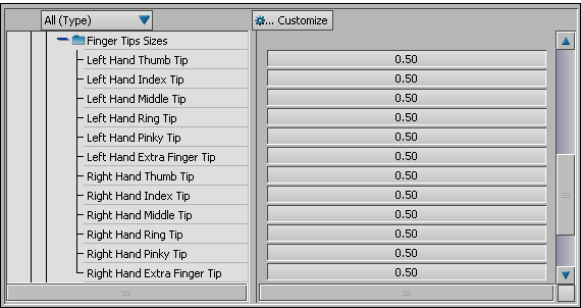
| Option | Behavior |
|-----------------|---|
| Sticky | Each finger sticks to the floor exactly where contact is made. |
| Spread | Spreads the fingers as they make contact with the floor, attempting to keep the position of the fingers intact. Rotation is applied to the root of each finger. |
| Sticky & Spread | Averages the finger behavior between Sticky and Spread. |

Fingers Contact Roll Stiffness

Corrects unnatural finger rotation when finger floor markers contact the floor. At 100%, Fingers Contact Roll Stiffness attempts to prevent the fingers from rotating in unnatural directions.

Finger Tips Sizes

Adjust the size of each of the floor markers used to outline the finger tips for both the left and right hands.



Finger Tips Sizes group of properties

- [Finger and toe tips](#) on page 1144

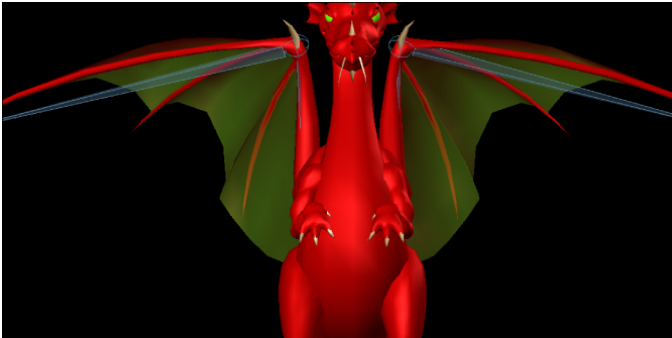
- [Viewing finger and toe tips](#) on page 1145
- [Defining finger floor contact for a character](#) on page 1148

Character Extensions

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Character Extensions can be created to associate any type of object with your character, whether it is an extra limb, a weapon your character carries, a camera, or a spot light that follows your character around. Any type of object or property that you want to control and key along with your character can be added as a Character Extension.

Character Extensions are particularly useful with character models that have atypical features (such as the character with wings and a tail in) because they let you easily include the added features with your character's Full Body keying group.



A dragon character with wing and tail Character Extensions.

Using Character Extensions in poses

When you create a pose with a character that has Character Extensions, the Character Extensions are included in the pose. You can also paste poses based on objects in the Character Extension.

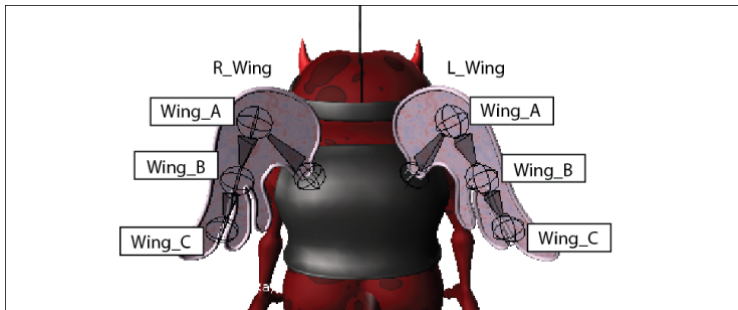
If you plan to create poses involving Character Extensions, make sure to define a Reference Object in the Character Extension properties *before* you begin to create poses. See [Character Extension properties](#) on page 1159 for more information on the Reference Object.

With the proper setup, you can also mirror-paste poses on Character Extensions just as you can on a character's regular body parts. For example, if your character has symmetrical left and right wings, you can mirror poses from the left wing onto the right wing, and so on.

Mirroring Character Extensions

Just like the right arm is the mirror of the left arm in a character's structure, you can set up right and left mirror pairs for Character Extensions. You can also mirror poses on a single Character Extension, such as a tail, the same way you can mirror poses on a character's spine.

The Mirror Partner property for Character Extensions lets you create left and right mirror pairs. For example, to set up a pair of symmetrical wings for your character, and to be able to mirror poses between them, you would select the right wing Character Extension as the Mirror Partner of the left wing Character Extension.



A character with two wings set up for symmetrical mirroring.

When you select the Extension Label for one Character Extension in the Mirror Partner menu, MotionBuilder determines whether the set up of the selected Extension matches the current Extension exactly. In order for two Extensions to function as a perfect mirror pair, both Extensions must be composed of objects with identical Label names and property references. If the setup for the Extension you choose in the Mirror Partner menu is not an exact match for the current Extension, a dialog box appears that reports the unmatched objects and properties.

TIP If you want the two Character Extensions that you have paired to be asymmetrical, you do not need to correct the mismatched objects and properties.

When you paste poses between two mirrored Character Extensions, only translation, rotation, and scaling values are calculated for mirroring. If you have added custom property sliders to two Character Extensions and you want to mirror that data, the custom properties on each Extension must have the same names, and the slider values will be copied directly.

See also [Mirror Partner](#) on page 1160 for more information.

Keying Character Extensions

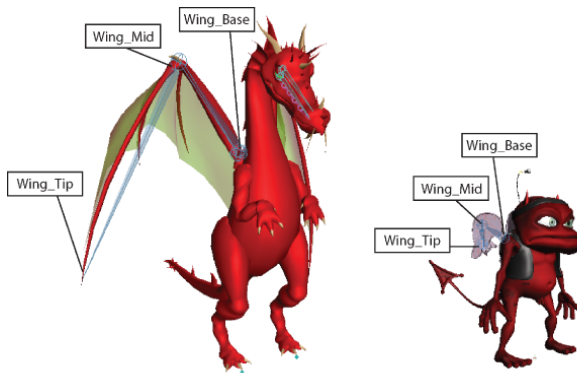
Once you have created Character Extensions for a character, you can use the Properties window to define exactly what is keyed when you set keyframes on the Character Extension. By default, the translation and rotation properties for objects in the Character Extension are keyframed.

Activate the Add To Full Body option in the Properties window if you want the Character Extension to be keyed whenever you set a Full Body keyframe on your character.

If your Character Extension is composed of markers, cameras, lights, limbs, Skeleton roots, Skeleton nodes, or nulls, the same visual feedback elements that you can activate for Control rigs are also available for your Character Extension. For example, the HighLight Active Body Part and Outline Currently Keyed visual feedback elements also work with your Character Extension if it is composed of these types of objects. See [Visual feedback on Control rigs](#) on page 1271 for more information on the types of visual feedback available.

Copying animation between two Character Extensions

If you have two characters with equivalent Character Extensions, you can copy keyframe animation from Extension to Extension. To create an equivalent set up on the source and target Character Extensions, both Extensions need to have the same Extension Label, and the corresponding objects within the Extensions need to have the same Labels.



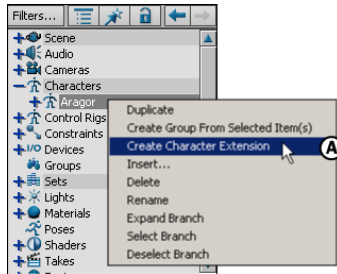
Two Character Extensions set up for copying animation.

See [Copying Character Extension animation](#) on page 1156 for more information.

Creating a Character Extension

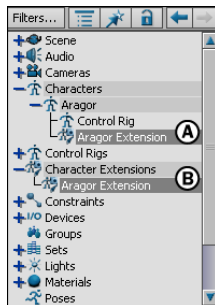
To create a Character Extension:

- 1 In the Scene browser, right-click a characterized character and select Create Character Extension.



Scene browser A. Create Character Extension option

A new Character Extensions heading is added to the Scene browser. By default, the new Character Extension object added is named "<char_name> Extension," where <char_name> is the name of your character.

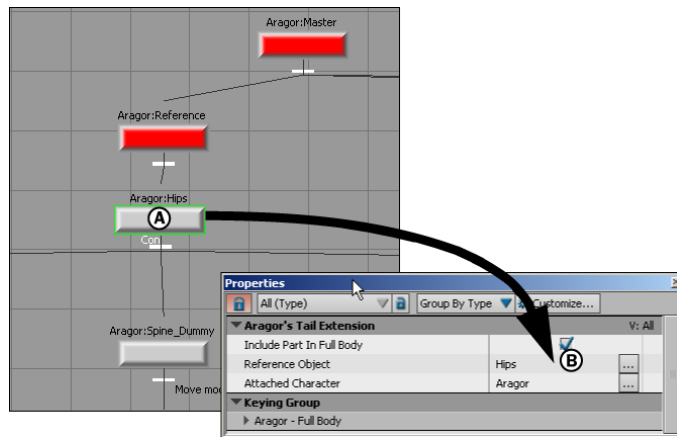


Scene browser A. A Character Extension is added to the character. B. A Character Extensions heading is added to the Scene browser.

- 2 Alt-drag any type of object(s) you want to associate with your character onto your character's Extension.

For example, you can add a light, a sphere, a constraint, or any other object. If your character model has additional limbs or a tail, you might add a series of Skeleton nodes.

- 3 Select Add to <char_name> Extension from the popup menu that appears. This object is now part of the Character Extension and is considered as if it is a “body part” on the current character.
- 4 Create a Reference Object for this Character Extension by doing the following:
 - Select the closest part of the body that affects the movement of your Character Extension. Normally, this is the direct parent of the Extension, but it can be any object associated with the Extension. For example, if you are adding a tail, you might select the Hips bone, because you want the tail to be attached at the hips.
 - Alt-drag the selected body part into the Character Extension’s Reference Object field in the Properties window.



- A. Select the bone you want to associate with the Character Extension.
- B. Drag it into the Reference Object property.

This creates a Reference for your Character Extension, which is used to calculate all future positioning of the Extension, for example if the Character Extension is included in a pose.

- 5 In the Properties window, view the list of properties to be keyed when you set a keyframe on this Character Extension. Add or remove the properties you want to have keyed by right-clicking and selecting Remove

Property from Extension or Add Property to Extension. These properties are also included in any poses you create for this character.

You can also use the Add To Full Body option to define whether you want the Character Extension to be keyed when you set keys in Full Body Keying mode.

Copying Character Extension animation

Once you have set up your Character Extensions correctly, there are two ways to copy animation between them. If you have two characters with Extensions in the same scene, you can copy the Extension animation as you retarget animation from character to character. Or, if you have saved Character Extension animation using the Save Character Animation option in the Character Controls, you can copy the animation onto characters in other scenes or reload them onto the same character using the Load Character Animation option.

See [Copying animation between two Character Extensions](#) on page 1153 for information on setting up Extensions for copying animation.

To copy Character Extension animation between two characters in a scene:

- 1 Make sure that the target character has a Control rig attached.
- 2 Select Character Input as the Input Type for the target character, and select the source character as the Input Source if it is not automatically selected.
- 3 In the Character Controls Edit menu, select Retarget.
- 4 In the Retargeting Options dialog box that appears, activate the Copy Character Extension Animation option and click Ok.
The animation is copied from the source Character Extension to the target Character Extension.
- 5 To see the result, in the Character Controls Edit menu, select the Control rig as the Input Source for the target character.

NOTE Although Character Extension animation can be included during retargeting, the Extension animation itself is not retargeted. The local Character Extension animation is copied directly, so if the axes of objects in both Extensions are not set up in a similar way, unexpected results may occur.

To copy saved Character Extension animation:

- 1 Make sure that the target character has a Control rig attached, unless you plan to activate the Replace Control Rig option in the Load Character Animation Options.
- 2 From the Character Controls File menu, select Load Character Animation.
- 3 Navigate to select an *.fbx* file containing Character Extension animation that was saved using the Save Character Animation option, then click Open.
- 4 In the Load Character Animation Options dialog box that appears, activate the Process Animation option in the Character Extensions area and click Open.

NOTE Always disable the Copy Missing Character Extensions option if you only want to copy animation between two Extensions.

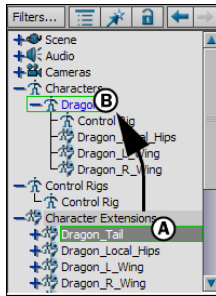
The animation is copied from the source Character Extension in the *.fbx* file to the target Character Extension in your scene.

■ [Character Extensions](#) on page 1151

Attaching a Character Extension to a character

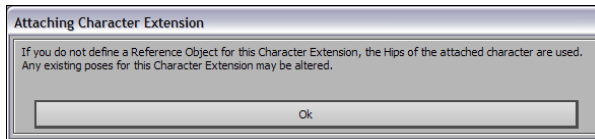
To attach a Character Extension to a character:

- 1 In the Scene browser, select the Character Extension you want to attach.
- 2 Drag the selected Character Extension onto a character.
- 3 In the contextual menu that appears, select Attach *<Extension_name>* To *<Character>* where *<Extension_name>* is the name of the Character Extension, and *<Character>* is the name of the character.



A. Drag the Character Extension B. Onto a character.

- 4 Click Ok in the Attaching Character Extension dialog box that appears .



Attaching Character Extension dialog box

This dialog box appears to remind you to define a Reference object for your Character Extension. It's very important to define a new Reference object as you attach the Character Extension because all poses and transformation for the Extension will be based on this object.

Detaching a Character Extension from a character

- 1 In the Scene browser, select the Character Extension you want to detach.
- 2 Right-click and select Detach <> From <>.

A dialog box appears warning you that you need to update the Reference object for this Character Extension.

Character Extension properties

This section describes the properties found in the Properties window when you have a Character Extension selected.

Add To Full Body

When activated, objects and properties in the Character Extension are keyed along with the rest of the character's body if Full Body keying mode is selected.

Reference Object

Lets you define the part of your character's body where the Character Extension is attached. Character Extensions are transformed relative to the Reference Object, and all poses are calculated relative to the Reference Object. Each time you attach an Extension to a new character, you should define a new Reference object.

If you do not define a Reference Object, and the Character Extension has no parent, the attached character's hips act as the default Reference Object. To assign a Reference Object, select and Alt-drag a part of your character's body into this field.

NOTE If you plan to mirror poses between Character Extensions, you must define a Reference object for each Extension. You can use the same Reference object for more than one Extension. For example if you have two wings, you might use the same Spine object as the Reference object for both.

When selecting a Reference object, it is best to use the closest object that affects the movement of the Extension. Normally, this object is the direct parent of the Character Extension.

When you define a Reference Object, a dialog box appears to let you know that the stance pose for this Character Extension will be updated with the new Reference. Any poses you created for the Character Extension before defining the Reference Object may be altered, so it's a good idea to define the Reference Object before you do any work with the Extension.

Attached Character

Lists the character to which the Character Extension is attached. This property is updated automatically when you attach the Character Extension to a character.

Extension Label

Lets you define “undercover” non-unique names for each Character Extension that enable you to copy animation between Extensions.

To avoid naming conflicts, no two Character Extensions can have the same name in MotionBuilder. For example, if you have two characters with tails in a scene, each tail must have its own unique Character Extension name.

However, you can give two Character Extensions the same *Extension Label*. Giving two Character Extensions the same Extension Label indicates to MotionBuilder that these Extensions are compatible, and animation can be copied between them.

In the scene with two characters with tails, both tail Extensions cannot have the same *name* “Tail”, but they can have the same *Extension Label* “Tail”.

See [Copying Character Extension animation](#) on page 1156 for more information.

Mirror Partner

Lets you define another Character Extension as the mirror of the current Character Extension. From this menu, you can choose from a list of the Extension Label names representing all Character Extensions in the scene.

For example, if your character has a pair of wings, you might use the Extension Labels “L_Wing” and “R_Wing”. To indicate that these are a mirror pair, you select the “L_Wing” Extension Label in the Mirror Partner menu for the right wing Extension.

See [Mirroring Character Extensions](#) on page 1152 for more information on setting up your Character Extensions to be mirrored.

Plot Method

Lets you define how you want the Character Extension to be handled when you plot the associated character’s animation. You can choose from the following options:

| Option | Function |
|--------|--|
| Never | Character Extension animation is not plotted when you plot the attached character’s animation. |

| Option | Function |
|------------------|---|
| With Skeleton | Character Extension animation is plotted when you plot to the attached character's skeleton. |
| With Control Rig | Character Extension animation is plotted when you plot to the attached character's Control rig. |
| Both | Character Extension animation is plotted when you plot to the attached character's Control rig, or if you plot to the skeleton. |

Update Stance Pose

Click to update the stance pose of the selected Character Extension. The stance pose is like a snapshot of all the properties associated with the Character Extension, including its position, and it is used in calculations whenever you create poses, mirror poses, and copy animation.

The first stance pose of the Character Extension is determined by the objects and properties as they are added to the Extension. If you create the Extension with the objects and properties in a suitable state, you do not need to update the stance pose.

However, if you want to set up two Character Extensions as a symmetrical pair of body parts, both Extensions need to have mirror versions of the same stance pose. You can change the stance pose by positioning the Character Extension and changing its values, then clicking Update Stance Pose.

Go to Stance Pose

Click to put the Character Extension in its stance pose.

Properties for Character Extension objects

When you drop an object into a Character Extension, the object's Translation and Rotation values are added as reference properties in the Character Extension properties. A Label property is also added for any object added to an Extension, which lets you create a second non-unique name for the object.

The Labels that you define for each object in an Extension have a similar function to the body part names in the character Mapping List - they both let you describe a structure. The difference is, you can change the Label names for objects that make up your Character Extension.

For example, on a character with Character Extensions for two wings, you might want to mirror poses from the right wing to the left. To do this, you can create a symmetrical set up where the two Character Extensions are each made up of three objects. All of the wing objects must have a unique name in the scene, but you can indicate to MotionBuilder which objects correspond wing-to-wing by giving each pair the same Label, such as “WingA,” “WingB,” and “WingC.” Using the same Label for two objects indicates to MotionBuilder that the objects are compatible, so you can retarget animation between them, and mirror poses on them.

Plotting Character Extensions

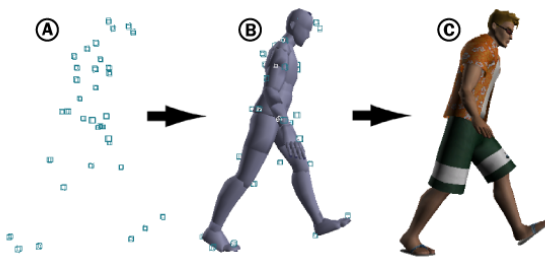
When you go to plot your character animation, turn on the “Plot character Extensions” option in the 2nd dialog box. Also, use the Plot Method property to specify if you want Character Extensions to be plotted when you are plotting to the skeleton, Control rig, neither, or both.

Plotting Character Extensions works around a limitation where the Mapping list only offers you five slots for prop objects. (Anything in the Mapping list gets plotted along with your character.) Because you can add any number of prop objects to a Character Extension, you can now plot animation for any number of objects associated with your character.

Actor assets

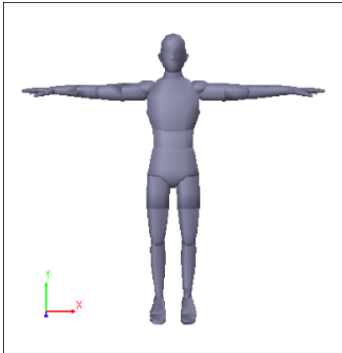
An Actor is an asset used to preview motion data, and to connect motion data to a character model. It is one of three types of motion source that can be used to drive a character.

During a motion capture session, a live performer wears a set of sensors that detect and record their movements as motion data. This motion data can be attached to an Actor using a Marker set. The Actor is then linked to a Character asset so it can drive the movement of the character model.



Motion capture data driving character animation A. Optical data markers B. Actor with Marker set C. Animated character model

Actors are visually represented in MotionBuilder by a gray humanoid model with detachable body segments. This generic model lets you preview how the motion data will drive your character. You can even use the same Actor to drive more than one character in a scene.



Actor asset

- [Marker sets](#) on page 1185
- [Character assets](#) on page 1081
- [Actor settings](#) on page 1169
- [Creating an Actor](#) on page 1164
- [Connecting an Actor to a character](#) on page 1166
- [Creating motion using a glove device](#) on page 1168

Creating an Actor

To create an Actor:

- 1 Drag an Actor asset from the Characters folder of the Asset browser into the scene.

The Actor displays as a humanoid model in the Viewer window.

Once you load an Actor, you can use a Marker set to map objects containing motion (markers or sensors) to the selected Actor. Mapped motion data in a Marker set eventually drives the Actor.

- [Marker sets](#) on page 1185
- [Creating a Marker set](#) on page 1185

Renaming an Actor

To rename an Actor:

- 1 Select the Actor you want to rename in the Scene browser.
- 2 Right-click and select Rename from the contextual menu.
- 3 Type a new name in the field.

■ [Actor assets](#) on page 1163

Changing the look of an Actor

You can define the appearance of Actors using the Actor Settings group of properties in the Properties window. These settings let you change the body, skeleton and pivot color of the Actor in the Viewer window, as well as change the size of pivot and market sets.

Changing the look of Actors is useful when you want to distinguish between multiple Actors in a scene.

■ [Actor properties](#) on page 1173

Manipulating Actors

You can manipulate an Actor's detachable body segments in two ways. You can use inverse kinematics to transform the Actor, or you can manually adjust the Actor to reach a Marker set.

To manipulate an Actor's hierarchy with Inverse Kinematics:

- 1 Activate the IK Manip option in the Actor Controls.
- 2 Select a cell in the Actor representation, then transform the Actor.

To manipulate the Actor to reach a Marker set:

- 1 Make sure that IK Manip is disabled in the Actor Controls.
- 2 Select a joint by clicking the corresponding cell in the Actor representation.

The corresponding body part is selected in the Viewer window with the name of the selected body part appearing at the lower right corner.

- 3 Translate, rotate, and scale the selected body part.

To scale and translate an Actor's limbs together:

- 1 In the Actor Controls, activate the Symmetry Edit option.
- 2 Select one of the Actor's limbs and activate a transformation mode.
- 3 Change the transformation values.

For example, to scale both arms simultaneously, select Symmetry Edit, choose an arm, then change the scaling values.

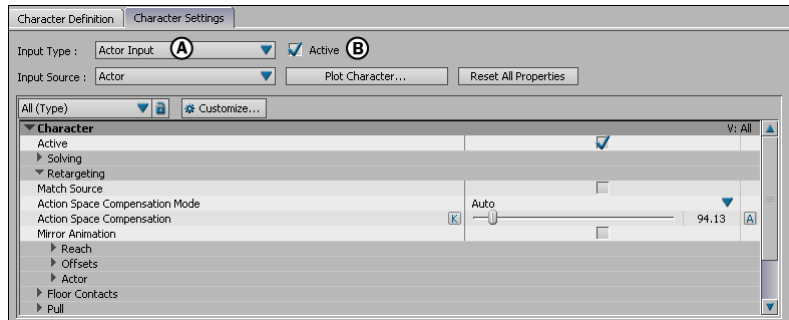
- [Actor assets](#) on page 1163
- [Actor Controls window](#) on page 1175

Connecting an Actor to a character

After you have connected motion data to an Actor asset using a Marker set, you can connect the Actor to a character. This lets you drive the character using the motion data, or plot the motion data directly onto the character's skeleton.

To connect an Actor to a character:

- 1 Load an Actor that has motion data mapped in a Marker set.
- 2 Merge a characterized character into the scene.
- 3 Expand the Characters folder of the Scene browser and double-click your character's name.
The Character Settings display in the Navigator window.
- 4 From the Input Type menu in the Character Settings pane, select Actor Input, then select the Actor by name from the Input Source menu (if it is not automatically selected).
- 5 Click the Active option (if it is not already activated) to snap the character onto the Actor source.



Character Settings pane A. Actor Input is selected as the Input Type. B. The Active option is activated.

The Actor and character will now move together using the same motion. You can select and play a take using the Transport Controls window.

In some cases, the movement may not be perfectly aligned between the Actor and the character. You can fine-tune the movement by adjusting certain Character settings, such as Match Source and Reach values.

- [Creating a Marker set](#) on page 1185
- [Characterizing](#) on page 1085
- [Adjusting a character connected to an Actor](#) on page 1167
- [Retargeting - Actor properties](#) on page 1349
- [Character Settings pane](#) on page 1324

Adjusting a character connected to an Actor

After you have connected an Actor to a character, you may notice the animation directed onto your character results in some awkward movement. For example, the character's shoulders may appear too low and close to the body in certain frames, or the neck may have some unnatural movements. This can occur when certain markers are poorly captured, or when the Actor configuration does not provide good capture data.

You can use the Motion Reduction settings in the Character Settings pane to adjust and fine-tune the way the character's chest, shoulders, neck, and head react to the Actor source.

To adjust a character connected to an Actor:

- 1 Switch to Models Only display mode in the Viewer window (Ctrl A).
- 2 In the Character Controls window, disable the Actor (All) option in the Show menu.
This hides the Actor in the Viewer window so you can see your character clearly. Even though the Actor is hidden, it still drives the motion of the character.
- 3 In the Scene browser, expand the Characters heading and double-click the character to open the Character Settings.
- 4 In the Character Settings pane, expand the Retargeting > Actor > Motion Reduction settings.
- 5 Experiment with the various Motion Reduction settings until your character moves more smoothly.
For example, if the shoulders appear too low and tight to the body, set the Shoulder Reduction slider to 80 to achieve a more natural result.

- [Character motion capture workflow](#) on page 1072
- [Connecting an Actor to a character](#) on page 1166

Activating all markers on an Actor

In the Marker table in the Actor Settings, click the Oriented title at the top of the column to activate all markers for a selected Actor.

- [Actor assets](#) on page 1163
- [Actor settings](#) on page 1169
- [Connecting an Actor to a character](#) on page 1166

Creating motion using a glove device

You can connect glove devices to an Actor to create realistic hand and finger movements. You can set gloves as live devices or as devices containing recorded data.

After you have connected the glove device to an Actor, you can select the Actor as the motion source driving your character model.

To connect a glove device to an Actor automatically:

- 1 Select the left or right-hand cell in the Actor representation.
- 2 Drop the root of the glove device into the Glove reference in the Model column.

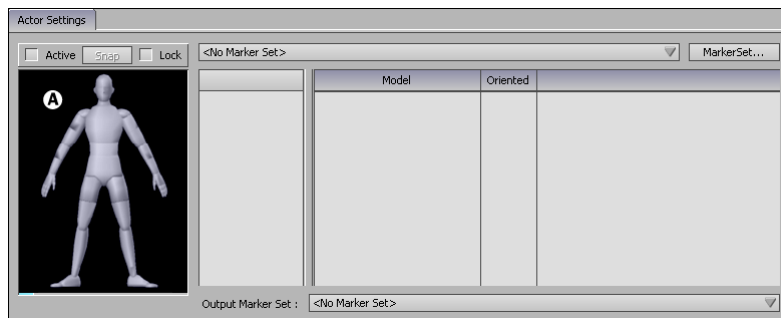
■ [Connecting an Actor to a character](#) on page 1166

Actor settings

To display the Actor settings in the Navigator window, select an Actor from the Actors folder in the Scene browser.

Actor representation

The Actor representation visually represents the Actor in the Actor settings. The Actor representation is used to add markers or sensors containing motion data to a Marker set and view selected markers in the Marker table (see [Marker Table](#) on page 1171).



Actor Settings A. Actor representation

When you first create an Actor, the cells in the Actor representation are empty. These cells indicate the number of markers that affect each part of the Actor body. You can assign up to five markers per cell.

To add markers to a Marker set, Alt-drag one or more selected markers or sensors into one of the cells corresponding to the Actor body part. You can drag from the Scene browser or from the Viewer window.

Dragging connects the marker or sensor to the other markers in the cell, and influences the corresponding part of the Actor body. If the cell already contains markers and sensors, the new markers and sensors are added to the existing list.

Active

The Active option above the Actor representation lets you activate the mapping and fit the Actor onto the Marker set. Enable Active to activate mapping.

Snap

The Snap button calculates rotational offsets and slight positioning differences between the Marker set and the markers or sensors used by the Marker set. Snap is best suited for Marker sets that have oriented markers, commonly found in magnetic capture data.

You can also use Snap to compensate for optical capture sessions that use the same Marker set, but were captured during different sessions. Although the Marker set is identical, the sensors might have been in slightly different locations on the performer's body compared to the previous capture session. Snap works best when these differences are subtle.

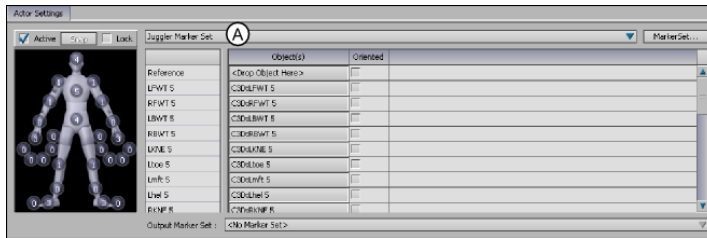
Lock

The Lock option locks the current position and rotation of the selected Actor and its Marker set. You must have an active Marker set to use Lock.

Current Marker Set

The Current Marker Set field lets you select the Marker set used by the Actor. You work with the current Marker set when you edit, rename, import, export, and map data to your Actor.

If there are no Marker sets, <No Marker Set> appears in the Current Marker Set field and no cells display in the Actor representation.



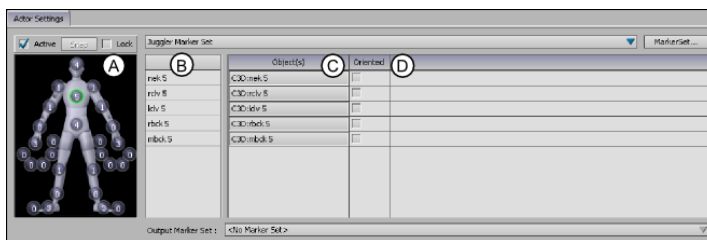
Actor Settings A. Current Marker set field

The Marker Set button to the right of the Current Marker set field opens the Marker Set menu that lets you create, rename, import, export, and delete Marker sets.

Marker Table

The Marker table lists the markers that drive the Actor joints. If your selected Actor does not have a Marker set, the Marker table is empty.

The Marker table consists of the Marker, Model, and Oriented columns.



Actor Settings A. Hips cell is selected in the Actor representation. B. Marker column C. Model column D. Oriented column

To view only the objects that influence a part of the Actor in the Marker table, click the corresponding cell in the Actor representation. A green outline circles the selected cell in the Actor representation. The list of markers that influence that part of the Actor appears in the Marker table as well.

Selecting a marker in the Marker column selects that marker in the Viewer window and deselects all other markers.

NOTE Be careful when you select markers in the Marker table. If there is a sensor or bone selected in your scene, it remains selected when you select a new marker from the Marker table.

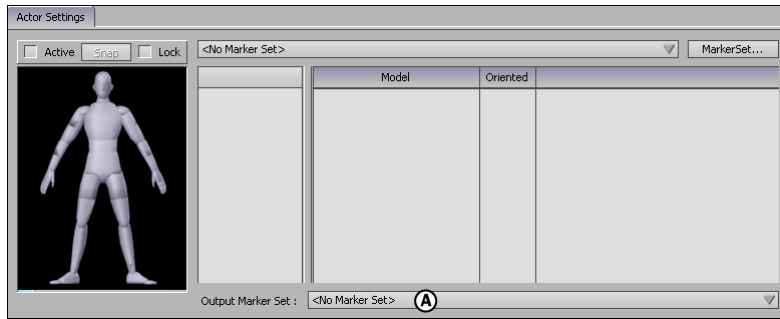
To view all the markers in the Marker table, click the background of the Actor representation to deselect any selected cells. To scroll through the Marker table, Shift-click and drag up or down, or use the scroll bars.

To remove a marker or sensor from the Marker table, select the marker in the Marker column, and press Delete. This removes the marker, which means that it is no longer used by the Marker set. The actual physical sensor or marker is still in the scene.

| Column | Function |
|----------|---|
| Marker | The Marker column lists the defined markers that indicate the placement of the sensors, markers, or bones that drive the Actor in your scene. You can rename the fields in the Marker table by double-clicking the field, changing the name, and pressing Enter. |
| Model | The Model column specifies the sensors, markers, or bones that drive the white markers. Make sure you Alt-drag the root of your object into the Reference field in the Model column. This is the only field that is not modified in the Actor representation cells. |
| Oriented | The Oriented column activates rotation and translation data for the corresponding marker. If a marker contains both rotation and translation data, activate the Oriented option for that marker. When Oriented is disabled, only translation data is active. Click the Oriented title at the top of the column to activate all markers for your selected Actor. |

Output Marker Set

The Output Marker Set field outputs the result from one Actor to another Marker set. You can use this technique to transfer motion data that was captured with many different Marker sets to a single format.



Actor Settings A. Output Marker Set field

For example, you can transfer data from the Marker set of an Actor using magnetic motion data to an Actor using optical data. You can then export the optical data using one of the export file formats.

You can also reverse the direction of Character mapping and have a Character output to a Marker set. Since the Marker set is based on either magnetic sensors or optical markers, you are actually outputting back to these sensors or markers.

Essentially, this method of mapping lets you reverse the flow of Character mapping and transfer data from a plotted Character to magnetic sensors or optical markers. This is important if you want to export the finished character as a data file (for example, Vicon .c3d). You can also save cleaned data as a different set of optical or magnetic sensors.

■ [Actor assets](#) on page 1163

Actor properties

The Actor properties display when you select an Actor in the Scene browser, or when you have an Actor selected in the Actor Controls window and select Edit Properties from the Edit menu.

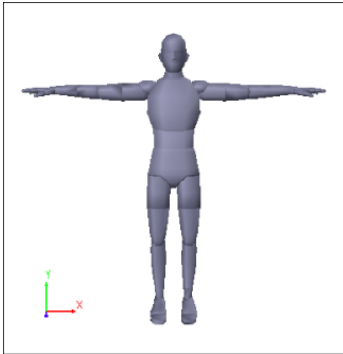
The Active, Snap, Lock, and MarkerSet properties are all defined using the Actor Settings. See [Actor settings](#) on page 1169 for more information on these settings. The other Actor properties include the Actor Settings and Body Part Pivots groups of properties.

Actor Settings

The Actor Settings group of properties let you change the way the Marker set, Actor body, skeleton, and pivot points display in the Viewer window.

Body Color

The Body Color properties let you modify the RGB color values that define the color of the Actor in the Viewer window. By default, the Actor displays in grey.



Default Actor color

Skeleton Color

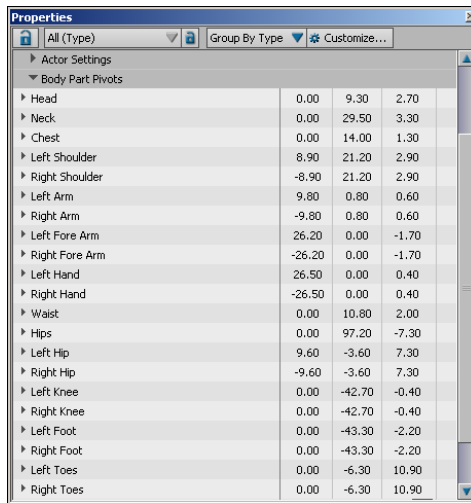
The Skeleton Color properties let you modify the RGB color values that define the color of the Actor skeleton in the Viewer window. By default, the Actor displays in grey. You can hide the Actor's skeleton using the Show menu in the Actor Controls.

Pivot Color

The Pivot Color properties let you modify the RGB color values that define the color of the Actor pivots in the Viewer window. By default, the Actor pivots display in orange. You can hide the Actor's pivot points using the Show menu in the Actor Controls. To work with the Actor's pivots, use the Body Part Pivots properties.

Body Part Pivots

The Body Part Pivots properties define the position for each pivot point associated with the Actor.



The screenshot shows a software window titled 'Properties' with a tab labeled 'All (Type)'. Below the tab is a 'Group By Type' dropdown and a 'Customize...' button. The main content area is a tree view with 'Actor Settings' expanded, showing 'Body Part Pivots'. A table lists 20 body parts with their pivot coordinates in a 4-column grid.

| Body Part | X | Y | Z |
|----------------|--------|--------|-------|
| Head | 0.00 | 9.30 | 2.70 |
| Neck | 0.00 | 29.50 | 3.30 |
| Chest | 0.00 | 14.00 | 1.30 |
| Left Shoulder | 8.90 | 21.20 | 2.90 |
| Right Shoulder | -8.90 | 21.20 | 2.90 |
| Left Arm | 9.80 | 0.80 | 0.60 |
| Right Arm | -9.80 | 0.80 | 0.60 |
| Left Fore Arm | 26.20 | 0.00 | -1.70 |
| Right Fore Arm | -26.20 | 0.00 | -1.70 |
| Left Hand | 26.50 | 0.00 | 0.40 |
| Right Hand | -26.50 | 0.00 | 0.40 |
| Waist | 0.00 | 10.80 | 2.00 |
| Hips | 0.00 | 97.20 | -7.30 |
| Left Hip | 9.60 | -3.60 | 7.30 |
| Right Hip | -9.60 | -3.60 | 7.30 |
| Left Knee | 0.00 | -42.70 | -0.40 |
| Right Knee | 0.00 | -42.70 | -0.40 |
| Left Foot | 0.00 | -43.30 | -2.20 |
| Right Foot | 0.00 | -43.30 | -2.20 |
| Left Toes | 0.00 | -6.30 | 10.90 |
| Right Toes | 0.00 | -6.30 | 10.90 |

Body Part Pivots properties

- [Actor assets](#) on page 1163
- [Changing the look of an Actor](#) on page 1165

Actor Controls window

The Actor Controls window provides options for adjusting your Actor. You can scale, rotate, and translate an Actor's detachable segments to reach the markers specified by the Marker set, to add offsets, or to compensate for the lack of a T-stance (neutral) position.

The Actor Controls window also lets you manipulate your Actor using Inverse Kinematics (IK). Using IK prevents unwanted dislocation of the Actor's parts while manipulating and adjusting the Actor.

To open the Actor Controls window, choose Window > Actor/Character Controls from the menu bar.

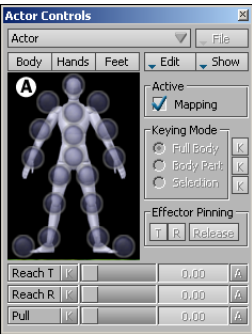
Current Actor

The Current Actor menu displays the name of the current Actor to which all options apply. When switching from an Actor to a character using this menu, the options in the Actor Controls window are replaced and become contextual to the current character.

Select an Actor in the Actor Controls window by making a selection from the Current Actor menu.

Actor Representation

The cells in the Actor representation visually represent the Actor’s joints. Selecting a cell lets you manipulate that part of the Actor using Inverse Kinematics or as detachable body segments.



Actor Controls window A.
Actor representation

Cells in the Actor representation can have the following states:

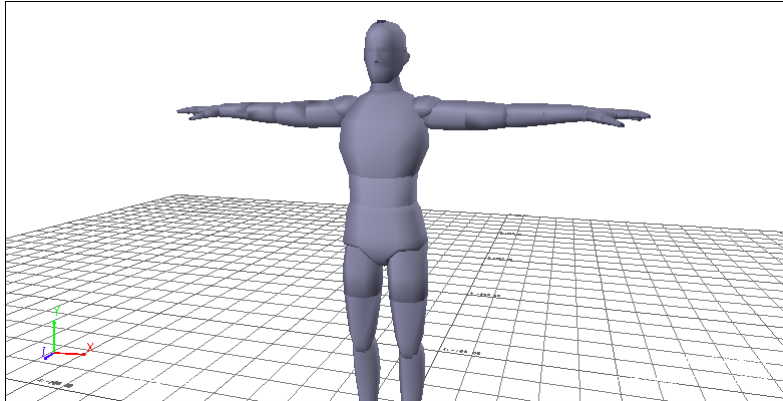
| State | Indicates |
|---------|---|
| T | A cell containing the letter T indicates that its corresponding body part is pinned in translation. |
| R | A cell containing the letter R indicates that its corresponding body part is pinned in rotation. |
| T and R | A cell containing both T and R indicates that its corresponding body part is pinned in both translation and rotation. |
| Empty | An empty cell indicates that its corresponding body part has no translation or rotation pinning. |

| State | Indicates |
|--------|---|
| Circle | A green circle around the cell indicates the corresponding body part is selected. |

Edit

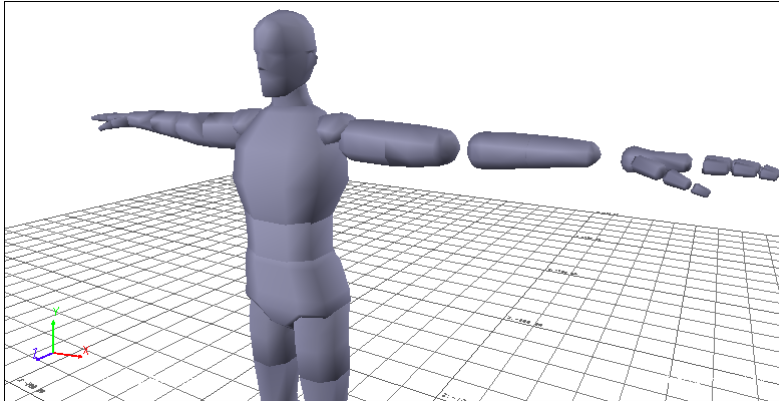
The Edit menu in the Actor Controls includes the following options:

| Option | Function |
|---------------|--|
| Lock | Activate Lock to lock the current position and rotation of the selected Actor and its Marker set. The Lock option in the Edit menu and in the Actor settings are identical. |
| IK Manip | Activate IK Manip to manipulate your Actor using Inverse Kinematics. Disable IK Manip to manipulate individual body segments on the Actor. |
| Symmetry Edit | Activate Symmetry Edit to simultaneously scale and translate an Actor's limbs. Disable Symmetry Edit to independently change the size or length of a limb. |
| Stance Pose | Activate Stance Pose to position the Actor in its default stance position. You can use this pose to reset and modify the Actor's position. Stance Pose only resets rotational offsets. These offsets remain if you translate or scale the model. |



Actor Stance Pose

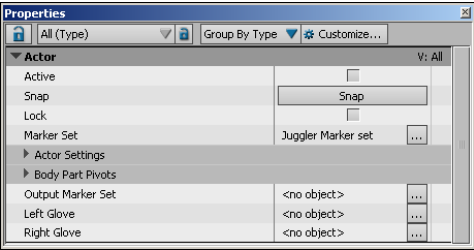
| Option | Function |
|------------|---|
| Collapse | Activate Collapse to rejoin any detached limb segments of an Actor without resetting the Actor's size or stance. This may be necessary in certain situations. For example, when adding position offsets to an Actor or when translating source markers further than their initial definition, some limbs may detach to reach all the markers defined by its Marker set. |
| Reset Size | Select Reset Size to reset the scale of the selected Actor to its default size. If a scaling offset affects the position of a segment, Reset Size resets the scale of the Actor, but leaves the segment at its new location. |



Reset Size resets the scale of the left arm but keeps the position of the left hand, detaching segments of the arm.

| Option | Function |
|--------------------|--|
| Find Size | Select Find Size when the Actor is in a T-stance to calculate and size each segment of the Actor based on the selected Marker set and source markers. |
| Reset Pivot Points | Select Reset Pivot Points to return all Actor pivot points to their original positions. |
| Reset All | Select Reset All to reset the Stance Pose, Collapse, and Reset Size options simultaneously. This option returns the Actor to its default stance position, reconnects any detached limb segments, and resets the scale of the Actor to the default size. |
| Edit Properties | Select Edit Properties to open the Properties window and display all the properties associated with the selected Actor. These properties let you change, activate, and disable various Actor properties. The Name, Active, Snap, Lock, and Marker Set properties also appear in the Actor Set- |

| Option | Function |
|--------|---|
| | tings. For more information see Actor settings. |



Actor properties display in the Properties window

| Option | Function |
|---------------------|---|
| Switch to Character | The Switch to Character option switches focus to the character that is constraining the current Actor. Selecting this option switches from the Actor Controls to the Character Controls, and all the options become contextual to the active character. This option is unavailable if there is no constraining character. |

Show

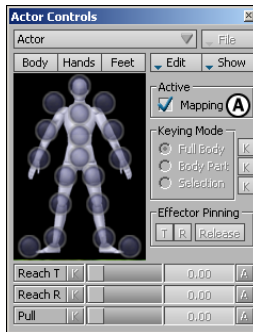
The Show menu in the Actor Controls window includes the following options:

| Option | Function |
|-------------|---|
| Actor (All) | Shows or hides the entire Actor. By default, the Actor’s body, bones, Marker set, source markers, and pivot points display. To hide the Actor, disable Actor (All). |
| Actor Body | Shows (default) or hides the body of the Actor. To hide the Actor’s body, disable Actor Body. |

| Option | Function |
|----------------|---|
| Actor Skeleton | Actor Skeleton shows a set of connecting lines representing the bones of the Actor. To show only the bones, activate Actor Skeleton and disable Actor Body. |
| Marker Set | Hides or shows the markers that belong to the defined Marker set. The Marker set displays as white markers around the Actor's body. To hide the Marker set, disable this option. |
| Source Markers | Shows (default) or hides the markers containing motion data. To hide the source markers, disable this option. When the Marker set and the Source markers are both active, the markers belonging to the Marker set display inside the source markers by default. |
| Pivot Points | Hides or shows the pivot points for the Actor. To hide the pivot point markers, disable this option. By default, the pivot points display as orange crosses. To change the way pivot points display, use the Actor Settings properties in the Properties window. You can also adjust the position of the pivot points using the Body Part Pivots properties. See Edit Properties. |

Active

The Mapping option in the Active area activates and snaps the Actor to its Marker set. This option is the same as the Active option in the Actor settings.

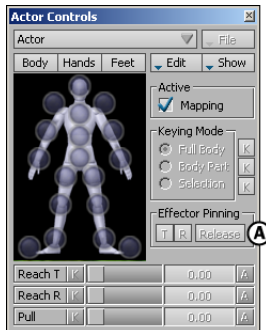


Actor Controls window A.
Active area

When the Mapping option is active, you can manipulate the Actor in the Viewer window.

Effector Pinning

When manipulating an Actor in IK Manip mode, the options in the Effector Pinning area help control the Actor's body movement.



Actor Controls window A.
Effector Pinning area

You can activate, disable, and temporarily release pinning on cells that represent the Actor's body parts. Pinning on certain body parts restricts the Actor's body movement, and determines how other body parts move relative to the pinned body part.

These options behave the same for Actors as they do for characters. The only difference is that for Actors, IK Manip mode is used only for positioning the Actor.

| Option | Function |
|---------|---|
| T and R | The T (Translation) and R (Rotation) options let you activate or disable pinning on body parts in translation or rotation. An Actor's hands are pinned in translation, and its feet are pinned in translation and rotation by default. This pinning constrains the Actor's body parts until they are unpinned. Activate pinning on one body part by selecting the cell in the Actor representation for the body part you want to pin, then activating T or R. Activate pinning on multiple body parts by Ctrl-clicking cells in the Actor representation, and then activating T or R. Remove pinning by selecting the cell in the Actor representation, and disabling T or R. You can also use the Release option and keyboard shortcuts to toggle pinning on selected cells. |
| Release | The Release option lets you temporarily remove the translation or rotation pinning related to a selected body part and those down the chain. This lets you manipulate your Actor without constraining the selected body part. Activate Release or press and hold the Q key to temporarily unpin effectors while manipulating your Actor. Disable the Release option to return the pinning to its previous state. |

- [Actor assets](#) on page 1163
- [Manipulating Actors](#) on page 1165

Marker sets

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In order to drive a character using motion data, you must first connect the data to an Actor, then select the Actor as the motion source for the character. The Marker set is the link between the magnetic or optical data recorded from a live performer and the Actor asset.

Creating a Marker set matches the motion data to the Actor's body parts, letting you preview how the motion data will make a character move. In the Viewer window, a defined Marker set displays as a group of white markers attached to an Actor.

Actors and the Actor settings are used to define the Marker set for a motion capture device or data.

- [Actor assets](#) on page 1163
- [Creating a Marker set](#) on page 1185
- [Creating an Actor](#) on page 1164
- [Importing a Marker set](#) on page 1191
- [Exporting a Marker set](#) on page 1193
- [Renaming a Marker set](#) on page 1192
- [Deleting a Marker set](#) on page 1192

Creating a Marker set

There are two ways to create a Marker set, depending on what type of motion capture data you are working with.

- [Creating and defining a Marker set with optical data](#) on page 1186
- [Creating and defining a Marker set with magnetic data](#) on page 1189

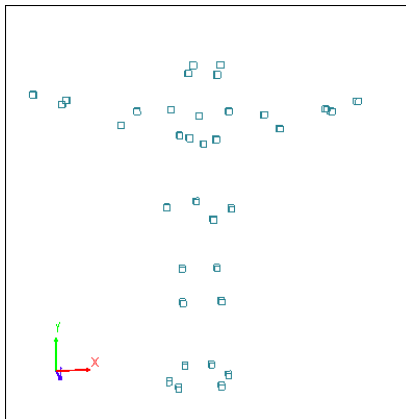
- [Marker sets](#) on page 1185
- [Importing a Marker set](#) on page 1191
- [Renaming a Marker set](#) on page 1192
- [Exporting a Marker set](#) on page 1193

Creating and defining a Marker set with optical data

A Marker set links optical motion data to the Actor asset, matching the motion data to the Actor's body parts. Linking the Actor to the optical data through a Marker set lets you preview the optical motion data on the Actor.

To create and define a Marker set with optical data:

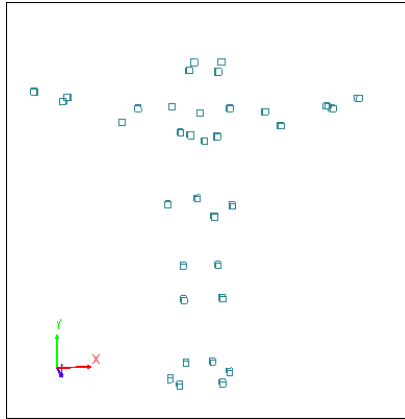
- 1 Load a file containing optical motion data .



Motion capture data loaded in the scene.

Ideally, the markers load in a T-stance facing the positive Z-axis. When capturing motion data, you should always start or end your take with the performer in a T-stance facing the positive Z-axis.

- 2 From the Characters folder of the Asset browser, drag an Actor asset into the scene .



Add an Actor to the scene.

The name “Actor” appears in the Actors folder of the Scene browser, the Actor Settings display in the Navigator window, and a gray model displays in the scene.

- 3 In the Viewer window, select the Actor’s hips and translate until the Actor appears inside the cloud of data markers.
- 4 Translate, scale, and rotate the Actor and its body parts until the data markers are appropriately aligned.

TIP Try to position the Actor’s body so that the markers are placed exactly as they were on the performer’s body.

- 5 In the Actor settings, click the MarkerSet button and select Create in the Marker Set menu.
- 6 In the Scene browser, click the Lock button to keep the Actor settings in the Navigator window.
- 7 Alt-drag each optical marker into the appropriate body part cell of the Actor representation. Each cell can have a maximum of five markers.

As you drag markers into the Actor representation in the Actor Settings, white markers representing the Marker set appear around the light blue optical sensors in the Viewer window. The cells in the Actor representation display the number of markers affecting each body part, and the names of the sensors appear in the Object(s) List.

NOTE Make sure to deselect each marker after you are finished dragging it, otherwise it is dragged into each successive cell. When using a Glove device, place hand markers into the wrist cells, and the Glove reference into the Glove reference fields in the hand cells. To see the Glove reference fields, click the hand cell in the Actor representation.

- 8 In the Actor settings, click Snap to calculate offsets and to activate the mapping in the Actor settings.
 - 9 Click TR in the dialog box that appears asking how you want to recalculate the Marker set offsets. TR indicates that you want to recalculate them based on both translation and rotation
- The Actor is active, and the position of the sensors match the Actor's body parts. The Marker set links the sensors and the Actor, letting the Actor move using the optical motion data.

After you have created a Marker set for an Actor, you can select the Actor as a motion source for a characterized character.

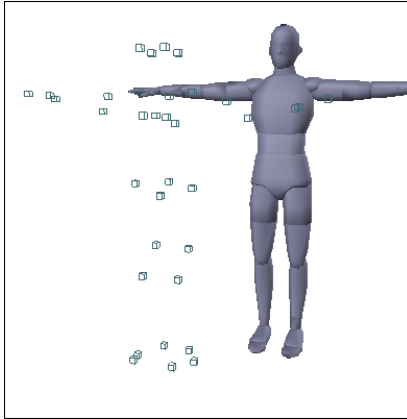
- [Actor assets](#) on page 1163
- [Marker sets](#) on page 1185
- [Creating an Actor](#) on page 1164
- [Importing a Marker set](#) on page 1191
- [Exporting a Marker set](#) on page 1193
- [Connecting an Actor to a character](#) on page 1166

Establishing a Zero Point

Before creating a Marker set, you must establish a zero point for your Actor, which is the stance where both translation and rotation are set to zero. By default, the Actor settings use the T-stance as the zero point. All subsequent movements are based on this zero point.

If your capture session does not begin with a T-stance, the Actor's limbs must be rotated to meet the starting location of the motion capture markers or sensors.

Before rotating the Actor, you should translate it to occupy the same space as the sensors. This makes it easier to match the markers .



The Actor needs to be translated to occupy the same space as the markers.

Even if you started the capture session with your performer in a T-stance, you should reposition and scale the Actor to the sensors before you create the Marker set.

TIP When transforming the Actor to match its sensors, you do not have to be precise. You can add additional offsets to compensate for poor placement later in the mapping process.

After you activate the Actor's Marker set, you may also have to adjust the position, rotation, or scale of the Actor's arms, legs, torso, chest, or head.

You can adjust your Actor using the Actor Controls window (see [Actor Controls window](#) on page 1175).

- [Marker sets](#) on page 1185
- [Actor Controls window](#) on page 1175
- [Creating and defining a Marker set with optical data](#) on page 1186
- [Creating and defining a Marker set with magnetic data](#) on page 1189

Creating and defining a Marker set with magnetic data

To create and define a Marker set with magnetic data:

- 1 Load a file containing set of magnetic motion data.

In the Viewer window, yellow markers containing magnetic motion data display as they were captured on the performer.

Ideally, the markers should be in a T-stance facing the positive Z-axis. When capturing motion data, you should always start or end your take with the performer in a T-stance facing the positive Z-axis.

- 2 Add an Actor asset to the scene.

The name “Actor” appears in the Actors folder of the Scene browser, the Actor Settings display in the Navigator window, and a gray model displays in the scene.

- 3 In the Viewer window, select the Actor’s hips, and translate until the Actor appears inside the cloud of magnetic markers.
- 4 Translate, rotate, and scale the Actor’s body parts to better align with the markers. Use the various camera perspectives and the Normal and X-Ray display modes as you adjust the Actor.

TIP Try to position the Actor’s body so that the markers are placed exactly as they were on the performer’s body.

- 5 In the Actor settings, click the MarkerSet button and select Create in the Marker Set menu.

By default, the first Marker set you create is named “Marker Set 1” in the Marker Set field. Additional Marker sets are numbered in sequential order.

- 6 In the Scene browser, click the Lock button to keep the Actor settings in the Navigator window.
- 7 Alt-drag each magnetic marker into the Actor representation in the Actor Settings, dropping them into the cell that represents the associated body part. Each cell can have a maximum of five markers.

As you drag markers into the Actor representation, white markers representing the Marker set appear around the yellow magnetic sensors in the Viewer window. The cells in the Actor representation display the number of markers affecting each body part, and the names of the sensors appear in the Object(s) List.

NOTE Make sure to deselect each marker after you are finished dragging it, otherwise it is dragged into each successive cell.

- 8 In the Marker table, click the Oriented header, then click Ok in the dialog box that appears to activate all the Oriented options in the Marker table.

- 9 In the Actor settings, click Snap to calculate translation and rotation offsets, and to activate the mapping in the Actor settings.
- 10 Click TR in the dialog box that appears to indicate that you want to recalculate the Marker set offsets for translation and rotation (TR).

The Actor is active, and the position of the sensors match the Actor's body parts. The Marker set links the sensors and the Actor, letting the Actor move using the magnetic motion data.

NOTE The mapping process is easy, but correctly tuning the Actor requires experience and intuition, especially if you do not remember exactly where the magnetic sensors were positioned on your performer. It is recommended that you keep a photographic record of your captures, and load an image of your performer in the Viewer window background to see the position of the sensors.

- [Actor assets](#) on page 1163
- [Marker sets](#) on page 1185
- [Creating an Actor](#) on page 1164
- [Establishing a Zero Point](#) on page 1188
- [Importing a Marker set](#) on page 1191
- [Exporting a Marker set](#) on page 1193

Importing a Marker set

To import a Marker set:

- 1 Select Import from the Marker Set menu in the Actor Settings.
- 2 From the Open directory dialog box that appears, choose a Marker set to import.

- [Marker sets](#) on page 1185
- [Creating a Marker set](#) on page 1185
- [Exporting a Marker set](#) on page 1193

Renaming a Marker set

To rename a Marker set:

- 1 Select Rename from the Marker Set menu.
- 2 Type a new name in the Current Marker Set field.

- [Actor assets](#) on page 1163
- [Marker sets](#) on page 1185
- [Importing a Marker set](#) on page 1191
- [Exporting a Marker set](#) on page 1193
- [Creating a Marker set](#) on page 1185

Deleting a marker from a Marker set

To delete a marker from a Marker set:

- 1 Select the name of the marker in the Model column, and press Delete on the keyboard.

WARNING If you click Delete in the Marker Set menu, you will delete the entire Marker set.

- [Actor assets](#) on page 1163
- [Marker sets](#) on page 1185
- [Deleting a Marker set](#) on page 1192

Deleting a Marker set

To delete a Marker set:

- 1 Select Delete from the Marker Set menu.

- [Actor assets](#) on page 1163

- [Marker sets](#) on page 1185
- [Creating a Marker set](#) on page 1185
- [Importing a Marker set](#) on page 1191
- [Exporting a Marker set](#) on page 1193
- [Renaming a Marker set](#) on page 1192

Exporting a Marker set

To export a Marker set:

- 1 Select Export from the Marker Set menu.
- 2 From the Save directory dialog box that appears, type a file name to save the current Marker set as an *.hik* file.

The *.hik* file format lets you save Marker sets and reuse them on other Actors.

- [Marker sets](#) on page 1185
- [Creating a Marker set](#) on page 1185
- [Importing a Marker set](#) on page 1191

Optical motion data

76

Optical motion capture involves the recording of data from reflective sensors attached to a performer's body. The movement of the performer is recorded using cameras placed at different angles that capture the translation of each sensor.

There are a few problems inherent with the capture of optical motion data that occur frequently. You can use the MotionBuilder Optical editor to correct these problems.

- [Optical systems and data](#) on page 1195
- [Optical terminology](#) on page 1197
- [Problems with Optical data](#) on page 1198

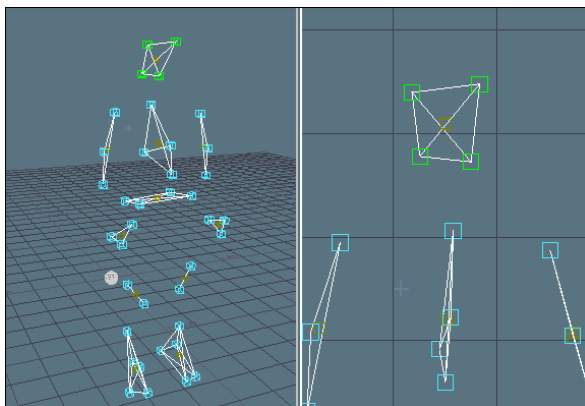
Optical systems and data

There are several different types of optical motion capture system, but they all work in essentially the same manner. Each type uses a series of cameras placed at different angles to track the position of reflective sensors attached to a performer.

Even if you are using optical data files that were captured by someone else, it is useful to know the basics of optical data.

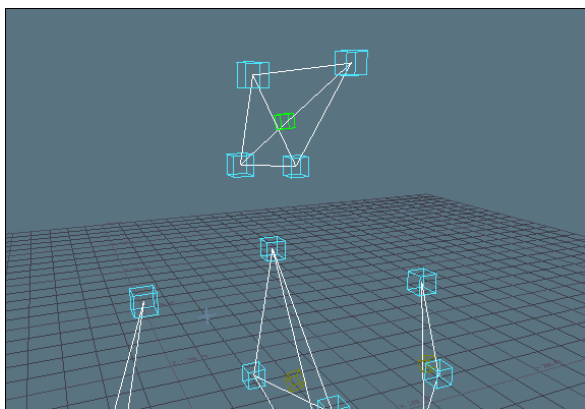
Optical data are sets of translation data. This data consists of many different points with only translations and no rotation or scale data.

To extract rotation data used to position an unlabeled (occluded) marker, you create a Rigid body which is a collection of at least three sensors that define a solid body part. For example, many optical capture setups define four markers for the head .



Four selected markers define the head rigid body.

As the head is tilted, some sensors move up while others move down. When the four optical markers are grouped as a Rigid body, this translation is interpreted as rotation and is indicated by the marker in the center of the Rigid body .



Center Rigid body marker indicates rotation.

Rigid bodies are also an important part of correcting occlusion and partial occlusion. Since an occluded or unlabeled marker is connected to other optical markers, the optical system attempts to calculate the position of the occluded marker based on the other markers in the Rigid body. This calculation may not be sufficiently accurate and may need to be corrected manually.

■ [Optical terminology](#) on page 1197

Optical terminology

Almost all optical devices, file formats, and capture systems have their own terminology that refers to optical capture and reconstructing optical data. This section lists the terms used to describe optical capture, cleaning, and reconstruction methods.

Optical Root

Represented as a sphere, the Optical root is the main reference for optical data imported into MotionBuilder. You can translate, rotate, and scale all markers attached to the optical marker.

Sensor

A sensor is a reflector or light source attached to a performer's body. Sensors are tracked by optical cameras during the capture process. Captured data is combined to create segments.

Marker

Markers are used to identify segments. One or more segments, after being labelled or identified, combine to create a marker of continuous data.

Segment

Refers to data captured from a sensor during an optical capture session. During optical cleaning, you label segments to associate them with markers. Unlabeled segments display as blue asterisks.

Current Segment

The current segment is selected in the Optical editor. When a segment is selected and active (not set to Done in the Label pane), it is colored green.

Rigid Body

Two or more markers that have been grouped together to correct occlusion are called a Rigid body.

Gap

A gap is the space before, after, or between a marker's segments that do not contain sensor data.

Done

Done refers to the state of a marker in the optical system. When set to Done, the marker is no longer an active optical marker and cannot be used within the Optical settings. Done optical markers are non-active markers whose data can be filtered and modified in the FCurves window.

Sample

The position of a sensor recorded by each camera at each frame is called a sample. All samples from each camera are processed by a computer which generates a three-dimensional representation of each sensor's position in time. These are also sometimes referred to as keyframes.

Problems with Optical data

The method of capturing optical data can create the following distinct problems:

- [Occlusion](#) on page 1209
- [Partial Occlusion](#) on page 1211
- [Swapping](#) on page 1206

Each problem can be corrected using either the capture system's proprietary software or MotionBuilder.

Most of the time, optical data is stored in a motion library and the data is already cleaned and fixed by the motion library vendor. If this is the case, you won't have to correct the optical data yourself and it is ready for Character mapping.

Whether you are capturing optical data yourself or using raw, uncorrected optical data files, it helps to understand occlusion, partial occlusion, and swapping. Separate topics describe each of these problems in more detail.

- [Optical terminology](#) on page 1197

- [Reconstructing optical data](#) on page 1199

Reconstructing optical data

This topic explains how to use the Optical settings to reconstruct and correct some common optical problems. A suggested workflow is as follows.

To reconstruct optical data:

- 1 Import an Optical motion file. You can import files to transfer optical data, raw data and skeletal data files between MotionBuilder and other software packages, applications, and dedicated hardware.
- 2 Make sure a Navigator window is open so that you can view the optical data for the selected optical marker.
- 3 Label all segments appearing at the beginning of your motion file, or at a location where the most segments are seen. When you label a segment, it becomes a marker. See [Segments and Labelling](#) on page 1200.
- 4 Create Rigid bodies using the markers you labelled in step 3. See [Creating a rigid body](#) on page 1203.
- 5 Create an Actor and use the optical markers to define the Actor's marker set. This is an optional step but highly recommended. Using an Actor makes it easier to view problems such as marker swapping and noise. See [Creating an Actor](#) on page 1164.
- 6 Eliminate marker swapping. While labelling markers, you may find that two markers that have passed close to one another have been swapped. [Eliminating Swapping](#) on page 1207.
- 7 Fix noise and partial occlusion by studying and correcting Rigid body quality. See [Correcting rigid body quality](#) on page 1204.
- 8 Fill in gaps. MotionBuilder provides two methods of filling in gaps: filling with unlabeled segments and filling with interpolation. See [Filling Gaps with Unlabeled Segments](#) on page 1208 and [Filling Gaps with Interpolation](#) on page 1215.
- 9 Switch all optical markers to Done so that further filtering may be applied using the FCurves window.

- [Optical systems and data](#) on page 1195

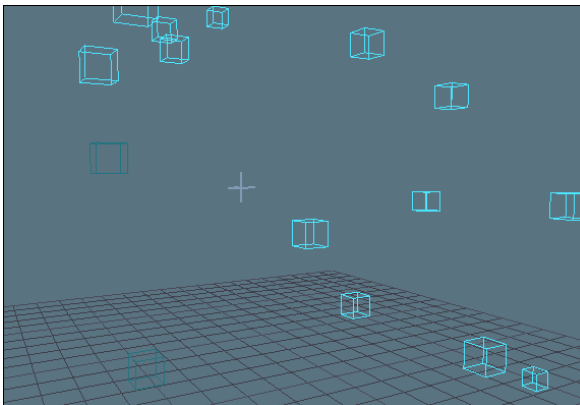
- [Problems with Optical data](#) on page 1198
- [Optical motion data](#) on page 1195

Optical asset

An optical root for captured or imported optical data. The Optical asset is only available in MotionBuilder.

Segments and Labelling

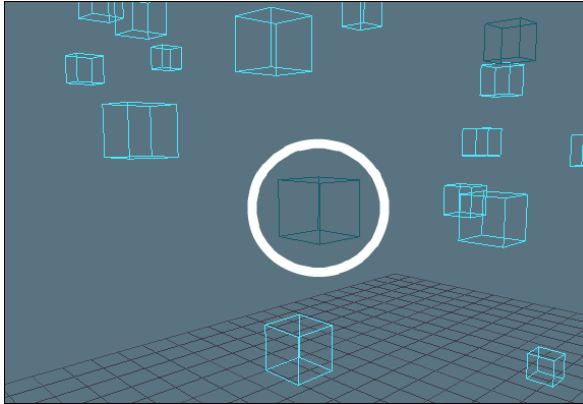
In MotionBuilder, segments refer to the captured data from an optical motion capture session. Unlabeled segments are segments that have not been labelled to markers. Unlabeled segments appear as an asterisk in the MotionBuilder scene . Asterisks cannot be directly selected.



Unlabeled markers are shown as a dark blue asterisk.

When a segment is labelled, it is associated with a marker in the Marker list. A marker can be associated with more than one segment, but not at the same time. This is how the Optical settings deal with occlusion: by labelling a segment before the sensor is occluded and then labelling the segment when the sensor reappears. A marker then has all the data segments captured for a certain sensor. MotionBuilder interpolates the missing data between two segments using a gap. Data in a gap is created using the extracted Rigid body information.

Markers are light blue if they contain a segment at the current time and dark blue if they are occluded .



Occluded segments are shown as dark blue cubes.

Markers show up as occluded only after they have been associated with at least two data segments, or have been connected to other markers using a Rigid body.

The dark blue markers serve as a mathematical estimate of where the occluded marker should be in the scene. This estimate is based on interpolation between data segments and placement based on Rigid bodies.

Most optical capture systems already create a Marker set. This Marker set is shown in the Label menu. If you are not satisfied with the Marker set, MotionBuilder lets you remove and re-label them.

■ [Optical systems and data](#) on page 1195

Labelling markers

To label markers:

- 1 Select Label from the Label pane.
- 2 Select the marker to be re-labelled from the Marker list or the Viewer window.

You can also use the Add and Remove buttons at the bottom of the Marker list to add or remove markers.

- 3 In the Viewer window, click the asterisk (unused segment) to be labelled. The segment appears in the Optical editor. You may have to scroll the Timeline indicator if the segment that you are looking for is presently occluded.
 - 4 Drag the Timeline indicator in the Optical editor to find which asterisk should be selected for the next segment. The combination of the Label Helper and Rigid bodies proposes the best segment.
- [Problems with Optical data](#) on page 1198
 - [Optical Editor](#) on page 1216

Rigid bodies

After all the markers are properly labelled to segments, you can build Rigid bodies. This helps match markers and reconstruct gaps in data. Rigid bodies also extrapolate rotation data.

Before you add a Rigid body:

- A Rigid body can be built from as few as two markers, but it is recommended that you use three or more. Three or more markers let you acquire all rotation data from the Rigid body.
- When selecting markers for a Rigid body, look for markers that appear to be arranged in deliberate groups.
- A marker cannot be used in more than one Rigid body.

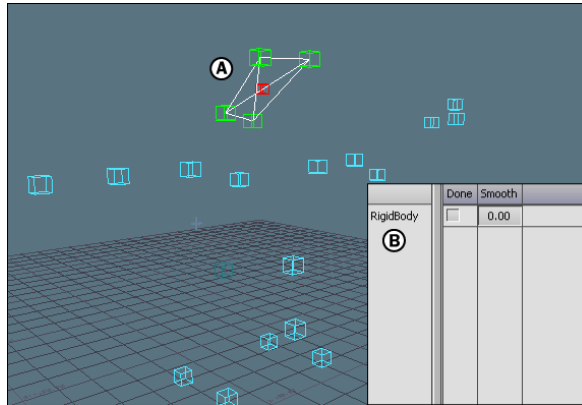
There are two methods for creating Rigid bodies: one method creates a Rigid body from a selection of markers, the second method lets you select each marker for the Rigid body as you go.

- [Creating a rigid body](#) on page 1203
- [Correcting rigid body quality](#) on page 1204
- [Removing a rigid body](#) on page 1204
- [Monitoring rigid body quality](#) on page 1205

Creating a rigid body

To create a rigid body:

- 1 Ctrl-click to select a group of markers that you want to act as a Rigid body.
- 2 In the Rigid Bodies pane, click Add to create a Rigid body from the selected markers .



A. Labelled segments are joined as a Rigid body in the Viewer window. B. A Rigid body is added to the Rigid body list.

An anchor point is created at the center of the Rigid body, referred to as a Rigid body marker. The Rigid body is also calculated.

NOTE It is very important to create Rigid bodies on a frame where your optical markers are arranged in a T-stance or an extended pose (arms and legs fully extended, reaching towards their limits). You can recalculate Rigid bodies using the Snap button.

- [Removing a rigid body](#) on page 1204

Removing a rigid body

To remove a rigid body:

- 1 Select the Rigid body to be removed from the Scene browser, Marker list, Rigid Body list, or Viewer window. To select a Rigid body in the Viewer window, select its anchor point.
- 2 Click Remove. A dialog box appears asking if you are sure you want to remove the Rigid body.
The current Rigid body refers to the selected Rigid body. If you have selected more than one, the last selected Rigid body is the current one.
- 3 Do one of the following:
 - Click Ok to remove the marker from the Marker list. Only the marker is removed. Segments labelled to this marker are unlabeled and added to the number of unlabeled segments.
 - Click Cancel to abort the removal of the marker. The marker and its labelled segments are unchanged.

- [Rigid bodies](#) on page 1202
- [Correcting rigid body quality](#) on page 1204

Correcting rigid body quality

- 1 Select the Rigid body you want to correct from the Rigid Body list.
- 2 Examine the Quality Bar and look for a pure black, or close to pure black region.
- 3 Step through the markers that comprise the selected Rigid body to find the marker containing bad data. Double-click to select each marker individually.
The marker with the segment that contains bad data should have a peak or jump that matches the black region.
- 4 Move the Timeline indicator inside the segment with the bad data.
- 5 M-click on the start or end of the data segment and drag until the peak disappears.

The area between either the edge of the original data segment and its new start or end is colored light green.

NOTE To extend a data segment or gap in the Optical editor, M-click and drag on the edge of the area to be increased.

The light green segment is re-interpolated, removing the noise and updating the Quality Bar. Continue searching for other black areas at the start or end of data segments.

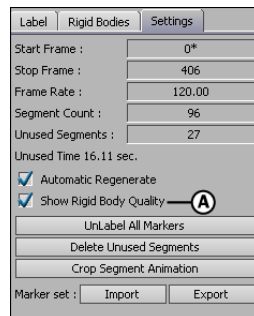
- [Removing a rigid body](#) on page 1204
- [Monitoring rigid body quality](#) on page 1205

Monitoring rigid body quality

After creating a Rigid body, you can monitor its quality in the Optical editor.

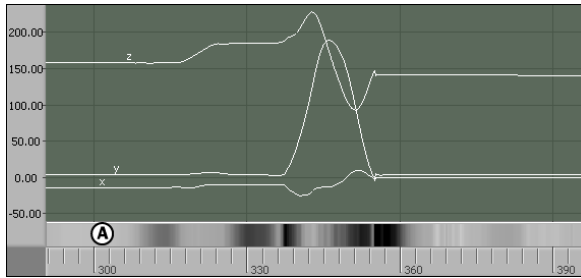
To monitor Rigid body quality:

- 1 Select Settings from the Optical Options pane.
- 2 Click Show Rigid Body Quality .



A. Show Rigid Body Quality option

A bar appears at the bottom of the Optical editor indicating the quality of the selected Rigid body. (See [Show Rigid Body Quality](#) on page 1225 for more information.)



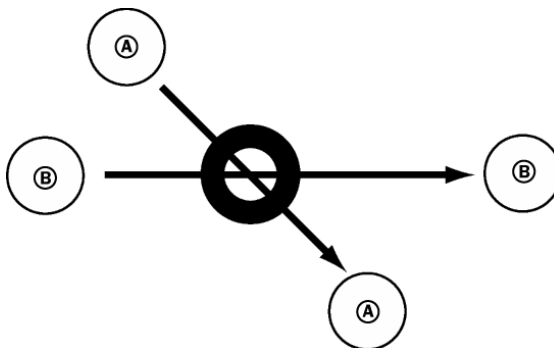
Optical editor A. Quality bar

- [Rigid bodies](#) on page 1202
- [Correcting rigid body quality](#) on page 1204
- [Removing a rigid body](#) on page 1204

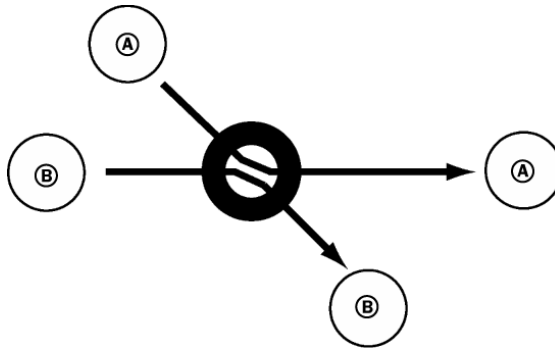
Swapping

Swapping may occur when two markers either cross or pass close to each other. The trajectory of the two markers is misinterpreted by the capture system and the wrong data segments are labelled for each marker.

For example, the following figures demonstrate how swapping may occur.



Sensor A and Sensor B cross paths in front of the camera and continue on straight trajectories.



Sensor A and Sensor B cross paths in front of the camera and appear to veer away on odd trajectories.

The first figure shows what actually occurs and the second figure shows how these markers may be misinterpreted by the capture system.

- [Eliminating Swapping](#) on page 1207
- [Optical systems and data](#) on page 1195

Eliminating Swapping

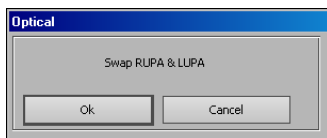
Use the Swap with Marker button in the Segment or Gap options to swap two markers that may have been swapped because of occlusion.

To swap two markers:

- 1 Do one of the following to select the swapping method from the Insert menu in the Label pane:
 - Click Insert Whole Segment to swap entire segments.
 - Click Insert From Cursor to End to swap the segments from the Timeline indicator to the end of the scene.
 - Click Insert from Start to Cursor to swap the segment from the beginning of the scene to the Timeline indicator.
- 2 Select a marker in the Viewer window or from the Marker list in the Label pane.
- 3 In the Optical editor, move the Timeline indicator to where you want the swapping to begin or end (if you are not swapping the entire take).

- 4 Click Swap with Marker and, in the Viewer window, click on the second marker that you want to swap.

A dialog box appears asking if you are sure you want to swap the data segments of the two selected markers.



Optical Swap dialog box

- 5 Click Ok to swap the two markers or click Cancel to abort swapping.

- [Problems with Optical data](#) on page 1198
- [Swapping](#) on page 1206

Filling Gaps with Unlabeled Segments

When all Rigid bodies are created and there are still unlabeled data segments, this is referred to as a gap.

To fill gaps with unlabeled segments:

- 1 Browse through the list of markers and analyze their movements to see gaps where the data should be. You can fill these gaps with segments by automatically searching for unlabeled segments.

The red crosshair shows the possible data segments that most likely fill the gap, and rebuild the current marker's data by joining the two data segments. Keep dragging the Timeline indicator back and forth along the gap to visually analyze what unlabeled segment represents the best fit. Select the unlabeled segment that seems the most appropriate.

NOTE You might find an unlabeled segment that is not considered a probable choice, but whose movement fits in the gap. You can force the segment's data into the current gap by I-clicking the unused segment, which displays as a blue asterisk.

Searching for a marker's missing segments

This topic shows how to search unlabeled segments for a single marker, but the steps involved are the same for matching the current Rigid body or all markers.

To search for missing segments:

- 1 Select Current Marker from the All Markers menu.
- 2 Select a marker from the Marker list.
- 3 Activate Auto Play.
- 4 Do one of the following:
 - If you are not satisfied with the chosen match, click Skip to bypass the match.
 - If the segment matches the marker, click Accept. The unlabeled segment is labelled and associated with the current marker.

Whether you click Skip or Accept, MotionBuilder continues trying to find the next unlabeled segment. When no unlabeled segments are within the Match Area, the message “No segment found” appears.

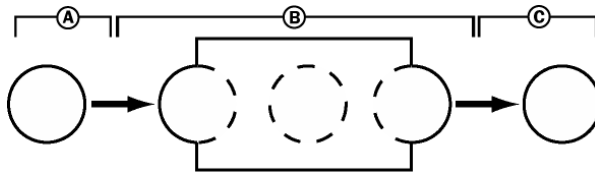
- [Problems with Optical data](#) on page 1198

Occlusion

One problem inherent with optical motion capture is occlusion, when a sensor is hidden from all but three cameras. This occurs when a performer passes by an obstructing object, or when the performer's body comes between the sensor and the camera. Occlusion is impossible to avoid because no single camera angle can capture all sensors at once. Cameras cannot look through a performer's body to find hidden sensors.

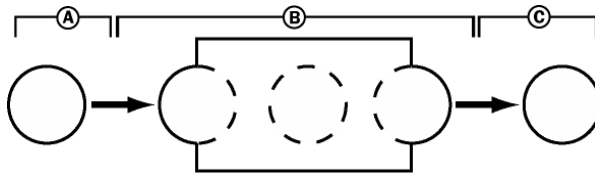
When occlusion happens, the sensor disappears from the camera's view, and the computer has no way of knowing where it went. When occlusion ends and the sensor reappears, some optical capture systems treat the sensor as a new sensor and add a new data segment at the location where the sensor reappears.

For example, let's assume a sensor is travelling in space and becomes occluded by an object. The camera records the trajectory, as illustrated in .



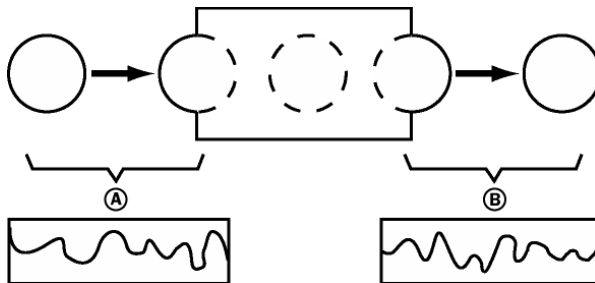
A. A sensor travels through space. **B.** An object obstructs the camera's view of the sensor. **C.** The sensor emerges from behind the obstruction.

How an optical capture system may interpret the situation is shown in .



A. The sensor's position is tracked and recorded as a segment. **B.** The sensor can no longer be tracked. **C.** A new sensor appears. The system records a new segment.

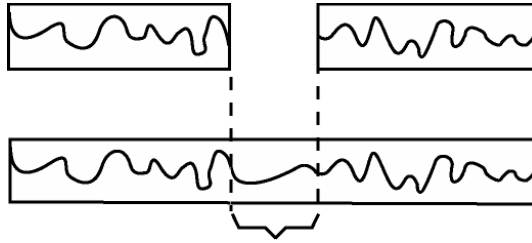
When the sensor reappears, the optical system has no way of knowing that it is the same sensor recorded as segment 1, so it begins a new data segment .



A. A new data segment begins. **A.** Segment 1 is recorded. **B.** Although it is the same sensor, a new segment is recorded.

Therefore, the raw data capture generates a large number of disconnected data segments. It is not uncommon for a thirty-second capture session to generate hundreds of different data segments.

For all of this data to be of any use, all these segments have to be connected together to create continuous data for each sensor .

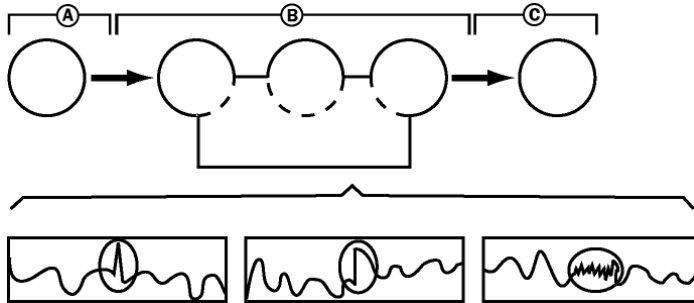


Connecting data segments from the same optical markers

- [Problems with Optical data](#) on page 1198
- [Optical systems and data](#) on page 1195
- [Partial Occlusion](#) on page 1211

Partial Occlusion

Partial occlusion may generate noise or a misinterpretation of the marker's position when either a sensor is placed too close to another on the performer's body, or when a sensor is partially hidden from one of the cameras .

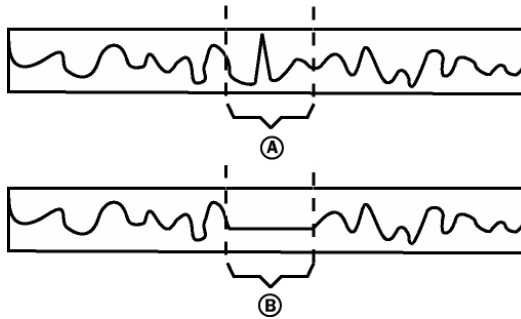


A. Sensor is tracked and recorded correctly. B. Sensor is partially occluded. The capture system cannot see the entire sensor, so it may record a peak, a data shift, or noise. C. Sensor is tracked correctly.

If you examine the data generated by a sensor that has been partially occluded, you can see peaks, shifts, or noise . These are commonly found just before a sensor becomes fully occluded.

In these cases, the data is good on either side of the noisy part of the data segment, so you need a way to trim out only the noisy portion of the function curve, and keep the correct data on either side.

The Optical tool lets you split a data segment into two segments, so that you can keep the data you want and discard the noise .



A. Artifact in an otherwise correct curve. B. The artifact is removed and the gap is filled by interpolating between the data segments (in this case, constant interpolation).

Recognizing artifacts (unnatural data effects) demands careful analysis of the data segment at the point where the marker begins to move erratically. Playing back the take at a slow speed is a good way to find where the markers begin to drift, jump, or shift.

- [Problems with Optical data](#) on page 1198
- [Optical systems and data](#) on page 1195

Removing Peaks and Noise

Just before a marker disappears from occlusion, it may be partially occluded, causing noise, peaks, or other jumps in the capture data. During playback, you may notice that the marker appears to be moving normally, then it begins to fly off on an incorrect tangent. The Quality Bar shows this as a black area. These normally appear near the end of a data segment.

There are two methods of correcting bad data segments:

- Split and remove the part of the data segment containing the peak, noise, or jump. This method is used for removing bad data within a segment.

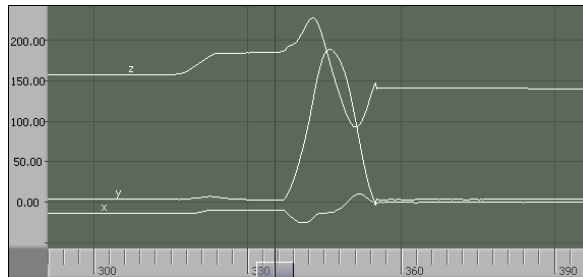
- Change the start or end of the data segment to remove the bad data. This forces MotionBuilder to interpolate the data before or after the data segment, usually resulting in better, more accurate movement, especially within a Rigid body. (Correcting rigid body quality)

Using Gap Interpolation to Remove Noise

Gap interpolations are also used to interpolate between two segments where there is noise. The segment that contains the noise is split, then removed. Gap interpolation reconnects the two segments.

To split the segment:

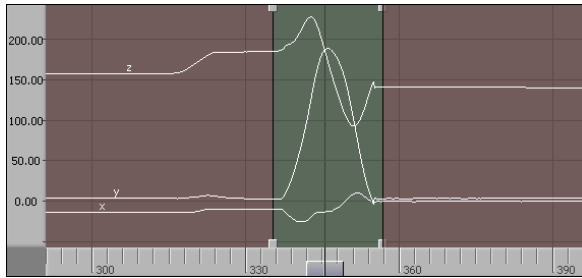
- 1 Place the Timeline indicator at the beginning of the noise .



Timeline indicator positioned at the beginning of the noise.

Because the Timeline indicator is placed in a segment, the Segment menu is activated in the Optical Options pane.

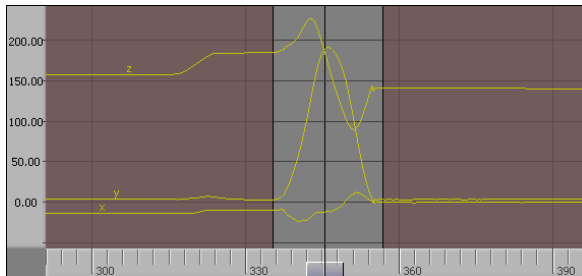
- 2 Click Split Segment in the Segment menu. The segment is split into two separate segments.
- 3 Place the Timeline indicator at the end of the noise in the new segment, and split this segment as described in step 1 and 2.
You now have three segments with the center segment containing the noise to be removed .



Two new segments are created.

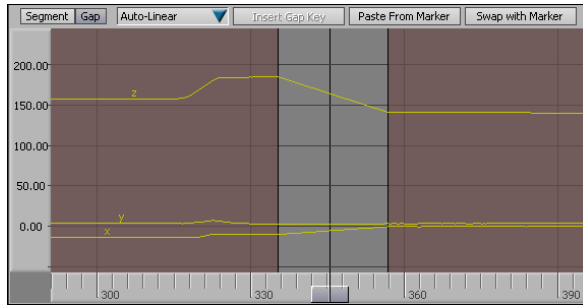
- 4 Place the Timeline indicator inside the segment to be removed and click Remove Segment in the Segment menu.

A gap is created. By default, its interpolation is set to Auto-Rigid Body which calculates the data based on the Rigid body .



A gap is created by clicking the Remove Segment option.

If you want, you can change the Gap Interpolation. For example, shows the gap using Auto-Linear interpolation. For more information, see [Filling Gaps with Interpolation](#) on page 1215.



The gap is interpolated using Auto-Linear interpolation.

- [Filling Gaps with Interpolation](#) on page 1215
- [Removing Peaks and Noise](#) on page 1212
- [Correcting rigid body quality](#) on page 1204

Filling Gaps with Interpolation

To fill gaps with interpolation:

- 1 Select the marker with the gap that you want to fill using interpolation.
 - 2 Move the Timeline indicator to the gap that you want to interpolate. The Gap options display above the Optical editor.
 - 3 Select one of the gap interpolation methods (Auto-Linear, Auto-Constant, and so on) from the Gap Interpolation field. By default, it is set to Auto-Rigid Body.
 - 4 Change the gap interpolation to Control Curve. The interpolation keeps the shape of the previously selected Gap interpolation.
 - 5 For more control over the shape of the data in the gap, add Gap keys.
- [Problems with Optical data](#) on page 1198

Optical Settings

The Optical settings let you edit and correct optical data associated with an optical root. When you import a data file containing optical data, an optical root is automatically created.

The Optical Settings are divided into three main areas:

- [Optical Editor](#) on page 1216
- [Optical Options pane](#) on page 1218
- [Segment and Gap Options](#) on page 1226

Use the Optical Settings to edit *active optical data*. When processing optical data, the Optical settings set up Rigid bodies that solve occlusions in real-time.

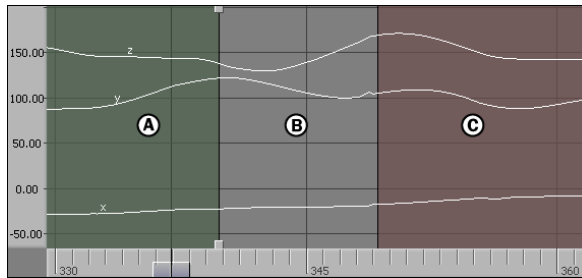
Active optical data refers to optical markers that are not set to Done in the Label pane (Optical Options). When set to Done, optical markers are no longer active in the Optical settings and can be filtered using the FCurves window.

The difference between active optical data and non-active optical data (markers set to Done) is a basic concept that should be understood before using the Optical settings. There are many other basics and terminology that may be of help when using the Optical settings.

Optical Editor

The Optical editor lets you correct optical data, fix poor gap interpolation, switch swapped markers, and perform other optical data reconstruction. The Optical editor is empty until you select an optical marker from either the Scene browser or the list of markers in the Label pane.

The Optical editor shows all the data segments labelled by the selected marker. Segments display using one of three colors which indicate either the type of data or the segment's status .



A. Green: Current segment B. Gray: Interpolated data C. Red: Labelled data segment

The following table describes the three colors of segments and what they indicate.

| Segment Color | Represents |
|---------------|---|
| Red | Indicates an inactive labelled data segment. |
| Green | Indicates an active data segment on which actions are performed, referred to as the <i>current segment</i> . To make a segment the current active segment, move the Timeline indicator within the segment and make sure that the label is not set to Done. Setting a label to Done indicates that it is inactive in the Optical settings and active in the FCurves window, for FCurve editing and/or filtering. |
| Gray (Gap) | Shows interpolated data before, after, or between labelled segments. Gray segments are also referred to as gaps, caused by occlusions in the data. |

- [Optical systems and data](#) on page 1195
- [Optical Settings](#) on page 1216

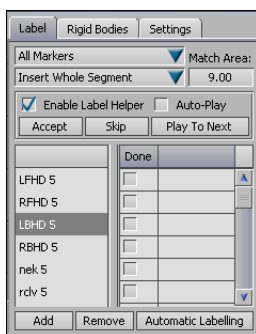
Optical Options pane

The Optical Options pane lets you label markers, create Rigid bodies, and perform other commands on optical data. The Optical Options pane consists of three tabs:

- [Label tab](#) on page 1218
- [Rigid Bodies tab](#) on page 1222
- [Settings tab](#) on page 1223

Label tab

The Label tab lets you add, remove, and change the names and states of markers. You can also automatically label segments using the Automatic Labelling option.



Label pane

Search Mode

Use the Search Mode menu to select the search method for finding missing segments when automatically playing your motion for either the current marker, the current Rigid body, or all markers.

NOTE The Search Mode is only used by the Auto Play function.

The Search Mode menu contains the following options:

| Search mode | Description |
|--------------------|--|
| Current Marker | Finds unlabelled segments for the currently selected marker to be placed in the current segment. |
| Current Rigid Body | Finds unlabelled segments for a marker based on its position within a Rigid body. |
| All Markers | Finds unlabelled segments for all markers in the Marker list. |

Match Area

Set a value in the Match Area field to specify the radius of the marker search.

The Match Area is a search distance used only in conjunction with the Automatic Labelling buttons Accept, Skip, Play to Next, and the Auto-Play option.

Insert Menu

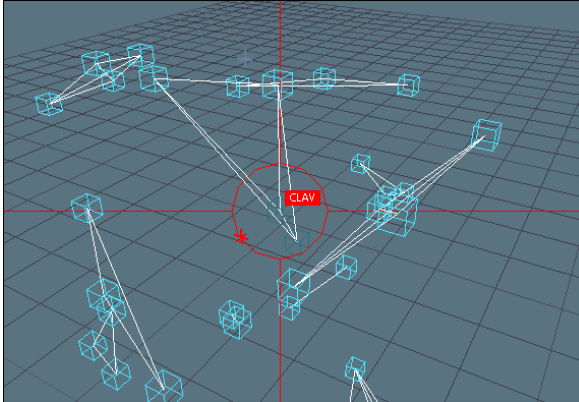
Use the Insert menu below the Search Mode menu to select the segment swap regions.

The Insert menu contains the following options:

| Insert option | Description |
|-----------------------------|--|
| Insert Whole Segment | Swaps entire segments. |
| Insert From Cursor to End | Swaps the segments from the Timeline indicator to the end of the scene. |
| Insert from Start to Cursor | Swaps the segment from the beginning of the scene to the Timeline indicator. |

Enable Label Helper

Activate the Enable Label Helper option to visualize the search area and proposed assignments. The Label Helper is a red crosshair and a circle that gives you a visual reference of the distance between the search area and the assignments.



Unlabeled segment found during search is shown with a red crosshair, a circle, and the label name.

Auto-Play

Activate Auto-Play to play the take and survey all the unlabeled segments within the Match Distance radius of any unlabeled marker at each frame.

Each segment found is displayed with the most likely unlabeled segment using a red crosshair and a circle (Label Helper).

Accept, Skip, and Play To Next

Use these buttons during auto-play or automatic and manual labelling to skip the found segment, accept the found segment, and label it using the proposed marker.

Marker List

The Label pane contains the Marker list, which is a list of all the markers used to label data segments in the current motion file. Depending on the optical capture system used to create the motion file, data segments may already be labelled as markers.

Navigate the Marker list using the Up and Down arrow keys. Shift-up and Shift-down skips between markers grouped within the same Rigid body.

The Marker list is split into two columns:

| Column | Description |
|-------------|--|
| Marker Name | Shows the name of the marker. Click the marker name to select the marker in the Viewer window and show its data in the Optical editor area of the Optical settings. Double-click its name to rename the marker. |
| Done | Activate the Done column to lock the marker from the Optical settings. Locking a marker transfers data from the segment to the assigned marker, making the data available to other MotionBuilder tools such as filtering in the FCurves window. Re-activating a marker (not-Done) after using the FCurves window regenerates the FCurves based on the Optical system. This means that FCurve edits are lost permanently. This is one way of undoing multiple filtering steps created in the FCurves window for single or multiple markers. |

Add, Remove, and Automatic Labelling buttons

You can remove markers and label them automatically using the buttons below the Marker list.

Add

Adds a new marker to the bottom of the Marker list.

Remove

Removes the selected marker. Its segments become unused.

Automatic Labelling

Automatically labels segments that disappear and then reappear as the result of occlusion.

Rigid Bodies tab

Creating Rigid bodies is a method of grouping markers together to fix problems such as occlusion and partial occlusion. A Rigid body cannot be created if there are no markers.

The Rigid Bodies pane lists all the Rigid bodies created for use with the current motion file.



Rigid Bodies pane

Rigid Body List

Navigate the Rigid Body list using the Up and Down arrow keys. The Right and Left arrow keys step backwards or forwards through the motion file.

The Rigid Body list is split into three columns:

| Column | Description |
|-----------------|--|
| Rigid Body Name | Shows the name of the Rigid body. Click the name column to select the Rigid body, show its location, and show which markers it contains in the Viewer window. Double-click a Rigid body name to rename it. |
| Done | Locks the Rigid body when you have finished with optical reconstruction. |

| Column | Description |
|--------|---|
| Smooth | Resamples data to remove segment noise. This can be an alternative to filter smoothing for live input when real-time smoothing is required. |

Add, Remove, Snap

Use the Add and Remove buttons to add and remove Rigid bodies. Use Snap to center the anchor point.

Add

Creates a new Rigid body at the bottom of the list based on the selected markers. This is necessary when all offsets are calculated. It is very important that the marker positions represent an extended pose, for example, a T-stance.

Remove

Removes the selected Rigid body from the list.

Snap

Centers the anchor point for the currently selected Rigid body or for the entire list. This basically resets the offset calculations, equivalent to creating a new Rigid body marker.

Regenerate Marker Animation

Use the Regenerate Marker Animation button to regenerate the sample data based on its Rigid body. You can regenerate animation for the currently selected Rigid body or for the entire list.

Settings tab

The Settings tab contains options to set preferences and modes that are used to correct Rigid body quality, label markers, and clear or swap segments. You can also import and export Marker sets.

Label Rigid Bodies Settings

Start Frame : 250

Stop Frame : 1450

Frame Rate : 120.00

Segment Count : 121

Unused Segments : 0

Unused Time 0.00 sec.

☒ Automatic Regenerate

☐ Show Rigid Body Quality

UnLabel All Markers

Delete Unused Segments

Crop Segment Animation

Marker set : Import Export

Settings pane

Start Frame

Displays a value for the start time of the motion file. Double-click the Start Frame field to enter a new value for the start time.

Stop Frame

Displays a value for the Stop Frame of the motion file. Double-click the Stop frame field to enter a new value for the stop time.

Frame Rate

Displays the frame rate of the motion file. This value cannot be changed.

Segment Count

Displays the total number of segments in the motion file. This value cannot be changed.

Unused Segments

Displays the number of segments that have not been labelled by markers. Unused segments are also referred to as unlabeled segments.

Unused Time

Displays the total amount of time for all unlabeled segments.

Automatic Regenerate

Activate the Automatic Regenerate option to automatically regenerate optical data as it is being constructed. This option must be active if you want to view changes in the Optical settings in real-time.

Several options in the Optical Options pane are not available if Automatic Regenerate is disabled.

Show Rigid Body Quality

Use the Show Rigid Body Quality option to display a grayscale band at the bottom of the Optical editor indicating the quality of the selected marker relative to its Rigid body.

Data which may suffer from partial occlusion is indicated in the Quality Bar using different shades of gray. Pure black indicates very poor data, noise, or peaks. Pure white indicates good data.

Before you can use this option, you must create at least one Rigid body.

See also [Monitoring rigid body quality](#) on page 1205.

UnLabel All Markers

Use the UnLabel All Markers button to remove all links between markers and data segments. The list of markers remains, but each marker is no longer assigned to a data segment.

Delete Unused Segments

Use the Delete Unused Segments button to remove all segments that have not been labelled by a marker. You should only do this after you have completely reconstructed your optical data and the remaining unused data segments do not affect your animation.

Crop Segment Animation

Use the Crop Segment Animation button to remove unwanted optical data. This option is useful if you have a large amount of optical data and you only want to keep a small part of it.

To use this feature, set the starting point of the data you want to keep in the Start Frame field. Set the end of the data in the Stop Frame field and click Crop Segment Animation. All data before the Start Frame time and after the End Frame time is deleted.

Import and Export buttons

Use the Import and Export buttons beside the Marker set to import and export Marker sets created in the Optical editor.

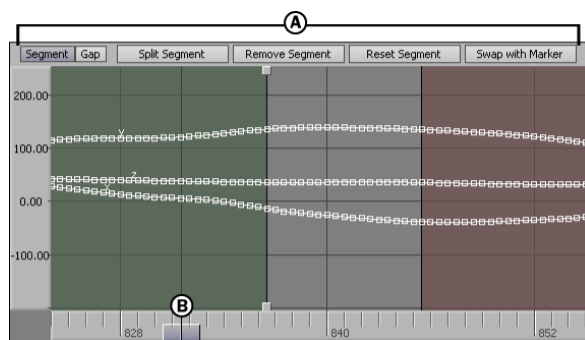
- [Optical Settings](#) on page 1216
- [Optical systems and data](#) on page 1195
- [Segment and Gap Options](#) on page 1226
- [Optical Editor](#) on page 1216

Segment and Gap Options

The Segment options or the Gap options display above the Optical editor, depending on whether the Timeline indicator is positioned over a labelled segment or a gap in the Optical editor.

Segment Options

The Segment options display above the Optical editor, and are available only when the Timeline indicator is positioned over a labelled segment in the Optical editor .



A. Segment options display when the Timeline indicator is within a segment. B. The Timeline indicator is within a segment.

Split Segment

Splits the current segment. This is useful if you want to remove part of a data segment that contains a spike, noise, or other results of partial occlusion.

NOTE Split Segment permanently splits the segment and cannot be reset by the Reset Segment function.

Remove Segment

Removes the current segment from its marker. This is useful if you have labelled a segment with the wrong marker and you want to label the segment to another marker.

Reset Segment

Resets the data segment to its original state. This is useful after you have modified a segment using a control curve or performed other operations and you want to return the segment to its original form.

If the original segment was split, this action won't reassemble the segments, but resets all other modifications made to the current segment.

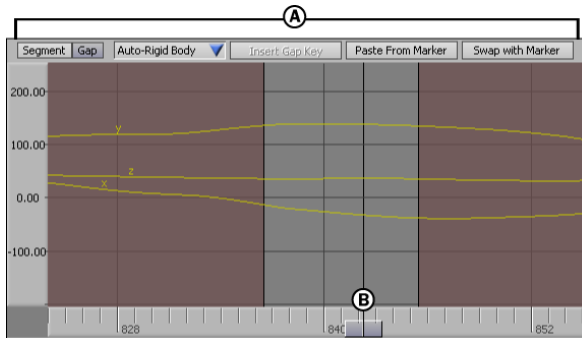
Swap with Marker

Swaps data from the currently selected marker to another marker. The swapping method is determined by the settings in the Insert menu in the Label pane.

For more information on using Swap with Marker, see [Eliminating Swapping](#) on page 1207.

Gap Options

The Gap options are available only when the Timeline indicator is positioned over a gap in the Optical editor .



A. Gap options display when the Timeline indicator is within a gap. B. Timeline indicator is within a gap.

In some cases, it is impossible to fill gaps with data segments. For example, when dealing with instances of occlusion where the sensor could not be captured. In these cases, use the appropriate interpolation setting to reconnect two segments.

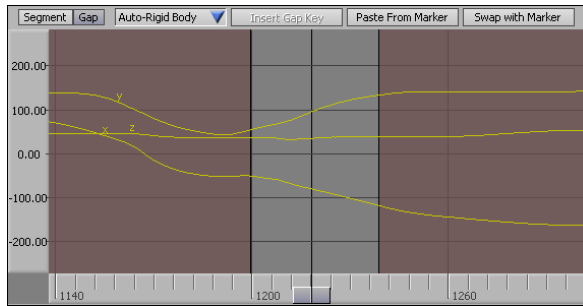
Gap Interpolation

The options in the Gap interpolation menu let you change the interpolation of a gap. There are six different modes: Auto-Rigid Body, Auto-Constant, Auto-Linear, Auto-Bezier, Control Curve, and Sample Curve.

When choosing the interpolation, consider whether you want to paste data over the existing data, edit the existing data, or manually reconstruct the data.

Auto-Rigid Body

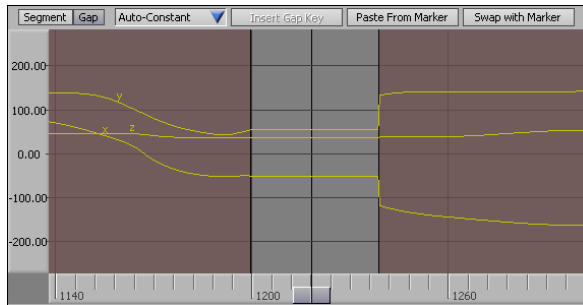
Use this mode when there is a lot of data in the gap. Auto-Rigid Body uses the data information of the other markers that are in the same Rigid body to build accurate data for the current marker. The higher the number of markers in the Rigid body, the more accurate the data.



Gap set to Auto-Rigid Body interpolation

Auto-Constant

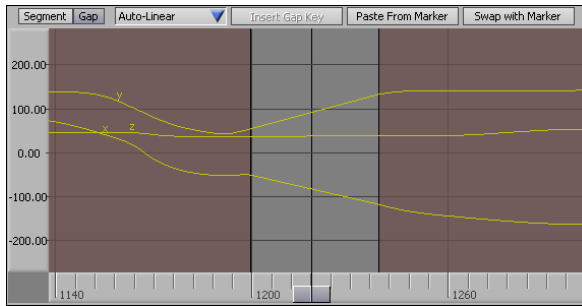
Use this mode to re-interpolate the gap without using the Rigid body information or to prepare the gap for control curve keyframing. Auto-Constant also generates a key of the same value as the first frame of the gap at the last frame of the gap.



Gap set to Auto-Constant interpolation

Auto-Linear

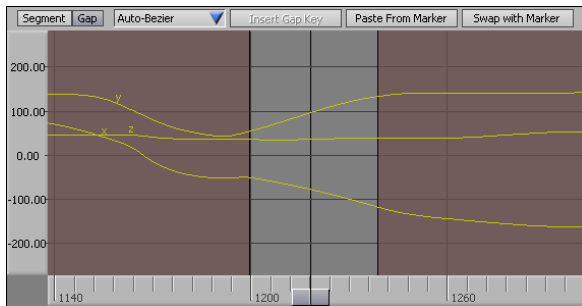
Use this mode to re-interpolate the gap without using the Rigid body information or to prepare the gap for Control Curve keyframing. Auto-Linear also joins the data from the surrounding segments using a linear curve .



Gap set to Auto-Linear interpolation

Auto-Bezier

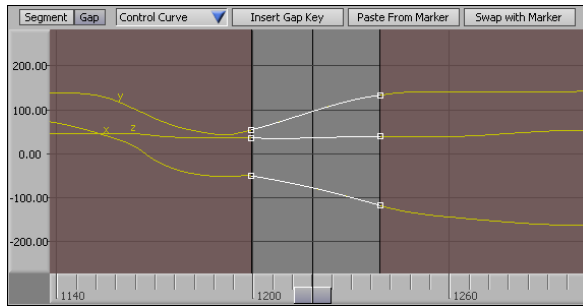
Use this mode when there is not a lot of data to reconstruct, when a smooth interpolation would give better results than the Rigid body information, or to prepare the gap for control curve keyframing. Auto-Bezier should fix most problems because its editable spline curve gives a smooth transition between the two segments .



Gap set to Auto-Bezier interpolation

Control Curve

Use this mode if you want to insert keyframes to edit the gap. The Control Curve Gap Interpolation lets you edit the gap by inserting new keyframes and reconstructing the data manually, or by keyframing over the existing Rigid body information .



Gap set to Control Curve interpolation

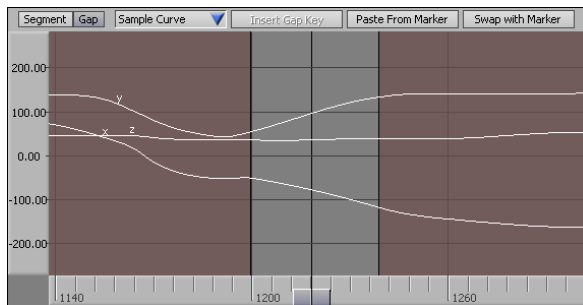
When Control Curve mode is selected, the Insert Gap Key button is enabled. See [Insert Gap Key](#) on page 1232.

If you want to start from the existing Rigid body information, choose Auto-Rigid Body, then switch to Control Curve, or press K to add a Gap key.

If you do not want to start from the existing Rigid body information, choose one of the other interpolation options (Auto-Constant, Auto-Linear, or Auto-Bezier), then switch to Control Curve. The Control Curve matches the previously selected interpolation.

Sample Curve

Use this mode to turn the gap into its raw sample data. This lets you modify each individual key. You may have to zoom in on the curve to view the individual keys.



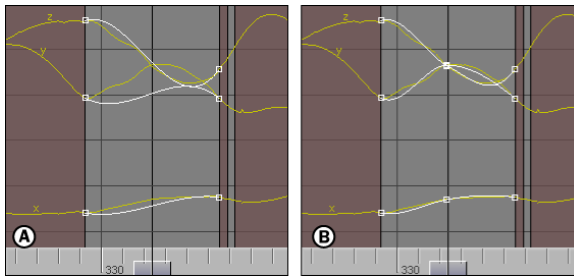
Gap set to Sample Curve interpolation

Insert Gap Key

Inserts a gap key on a control curve between two segments. This button is only available when the Gap Interpolation is set to Control Curve.

To insert gap keys within a gap, select Control Curve in the Gap Interpolation menu. Move the Timeline indicator to the location within the gap where you want to add a key and click Insert Gap Key. This added key does not modify the curves themselves, it glues the control curve to the original curve. You can then modify these keys and change the original curve.

Double-click the added key to select the new gap key. When selected, you can drag the key to change its value or you can use its handles to adjust the slope of the control curve.



A. Control curve before adding a gap key B. Same curve after adding a gap key

Paste From Marker

Pastes data from one marker to another with a global offset. To paste, move the Timeline indicator within a gap, click Paste From Marker, then select the marker you want to paste in the Viewer window. This option generates a control curve in the current gap containing the animation from the other marker with an offset to fill the gap.

When you perform Paste From Marker in a gap, handles are generated with which you can adjust the interpolation.

Swap From Marker

Switches data from one selected marker to another. This option is identical to Swap From Marker in the Segment menu. See [Swap From Marker](#) on page 1232.

■ [Optical Editor](#) on page 1216

Magnetic motion data

77

Magnetic motion capture involves the recording of data from magnetic sensors affixed to a performer's body.

In MotionBuilder, the Actor asset allows you to link that recorded magnetic data to character models in order to make them move.

This section covers the devices, topics, and procedures required when working with magnetic motion data and MotionBuilder.

- [Motion sources](#) on page 1062
- [Actor assets](#) on page 1163
- [Creating a capture area](#) on page 1234
- [Magnetic capture and calibration](#) on page 1233

Magnetic capture and calibration

Magnetic motion capture devices are sensitive to magnetic interference caused by metallic objects such as aluminium heating ducts, metal plumbing fixtures, and steel-reinforced concrete. This can cause noticeable distortion in captured data.

To minimize distortion, you can remove all metallic objects from the capture area. You can also build an elevated stage to raise the capture area and eliminate interference from beneath the studio floor.

Even after taking these precautions, your studio may still contain some magnetic distortion. To compensate for the remaining distortion, MotionBuilder creates an internal 3D distortion grid as part of the calibration process with your motion capture devices.

The 3D distortion grid represents the amount of distortion the sensors receive at different locations of the capture area. While creating the 3D distortion grid, the calibration pole is physically placed at the corner of each square, and the location of the sensors are recorded. A distortion grid is created using the data from all recorded corners.

Before calibrating, do the following:

- Find the best location for your floor grid by walking around your studio holding the calibration pole, and capturing the location of the sensors on the pole.
- Create a floor grid representing the capture area on your studio floor. The grid must be square and each grid unit must have the same dimensions, such as one square foot, or 30.5 cm. Linoleum with a square tile pattern generally works well as it usually has 6 or 12 tiles.

NOTE Although it is not recommended, you may decide to do motion capture without calibrating your environment. This decision depends on the amount of magnetic distortion in your capture environment, as well as the type of production.

- [Creating a capture area](#) on page 1234

Creating a capture area

To create a capture area:

- 1 Decide where to place the capture area in your studio.
Read over the following steps to get an idea of what you need to do. These steps describe how you can create a capture area, and can give you an idea of the best location as well as a reliable way of testing the amount of magnetic interference.
- 2 Place the floor grid.
Decide on the size of each square in your floor grid. Use tiles or tape on the floor to roughly mark each corner of a square grid. Each unit of the grid should use the same dimensions. A 12 x 12 foot grid is a good starting size, but this does not mean that your eventual capture grid is this large. If you have a small studio with only enough space for a 6 x 6 grid, measure this grid and mark the corners with tape.

Place the emitter beside your floor grid about 2 feet (60 cm) off the floor. Keep the emitter in mind when deciding on the placement of your floor grid.

3 Build the calibration pole using the following guidelines:

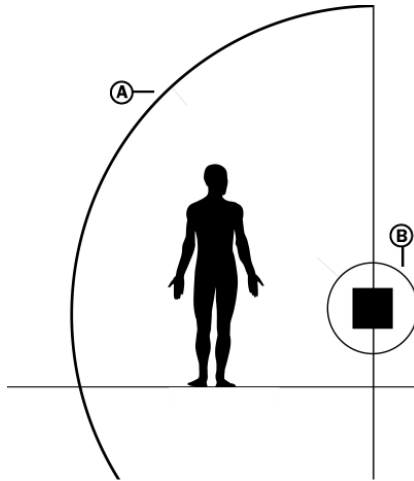
- Build your calibration pole using a non-metallic substance, such as wood or plastic. The pole should be as tall as the action you plan to capture. Avoid using cylindrical poles because the surface may produce ambiguous sensor positions, and it is also easier to place and align sensors on a flat, rather than a rounded, surface.
- Autodesk recommends that you use 8 sensors, although the number of sensors can be increased or decreased depending on the height of your studio and how high you want to capture data.
- To guard against interference from the pole's wiring, you should place the first sensor about five centimeters from the bottom of the pole. The next and all subsequent sensors should be the same distance apart as the dimension of each tile on the floor grid. For example, if you are planning to set up a floor grid with 30 centimeter squares (roughly 1 foot), place the sensors on the pole 30 cm apart.
- When attaching the sensors to the pole, make sure they all face the same direction and align on the pole. In addition, arrange the sensors in ascending order. For example, if the sensor closest to the floor is sensor number 1, the next sensors should be 2, 3, 4, and so on. You can also skip sensors. For example, if the first sensor is number 2, the next can be 4, 6, 8, and 10.

4 Place the emitter.

All magnetic systems work by radiating a magnetic field using an emitter. The placement of the emitter is one of the most important aspects of creating a successful motion capture area.

Autodesk recommends that you place the emitter between 1.5 to 2 feet from the outer edge of the capture area, raised approximately two feet off the floor. You should place the emitter to take advantage of the largest possible capture area.

You should also place the emitter away from machines or other devices that may cause magnetic interference, such as computer monitors. If your studio is small, you can place the emitter within the capture area under an elevated stage or hang it from the ceiling.



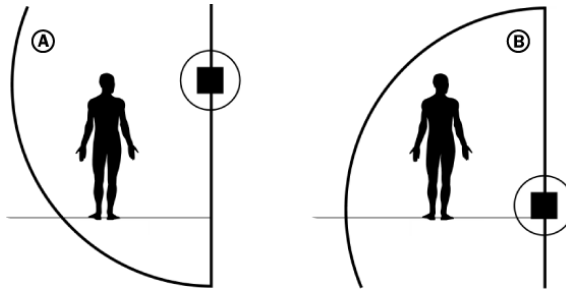
A. External Range limit B. Internal Range limit

The magnetic field is very strong; it is approximately 1.5 feet around all emitters. If the calibration pole or a wired performer stands within this area (Internal Range Limit), it is impossible for the position of the magnetic sensors to be accurately captured.

The magnetic field from the emitter also has a physical range (External Range Limit). If the calibration pole or a wired performer gets too close to the limit or moves outside the range, the position of the sensors cannot be properly captured.

Depending on the magnetic system and the number of emitters, the internal and external ranges may vary. Consult the documentation accompanying your magnetic device for more information on its capture range.

It is important to place the emitter at the proper height. A magnetic field is circular, with its longest range near its horizontal or vertical middle. For best results, place the emitter at a height where the longest part of the magnetic field rests over the capture area. Problems may occur during motion capture if an emitter is too high or too low .



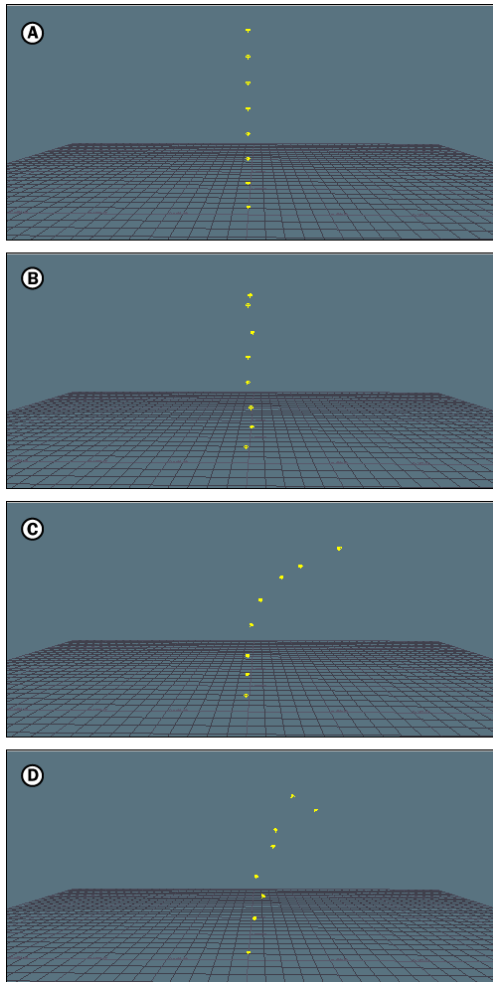
A. Emitter is too high. The performer's feet may not be captured. B. Emitter is too low. The performer's hands may not be captured if they are raised over the head. Even more may be lost if the performer jumps.

5 Test the capture area.

After placing the floor grid, building the calibration pole, and placing the emitter, test the capture area to make sure it does not contain too much magnetic interference.

To test the area, MotionBuilder must be running and the appropriate magnetic device must be added and set up. Then move the pole around the edge of the proposed capture area and around arbitrary locations within the capture area. While you move the pole, watch the Viewer window to see how sensors react to your proposed capture area.

For example, , A represents an ideal capture, because the sensors are straight, and are exactly as they appear on the pole. In , B, the sensors are not completely straight, but would be easy to calibrate. In , C, the sensors are limited for a capture but they can still be calibrated. However, , D shows too much distortion produced by sensor 8 (second from top) relative to sensor 7 (top sensor).



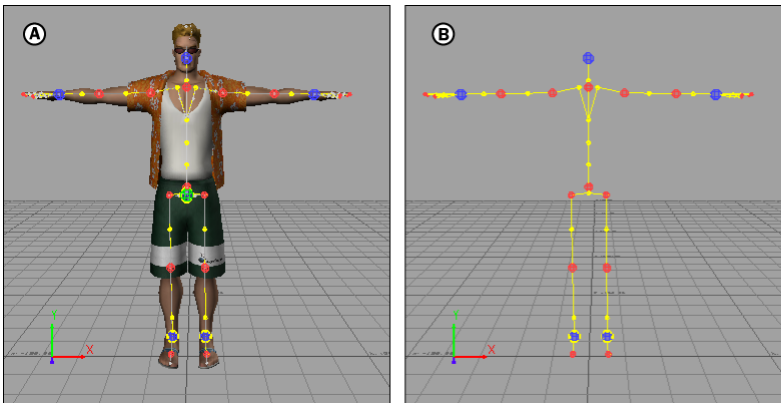
A. Ideal capture B. Suitable capture C. Limited capture D. Poor capture

■ [Magnetic capture and calibration](#) on page 1233

Control rigs

A Control rig is a character manipulation tool that lets you change the position and orientation of a character to create or alter animation. You can only create Control rigs for characters that are characterized.

In the Viewer window, Control rigs display by default as a set of semi-transparent blue, red, and yellow markers on a character model's joints.



A. Character with Control rig B. Control rig

Control rigs are equipped with kinematic tools that let you control the character's skeleton intuitively and automatically achieve smooth and predictable results over the entire body. They provide body part pinning, automatic floor contact, and three different keying modes. All of these elements help you achieve quick, high-level manipulation of a complex structure.

Control rigs let you do the following:

- Create character animation from scratch.
Control rigs are one of the three types of motion source that you can connect to your character to make it move. You can use the Control rig to manipulate your character, then set keyframes on its position over time to create animation.
- Create, save, and reuse poses as you manipulate.

For example, you may want to repeat a certain pose to create a cycle, or use a pose in multiple takes. You can even include any extra limbs, wings, or tails in these poses, using a Character Extension.

- **Edit existing animation.**

When you import a skeleton with animation data into MotionBuilder, you have to plot that animation to a Control rig in order to edit it. When you finish creating or editing animation with a Control rig, you plot the animation back to the model's skeleton to prepare it for export to other 3D software.

While editing character animation with the Control rig you can exaggerate or lessen the character's movements. You can also use the Control rig to permanently offset body parts when retargeting animation from one character to another.

- **Compensate for missing data.**

If you are working with imported motion data, you can use the Control rig to fill in any missing animation.

You can save, modify, and load Control rigs just as you would any other asset. This is useful if you want to use the same settings for pinning, stiffness, reach, and pull on multiple characters.

Refer to the following topics for more information on Control rigs:

- [Types of Control rigs](#) on page 1240
- [Aligning Control rigs](#) on page 1252
- [The Control rig hierarchy](#) on page 1287
- [Visual feedback on Control rigs](#) on page 1271
- [Saving a Control rig](#) on page 111
- [Characterizing a character model](#) on page 1086
- [Creating a Control rig](#) on page 1245

Types of Control rigs

There are two types of Control rigs in MotionBuilder, one that uses only Inverse Kinematics, and one that uses a combination of Inverse and Forward Kinematics. These two rigs are available so that you can choose what type of control best suits your project. Some situations may require fine tuning that may not be possible using Inverse Kinematics alone. In this case, you can use

the FK/IK combination rig. Both Control rigs use special markers that let you adjust the position and rotation of a character's bones and joints.

When using a rig that combines IK and FK, you can adjust the amount of reach between the two rigs. Adjusting the reach lets you control how much the rig follows the IK effectors in terms of rotation and translation.

- [Control rigs](#) on page 1239
- [The Control rig hierarchy](#) on page 1287
- [Creating a Control rig](#) on page 1245
- [Customizing the Control rig hierarchy](#) on page 1289
- [Kinematics](#) on page 1241

Kinematics

When you work with bones on a skeleton or effectors on a Control rig, the rules of kinematics are used to specify how the relative motion between these objects is calculated. There are two main kinematic rules, [Forward kinematics](#) on page 1241 and [Inverse kinematics](#) on page 1243.

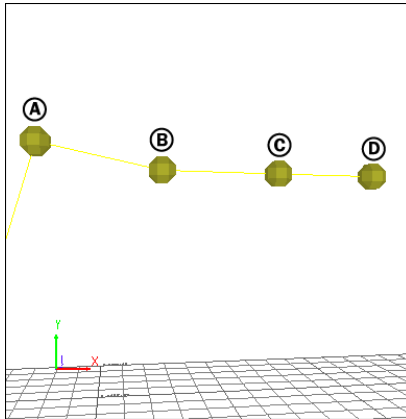
Most animators use a combination of Inverse Kinematics (IK) and Forward Kinematics (FK) to manipulate characters. You can select and manipulate pivot points to affect individual bones using FK, or you can use IK to move a hierarchy of bones.

Most situations require fine-tuning that is only possible using a combination of both FK and IK, so it is a good idea to have a solid understanding of both.

Forward kinematics

Forward Kinematics is the method of transforming a group of connected joints where the movement of the root (or top) of the chain influences all joints along the chain until reaching the end joint. All joints along the chain influence the succeeding joints in the chain, but not the preceding joints. In other words, Forward Kinematics propagates down the chain.

The easiest way to explain this rule is to compare it to a simple chain. The following figure uses four joints to represent an arm.

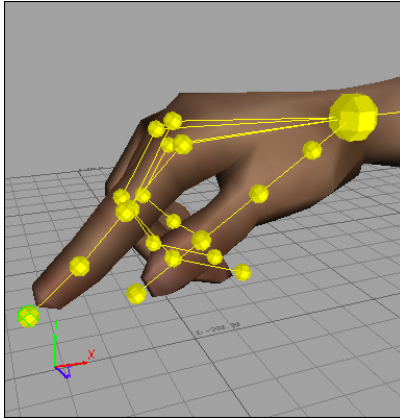


Arm FK chain A. Shoulder or root joint B. Elbow joint C. Wrist joint D. Hand or end joint

In the arm FK chain, rotation of the shoulder joint (A) is propagated down through the elbow (B) and wrist (C) to the hand (D). If only the elbow (B) is rotated, only the wrist (C) and hand (D) move, but not the shoulder (A). In other words, the joints in an FK chain have a parent-child relationship in which the child node (B) follows the behavior of the parent node (A). Usually, the animator must define these complex rules for all of the joint motions on a character, but in MotionBuilder, the work is done for you by the Control rig.

Forward Kinematics gives you complete control over individual bones in the skeleton, letting you manually position each individual joint in a chain. Some situations may require this kind of fine tuning that may not be possible using Inverse Kinematics alone.

For example, shows FK effectors on each finger of a character in MotionBuilder. These effectors were translated and rotated to close the hand, something that would not have been possible with IK.



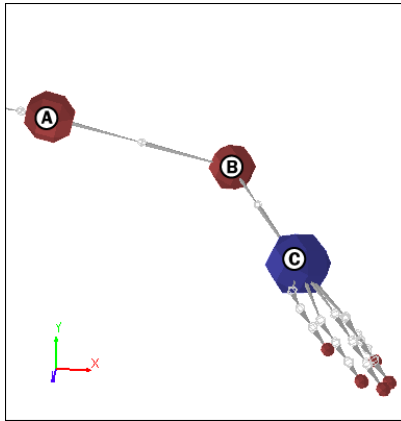
FK lets you manipulate individual joints such as those in the fingers.

Thus, one of the features of FK is that it gives you complete control over individual bones in the skeleton, letting you manually position each individual joint in a chain.

Inverse kinematics

Inverse Kinematics (IK) is the method of transforming a group of connected joints where the movement of the end joint influences all the joints upwards through the chain. Since you are determining the goal of the action by positioning the end effector of a chain, end effectors are sometimes referred to as goals, and IK as “goal-based movement”. All joints influence preceding joints, but not succeeding joints. In other words, inverse kinematics propagates up the chain.

The following figure uses three joints to represent an arm. This time, it is the rotation of the wrist joint (C) that is propagated up through the elbow (B) to the shoulder (A).



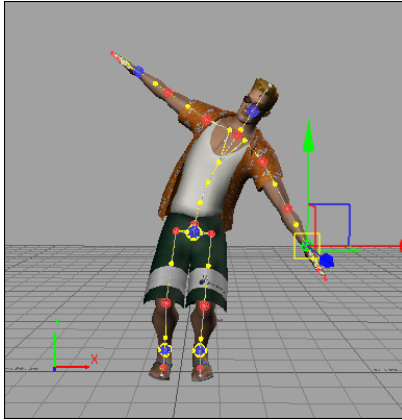
IK arm chain A. Shoulder effector B. Elbow effector C. Wrist effector

Any transformation of the IK chain, even a finger tip, is propagated up through the finger joints, hand, wrist, elbow, and shoulder.

Since IK is goal-based, there are an infinite number of positions the IK chain can take to reach the same goal. It is necessary to specify additional effectors that give the main IK chain “hints” in which direction the joints should bend.

MotionBuilder deduces how to position the rest of the chain to reach this goal. This lets you create realistic movement, since all body parts move in relation to other parts. You position the goal, and MotionBuilder positions the rest of the body.

For example, shows the result of moving a character's left wrist effector in MotionBuilder. Since the wrist effector is the end effector for the arm hierarchy, the rest of the arm and consequently the body follow and reach toward that effector.



Inverse Kinematics affects related body parts.

The Control rig is responsible for determining which way the joint is pointed. There are also supplementary effectors you can add to a Control rig that correspond to an existing IK effector. Auxiliary effectors and pivots provide additional IK control for a character's reach, and display on the corresponding IK effector.

Essentially, the IK rig lets you position your character quickly and intuitively by moving effectors at the end of a chain to manipulate a hierarchy of bones. Some situations may require fine tuning that may not be possible using Inverse Kinematics alone. In this case, you can combine Inverse Kinematics with Forward Kinematics to create exactly the position you need.

- [Control rigs](#) on page 1239
- [Auxiliary objects](#) on page 1277

Creating a Control rig

In order to create a Control rig, you must first have a characterized character. The Control rig is created based on the structure of the character.

To create a Control rig:

- 1 In the Scene browser, expand the Characters folder and double-click the characterized character for which you want to create a Control rig.

The Character settings for the selected character display in the Navigator window.

2 In the Navigator window, select the Character Definition tab.

3 In the Control Rig area, click Create.

The Create Control Rig dialog box appears.

4 Depending on how you plan to animate your character, choose which type of Control rig you want to create:

- Click FK/IK to create a rig with IK (Inverse Kinematics) and FK (Forward Kinematics) effectors.

IK effectors let you intuitively manipulate a character using a setup that simulates how a human body reacts when moving, and the FK effectors let you selectively fine-tune individual body parts. If you plan to do any fine-tuning, you should create a rig with both FK and IK effectors.

- Click IK Only to create a rig with only IK effectors.

When using an IK only Control rig, all features associated with the FK rig are not present. For example, in the Character Controls window, the Reach T and Reach R sliders are not available. The Control rig constantly reaches towards the IK rig.

If the current character already has one or more Control rigs, a dialog box appears confirming that you want to create an additional Control rig. You can click Create New Rig to add an additional Control rig.

All Control rigs you create are added to the Control Rig section of the Scene browser. Each additional Control rig is named Control rig plus a sequential number.

5 Switch to X-Ray display mode (Ctrl-A) in the Viewer window and view the Control rig on the character's skeleton.

By default, the small yellow effectors are FK, and the larger blue and red effectors are IK. You can customize the look of your Control rig effectors using the Properties window.

You can now use the Character Controls window to select Control Rig Input from the Edit menu and activate Ctrl Rig In in the Active area in order to specify that you want the Control rig input to drive this character.

- [Characterizing a character model](#) on page 1086

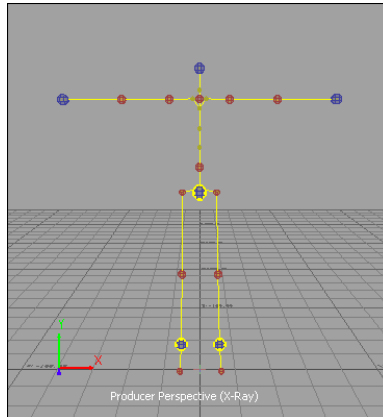
- [Visual feedback on Control rigs](#) on page 1271

- [Saving a Control rig](#) on page 111

Attaching a Control rig to a character

To attach a Control rig to a character:

- 1 Load a Control rig into the scene.

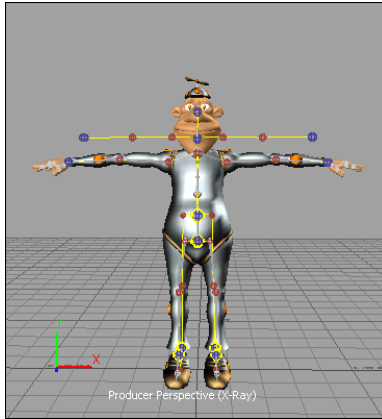


A Control rig loads in the scene.

The Control rig displays in the Viewer window, and is listed in the Scene browser.

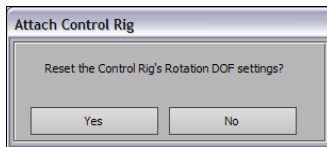
NOTE The Control rig effectors only display in the Viewer window if you saved them when you saved the Control rig. See [Saving a Control rig](#) on page 111 for more information.

- 2 Select File > Merge, then navigate to select a character *.fbx* file. Click Merge in the Merge Options dialog box to merge the character into the scene. The character loads into the scene with the Control rig, but they are not yet connected.



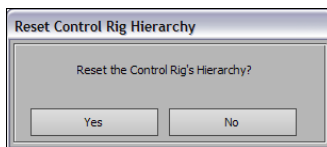
The Control rig is not yet connected to the merged character.

- 3 In the Scene browser, drag the Control rig asset onto the character.
- 4 Select Yes or No if the Attach Control Rig dialog box appears asking if you want to reset the Control rig's Rotation DOF settings.



Attach Control Rig dialog box

- 5 Do one of the following if the Reset Control Rig Hierarchy dialog box appears:



Reset Control Rig Hierarchy dialog box

- Click "Yes" if you want to reset the Control rig hierarchy to the default structure. See [The Control rig hierarchy](#) on page 1287 for more information on the default rig.

- Click “No” if you want to keep the current Control rig structure, including any reparenting or customization you have created.

If the structure of your Control rig does not match the character, MotionBuilder creates or disables effectors as needed to make the Control rig fit. For example, if you connect a Control rig from a character that has fingers to a character that does not, the finger effectors are disabled.

You can now manipulate and keyframe this character using the new Control rig. If the character had an original Control rig, it is detached and replaced with the new Control rig. The original Control rig is still available and listed in the Scene browser, but it is no longer connected to the character.

NOTE You can also select Control rigs and attach them to characters using the Input option in the Edit menu of the Character Controls.

- [Control rigs](#) on page 1239
- [Creating a Control rig](#) on page 1245
- [Detaching a Control rig from a character](#) on page 1249
- [Deleting a Control rig](#) on page 1250
- [Saving a Control rig](#) on page 111
- [Character Controls](#) on page 1357

Detaching a Control rig from a character

To detach a Control rig from a character:

- 1 Right-click the Control rig attached to your character in the Scene browser and select Detach Control Rig from the contextual menu.

The Control rig is detached from the character, but still exists in the scene. The Control rig is still listed under the Control Rig heading in the Scene browser, and can be attached to any characterized character in the scene.

- [Control rigs](#) on page 1239
- [Attaching a Control rig to a character](#) on page 1247
- [Deleting a Control rig](#) on page 1250

Deleting a Control rig

To delete a Control rig:

- 1 Select the Control rig you want to delete in the Scene browser.
 - 2 Do one of the following:
 - Right-click and select Delete from the contextual menu.
 - In the Character Definition pane, click Delete in the Control rig area.
 - 3 Click Ok in the dialog box that appears asking if you want to delete the Control rig.
- [Control rigs](#) on page 1239
 - [Detaching a Control rig from a character](#) on page 1249
 - [Creating a Control rig](#) on page 1245
 - [Character Definition pane](#) on page 1310

Selecting Control rig effectors

To select an effector:

- 1 Select it in the Viewer window or click its corresponding cell in the Character representation.

To select multiple effectors:

- 1 Ctrl-click to select them in the Viewer window, or Ctrl-click multiple cells in the Character representation.

To select all effectors:

- 1 Click any empty space in the Character representation background.

To select all effectors in a body part:

- 1 Shift-click an effector within the body part hierarchy that you want to select. For example, Shift-click the left wrist to select all effectors for the left arm.

■ [Control rigs](#) on page 1239

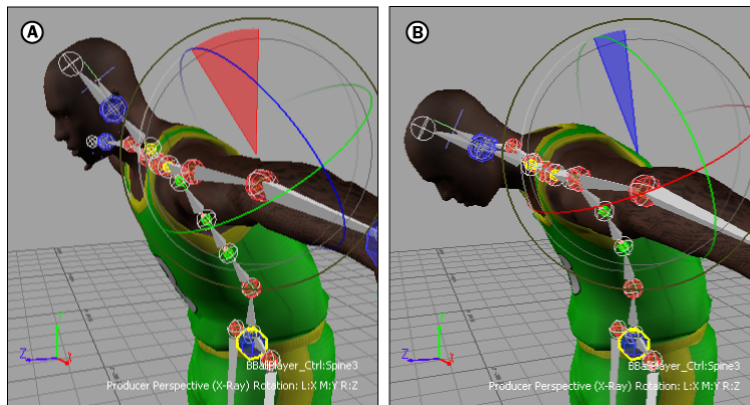
Manipulating spines, fingers, and tails

To create a natural bend as you manipulate a body part such as the spine, fingers, or a tail, activate the Local Reference mode available in the Viewer window.

Local Reference mode lets you simulate additive rotation behavior as you rotate objects that are part of the same continuous hierarchy, such as objects in the spine. The rotation of each object in the hierarchy is calculated relative to its parent.

NOTE The regular [Additive Reference mode](#) on page 509 is not available when you have Control rig effectors selected and use Full Body or Body Part keying mode.

In the following figure, you can see the difference between rotating a series of spine bones in Global Reference mode and in Local Reference mode.



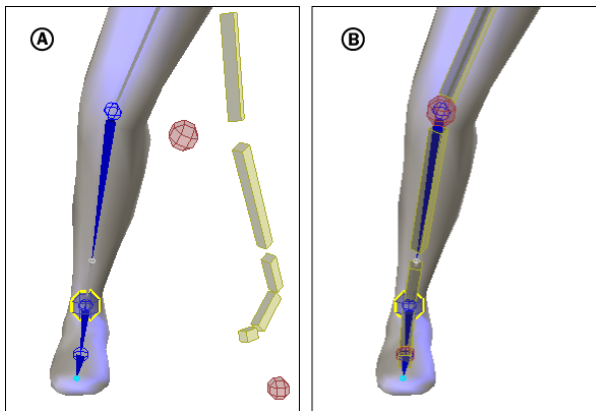
Rotating FK effectors in the spine. A. Using Global Reference mode. B. Using Local Reference mode.

Aligning Control rigs

When you have a complex Control rig set up, it can be difficult to visualize how your manipulations create the final solving on the character's skeleton. Because the FK and IK systems are solved differently and can interpolate in different directions between keyframes, the Control rig can appear disconnected even when there are no problems with the final animation on the bones.

It can also be difficult to keep track of prop objects parented to the FK or IK effectors (such as a weapon constrained to the wrist), and where they are positioned in your final animation. Because they can follow either the IK or the FK system depending on how you animate the Reach properties, prop objects can also appear disconnected from the character, even if they will appear normally in the final solving.

The Align Control rig option in the Properties window lets you visually merge the IK and FK systems together to show the final solving on the character's bones clearly. This gives you a preview of your final animation, and shows you the final solving from which the position of child objects is calculated.



A character's leg between keyframes A. Align Control Rig is disabled. B. Align Control rig is active.

Displaying the two systems forced together gives you a more intuitive way to manipulate the rig, as it replicates direct manipulation of the character's bones. The IK and FK elements can still be manipulated individually, are solved differently, and have different function curves, but you can manipulate them and their children while previewing the final solving.

By default, the Align Control rig option is activated when you create a Control rig. If you need to view the solving of the IK and FK systems individually in order to fine-tune your animation, disable the Align Control rig option.

NOTE The way the FK and IK systems are solved remains the same when the Align Control rig option is activated. The difference is that the two systems are synchronized visually in the Viewer window and you can clearly see the final solving that affects all child objects.

- [Control rig properties](#) on page 1253
- [Viewing final solving on a Control rig](#) on page 1253

Viewing final solving on a Control rig

To view the final solving of a character's Control rig:

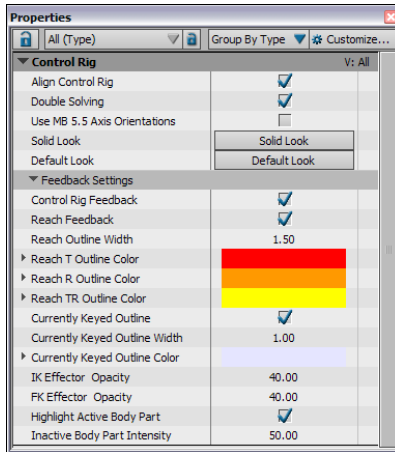
- 1 Select the Control rig in the Scene browser.
- 2 In the Properties window, activate the Align Control rig option.

This forces the IK and FK systems to visually merge together, showing the final result of your animation on the character's bones. Any child objects of the Control rig are calculated from this final solving.

- [Selecting Control rig effectors](#) on page 1250
- [Visual feedback on Control rigs](#) on page 1271

Control rig properties

The Control Rig group of properties display in the Properties window when you have a Control rig selected in the Scene browser.



Control rig properties

Align Control rig

When activated, this option forces the IK and FK systems that make up the Control rig align together, showing you the final solving for the character's bones. This option is activated by default.

See [Aligning Control rigs](#) on page 1252 for more information.

Double Solving

Lets you use complex character setups in which one part of the character directly or indirectly drives another part of its own body, or part of another character. This option makes MotionBuilder evaluate character solving repeatedly so that body parts driven by other body parts are always positioned correctly.

For example, you can set up a character carrying a weapon so that the left hand drives the weapon, and the weapon drives an Auxiliary effector of the right hand. This creates a situation in which the left hand indirectly drives the right hand. With Double Solving activated, the position of the left hand (and the weapon) is solved first, then another round of solving determines the position of the right hand.

When Double Solving is disabled, the position for all body parts is calculated simultaneously, so any body part constrained by another body part may not reach the expected position.

NOTE If you plan to manipulate characters in Expert mode and use the Pull settings, Double Solving is calculated correctly only if one side of the character-driving-character set up has Pull values. For example, if a character is set up so that the right hand pulls the left, or if two characters are set up so that the first character pulls the second, Double Solving is not affected. However, if you set up the left hand to pull back on the right, or the second character to pull back on the first, activating Double Solving will not give the expected result since reaching both Pull goals simultaneously is not possible. You may notice a decrease in MotionBuilder's performance if you have a complex scene where several characters use Double Solving and influence each other's body parts.

Use MB 5.5 Axis Orientations

Activate this option if you want a Control rig to have markers oriented as they were in earlier versions of MotionBuilder. Previously, Control rig markers were oriented in line with the bones, pointing toward the next marker in the chain. On new Control rigs, markers are oriented at 0, 0, 0 by default.

If you are working with a Control rig created in MotionBuilder 5.5 or earlier, this option is automatically activated. If you are using a newer Control rig, or create a new Control rig, this option is disabled.

Solid Look

Changes the geometry of FK effectors to display as solid bone-like objects. IK effectors display normally.

Default Look

Makes the Control rig display with default IK and FK effectors.

Feedback Settings

This group of properties lets you show, hide, and change the way visual feedback is displayed on the Control rig.

| Property | Description |
|----------------------|---|
| Control Rig Feedback | Shows or hides all visual feedback elements on the Control rig. |

| Property | Description |
|-------------------------------|--|
| Reach Feedback | Shows or hides the Reach feedback outline that displays on effectors with Reach values defined. |
| Reach Outline Width | Changes the width of the outline that displays when an object has Translation Reach, Rotation Reach, or both values defined. When Reach is set to zero, no outline displays. |
| Reach T Outline Color | Changes the color of the outline that displays around objects with Translation Reach values defined. By default the Reach T Outline is red. |
| Reach R Outline Color | Changes the color of the outline that displays around objects with Rotation Reach values defined. By default, the Reach R Outline is orange. |
| Reach TR Outline Color | Changes the color of the outline that displays around objects with Rotation and Translation Reach values defined. By default, the Reach TR Outline is yellow. |
| Currently Keyed Outline | Shows or hides the pale blue outline that displays on effectors that are keyframed at the current time. You can change the color of this outline using the Currently Keyed Outline Color property. |
| Currently Keyed Outline Width | Changes the width of the outline on currently keyed objects in the Control rig. By default, the Currently Keyed Outline has a Width value of 1. |
| Currently Keyed Outline Color | Changes the color of the outline that displays on currently keyed objects in the |

| Property | Description |
|------------------------------|--|
| | Control rig. By default, the Currently Keyed Outline displays in light blue. |
| IK Effector Opacity | Changes the opacity of IK effectors. By default, IK effectors have an opacity value of 40. When set to zero, the markers are wireframe. The higher the value, the more opaque the effectors become. |
| FK Effector Opacity | Changes the opacity of FK effectors. By default, FK effectors have an opacity value of 40. When set to zero, the markers are wireframe. The higher the value, the more opaque the effectors become. |
| Highlight Active Body Part | When activated, active body parts are highlighted and inactive body parts are faded. When disabled, the entire Control rig displays with uniform highlighting. You can change the level of intensity on inactive effectors using the Inactive Body Part Intensity property. |
| Inactive Body Part Intensity | Adjusts the intensity of color for inactive body parts. When you are in Body Part keying mode, all effectors that are not part of the selected body part display with faded coloring. This property lets you adjust the level of fading on those inactive body part effectors. |

- [Control rigs](#) on page 1239
- [Kinematics](#) on page 1241
- [Control rig properties](#) on page 1253

Customizing Control rig appearance

You can change the way a Control rig displays in the Viewer window. This can be useful if you need to work with Control rigs in a particular way. For example, if you are keyframing effectors, it is helpful to enlarge the effectors so that you can select the more easily. Also see [Marker Settings](#) on page 1263

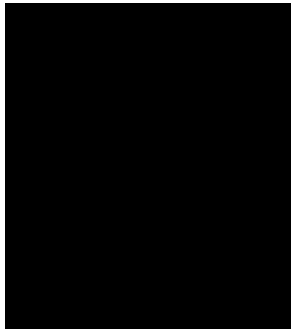
To customize the appearance of a Control rig or effectors:

- 1 Switch to X-Ray mode in the Viewer window (Ctrl+A).
- 2 Expand Control rig folder in the Navigator window Scene browser.
- 3 Open the Properties window.
- 4 See the following sections for specific changes.

Changing the rig

To change the look of a Control rig:

- 1 Switch to X-Ray mode in the Viewer window (Ctrl+A).
- 2 Expand Control rig folder in the Navigator window Scene browser.
- 3 Open the Properties window.
- 4 See the following sections for specific changes.
- 5 In the Properties window, click either Solid look or Default look.

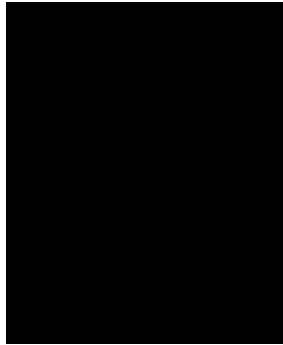


Control rigs: A. Default B. Solid

Showing or hiding Control rig effectors

If you cannot see the Control rig effectors, activate the Properties window Visibility option.

- 1 In the Properties window, set the Select property View menu to All (Type).
- 2 Expand the Markers section.
- 3 Activate or disable the Visibility option.



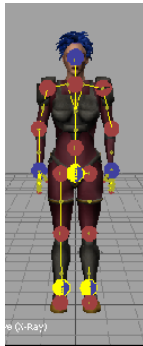
Control rig effectors: A. Visibility off B. Visibility on.

Changing the effector size

To change the size of IK effectors:

- 1 Follow the steps in the previous section ([Customizing Control rig appearance](#) on page 1258).
- 2 In the Properties window, set the Select property View menu to All (Type).
- 3 In the Properties window, set the Select property View menu to All (Type).
- 4 To select all IK effectors on a Control rig, go to the Character controls window and activate IK from the Show menu. (For a clearer view, you can also deactivate FK and skeleton so you only see the IK effectors on the rig.)
For individual effectors, you can also select them in the Viewer window or Schematic view.
- 5 In the Properties window, Expand Markers and Activate the Visibility option.

- 6 Set a new size in the Size field.



**IK effectors set
to 500.00**

NOTE You can also change the shape, color, and transparency of the markers in the same menu.

To change the size of FK effectors:

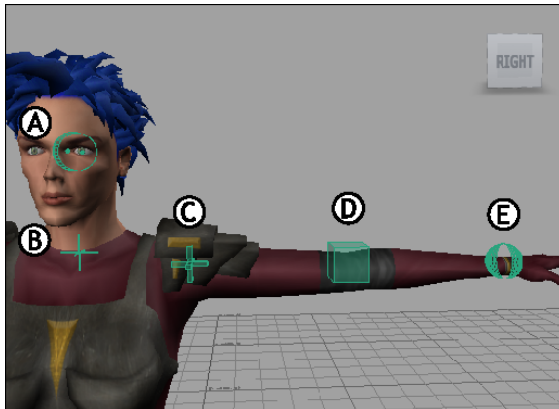
- 1 Follow the steps in the previous section ([Customizing Control rig appearance](#) on page 1258).
- 2 In the Properties window, set the Select property View menu to All (Type).
- 3 Go to the Character controls window and activate FK from the Show menu. (For a clearer view, you can also deactivate IK and skeleton so you only see the FK effectors on the rig.)
- 4 To select all FK effectors on a Control rig, double-click in an empty area of the Character controls window Character representation.
You can also select individual effectors in the Viewer window or Schematic view.
- 5 In the Properties window, Expand Markers and Activate the Visibility option.
- 6 Set a new size in the Size field.



FK effectors set to 500.00

NOTE You can also change the shape, color, and transparency of the markers in the same menu.

Changing the shape of Control rig effectors



Effector looks: A. Capsule B. Light Cross C. Hard Cross D. Cube E. Sphere.

To change the shape of a Control rig effector:

- 1 Follow the steps in the previous section ([Customizing Control rig appearance](#) on page 1258).
- 2 In the Properties window, set the Select property View menu to All (Type).

- 3 Select either Sphere, Cube, Hard Cross or Light Cross from the Look menu.

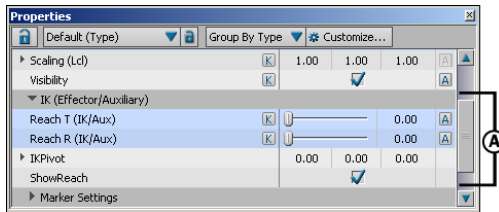
Control rig effector properties

The Control rig properties display when you select individual Control rig effectors (markers). The properties that display vary slightly depending on whether you select an IK or FK effector.

To modify properties, select the Control rig effectors you want to change in the Viewer window, then modify the properties. The changes apply to the Control rig in real time.

IK Properties

These properties let you adjust the IK Control rig effectors and Auxiliary objects.



Properties window A. IK effector properties

Reach IK Effector/Auxiliary

These properties are the same as the sliders that appear in the Character Controls window. They represent the Reach values for IK Control rig effectors, or for the Auxiliary objects associated with IK effectors. See [Character Controls](#) on page 1357 for more information on these Reach properties.

IK Pivot

The IK Pivot properties let you adjust the position of Auxiliary pivots that are created for IK Control rig effectors. You can define offsets for Auxiliary pivots

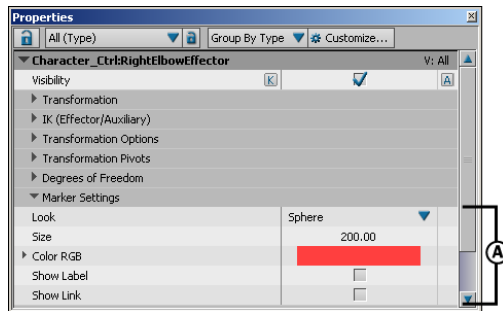
using these value fields, or you can switch to Pivot Selection mode in the Viewer window and translate the Auxiliary pivots in order to offset them. See [Auxiliary pivots](#) on page 1279 for more information.

Show Reach

This option lets you show or hide the outline that displays on Control rig effectors when they have Reach values. See [Reach and Pull Feedback](#) on page 1362 for more information.

Marker Settings

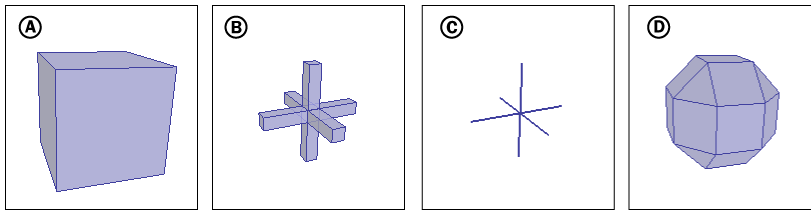
The Marker Settings properties let you change the shape, size, and color of the effectors that make up a Control rig. By default, IK effectors display as red or blue spheres. See [Customizing Control rig appearance](#) on page 1258 for procedures.



Properties window A. Marker Settings

Look

The Look menu lets you select the shape of Control rig effectors. See [Changing the shape of Control rig effectors](#) on page 1261The following table and describe the four Look options:



Control rig effector options A. Cube B. Hard Cross C. Light Cross D. Sphere

| Option | Description |
|-------------|--|
| Cube | Effectors display as cubes. |
| Hard Cross | Effectors display as thick crosses. |
| Light Cross | Effectors display as wireframe crosses. |
| Sphere | Effectors display as a sphere. This is the default appearance. |

Size

By default, red IK effectors are size 75 or 100, and blue IK effectors are size 150 or 175. Use the Size property to change the size of a selected effector. See [Changing the effector size](#) on page 1259.

Color RGB

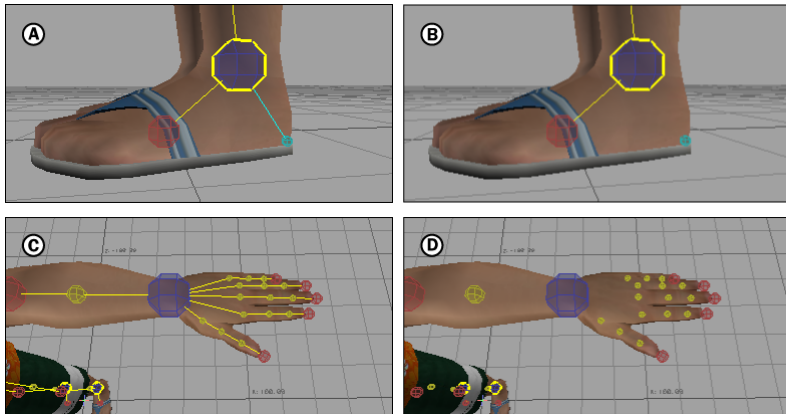
The Color RGB fields let you adjust the color of Control rig effectors. You can also double-click the Color RGB field to open the Color window and select a new color for the selected effector.

Show Label

This option lets you show or hide a text label that displays the name of the Control rig effector.

Show Link

This option lets you show or hide the line that displays between FK effectors and their child objects, and between IK effectors and their Auxiliary pivots.



Show Link option *A.* The Auxiliary pivot Show Link option is active. *B.* Show Link is disabled. *C.* The FK effectors Show Link options are active. *D.* Show Link is disabled.

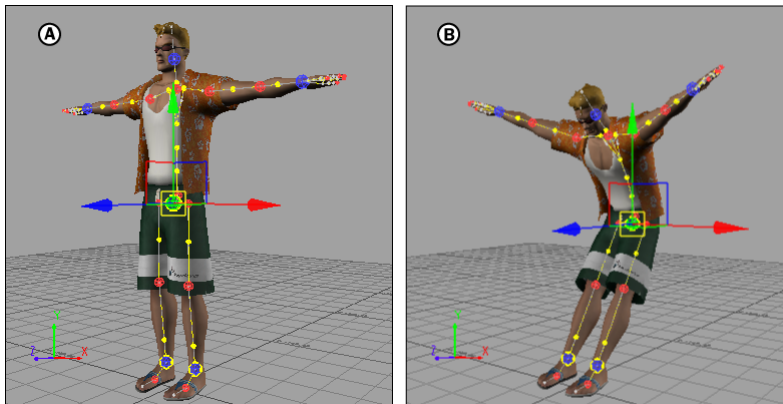
■ [Control rigs](#) on page 1239

Pinning

78

When you are manipulating a character with a Control rig, you can pin down the effectors to restrict body movement and influence how other joints behave relative to the pinned effector. This lets you selectively manipulate parts of your character without affecting the entire hierarchy.

For example, if you pin both wrists and ankles in translation and rotation, you can see that no matter how you move the character's body, the wrist remains in the same position .



Effector pinning A. Character with wrists and ankles pinned in translation and rotation B. The wrists and ankles remain in place even when the Hips are translated along the Z-axis.

See [Pinning a Control rig effector](#) on page 1268 and [Unpinning a Control rig effector](#) on page 1269.

When you create a biped Control rig, IK effectors on the character's feet are pinned in translation and rotation by default. On a quadruped Control rig, the feet are pinned in both translation and rotation.

The Character Controls window Effector Pinning area contains options that let you pin and unpin effectors. See [Effector Pinning area](#) on page 1379 for more information.

Pinning Keyboard Shortcuts

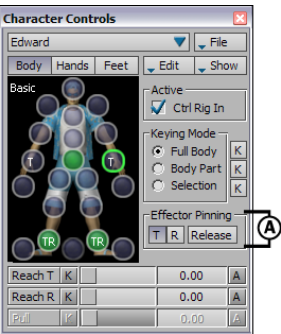
The following table describes keyboard shortcuts for pinning and unpinning effectors:

| Press | To |
|-------|---|
| W | Toggle translation pinning on and off selected cells. |
| E | Toggle rotation pinning on and off selected cells. |
| Q | Temporarily unpin effectors. |

- [Pinning](#) on page 1267
- [Selecting Control rig effectors](#) on page 1250

Pinning a Control rig effector

To pin a Control rig effector, select the effector you want to pin down, then activate the T, R, or both options in the Effector Pinning area of the Character Controls.



Character Controls window
A. Effector Pinning area

- [Pinning](#) on page 1267

- [Character Controls](#) on page 1357

Unpinning a Control rig effector

To unpin a Control rig effector, select the effector you want to unpin, then disable the T, R, or both options in the Effector Pinning area of the Character Controls.

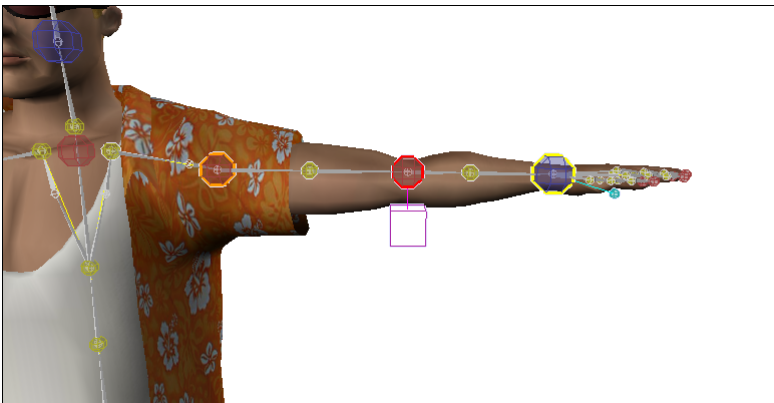
You can also use the Release option in the Effector Pinning area, or keyboard shortcuts to toggle pinning (see [Pinning Keyboard Shortcuts](#) on page 1268).

- [Pinning](#) on page 1267
- [Pinning a Control rig effector](#) on page 1268
- [Character Controls](#) on page 1357

Visual feedback on Control rigs

79

Control rigs now display improved visual feedback as you animate a character . Each feedback element is designed to help you identify which part of the rig you are working with, how your character is moving, and how it is affected by manipulations over time.



Visual feedback elements display on a character's Control rig

You can turn the visibility of the feedback elements on or off, or change the color and style of each element using the Properties window. You can also develop your own custom feedback elements using Relations constraints.

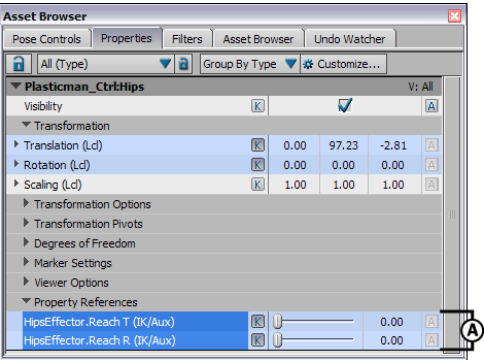
- [Control rig properties](#) on page 1253

Reach feedback on FK effectors

FK effectors in a Control rig do not have Reach properties. However, the properties for each FK object in the Control rig include property references to the Reach properties of a corresponding IK effector. This makes it possible for the FK objects to show the IK Reach feedback.

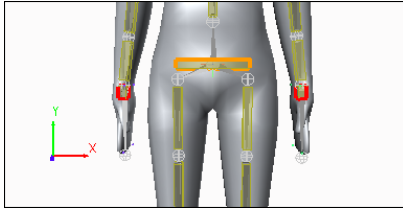
NOTE Only Control rigs created in MotionBuilder 7.5 and up have FK effectors with Reach property references. If you are working with older Control rigs, you can add the Reach property references by disabling then re-activating the character's Characterize option.

For example, if you select the FK effector for the hips and view its properties, property references to the Reach T and Reach R properties for the IK hips effector are also listed.



Properties of an FK effector for the hips. A. Two reference properties for the IK effectors of the hips are also listed.

These reference properties let you hide the IK effectors, work only with bone-like FK effectors, and still view the Reach feedback for your Control rig



The FK effectors on the hips and wrists display Reach Outline visual feedback for hidden IK effectors.

If you do not want to view IK Reach feedback on FK objects, or if you want to change which IK and FK effectors are associated, you can delete and re-create property references as required. See [Property references](#) on page 580 for more information.

- [Visual feedback on Control rigs](#) on page 1271
- [Creating a property reference](#) on page 580
- [Control rig properties](#) on page 1253
- [Auxiliary objects](#) on page 1277

Controlling visual feedback on Control rigs

You can show, hide, or change the appearance of any of the visual feedback elements for Control rigs using the Feedback Settings group of properties.

For example, you can change the color of the outline that displays on effectors with Reach values using the Reach T Outline Color, Reach R Outline Color, and Reach TR Outline Color properties. For a list of properties that adjust the Control rig feedback, refer to [Control rig properties](#) on page 1253.

To show or hide the visual feedback elements on a character's Control rig:

- 1 Select the Control rig in the Scene browser.
- 2 In the Properties window expand Feedback Settings.
- 3 Activate or disable the Control Rig Feedback option.
When activated, all visual feedback elements display on the Control rig.
When disabled, all visual feedback is hidden.

You can also show or hide each of the individual feedback elements using the appropriate option. For example, to show or hide the Reach feedback, activate or disable the Reach Feedback option.

- [Visual feedback on Control rigs](#) on page 1271
- [Control rig properties](#) on page 1253
- [Viewing currently keyed elements on a Control rig](#) on page 1274
- [Changing the opacity of Control rig effectors](#) on page 1274

Viewing currently keyed elements on a Control rig

To view elements that are keyframed at the current time on a Control rig:

- 1 Select the Control rig in the Scene browser.
- 2 In the Properties window expand Feedback Settings and ensure that the Control Rig Feedback and Currently Keyed Outline options are activated.
By default, a pale blue outline displays on all elements that are keyframed at the current time. You can change the color and width of the outline using the Currently Keyed Outline properties.

- [Visual feedback on Control rigs](#) on page 1271
- [Controlling visual feedback on Control rigs](#) on page 1273
- [Kinematics](#) on page 1241

Changing the opacity of Control rig effectors

To change the opacity of Control rig effectors:

- 1 Select a Control rig in the Scene browser.
- 2 In the Properties window expand Feedback Settings.
- 3 Do one of the following:
 - To adjust the IK effectors, change the IK Effector Opacity property.
 - To adjust the FK effectors, change the FK Effector Opacity property.

By default, all effectors have an opacity value of 40. When set to zero, the markers are wireframe. The higher the value, the more opaque the effectors become.

Auxiliary objects

80

Auxiliary objects can be added to a character's Control rig effectors to provide another level of IK control over your character . There are two types of Auxiliary object:

- [Auxiliary effectors](#) on page 1277
- [Auxiliary pivots](#) on page 1279

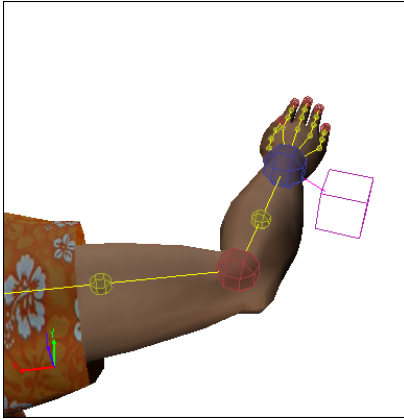


Auxiliary objects A. Auxiliary effector B. Auxiliary pivot

Auxiliary effectors

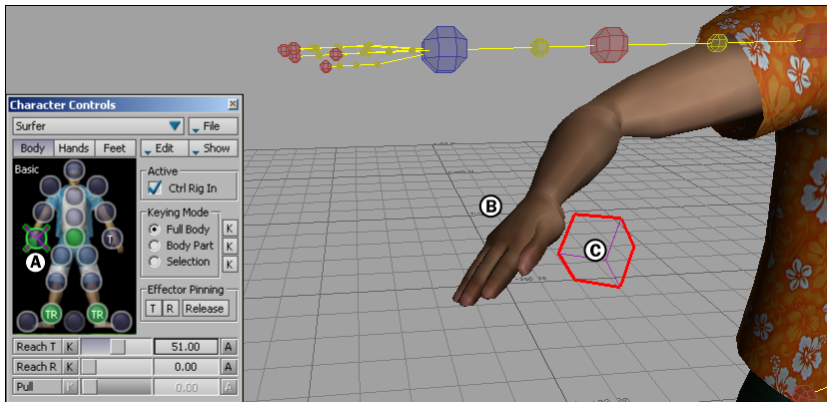
Auxiliary effectors are supplementary effectors in a Control rig that correspond to existing IK effectors. Every IK effector in a Control rig can have multiple Auxiliary effectors.

By default, an Auxiliary effector displays as a wireframe cube in the Viewer window . You can change the look, color, and size of Auxiliary effectors in the Properties window.



An Auxiliary effector displays on a wrist effector.

You can translate an Auxiliary effector to the position you want its corresponding IK effector to reach, then control the amount of reach between the IK effector and the Auxiliary effector using the Reach options . See also [Reach Actor/Character](#) on page 1385 for more information.



Adjusting Auxiliary reach A. Right wrist effector Auxiliary effector selected B. Hand reaches between IK effector and Auxiliary effector. C. Auxiliary effector is translated away from right wrist.

Auxiliary effectors are useful in many situations to provide an additional level of IK control. For example, you can use Auxiliary effectors to ensure that a character's arm always reaches towards a prop, such as a weapon.

You can also use Auxiliary effectors to stabilize a character's feet so that they do not slide on the floor. To do this, you can create an Auxiliary effector for

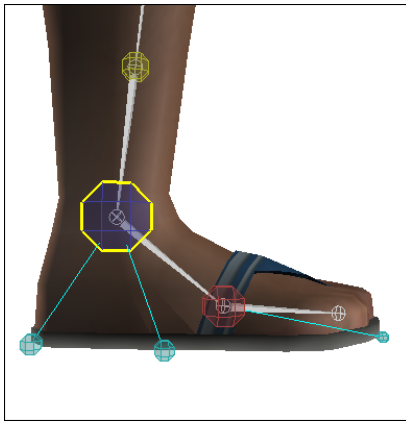
the primary IK foot effectors, then place the Auxiliary effector on the floor where the foot slides. Define the Reach values to maximum reach (100%).

When you play your take, the foot effector reaches toward the Auxiliary effector at the frame where the foot begins to slide, and the Reach T and Reach R sliders move as the animation plays. To see the keyframes on the Action timeline, select the Auxiliary effector in the Character Controls.

Auxiliary pivots

Auxiliary pivots are objects that let you quickly define and animate multiple rotation pivot points for IK Control rig effectors. You can use Auxiliary pivots for any character animation, and they are particularly useful if you want to manipulate the feet or hands of a character using more than one rotational point.

By creating multiple Auxiliary pivots for an IK effector in a character's foot, for example, the feet can rotate around multiple independent pivot points in order to create natural-looking walk cycles .



Three Auxiliary pivots display for two IK effectors in a character's foot.

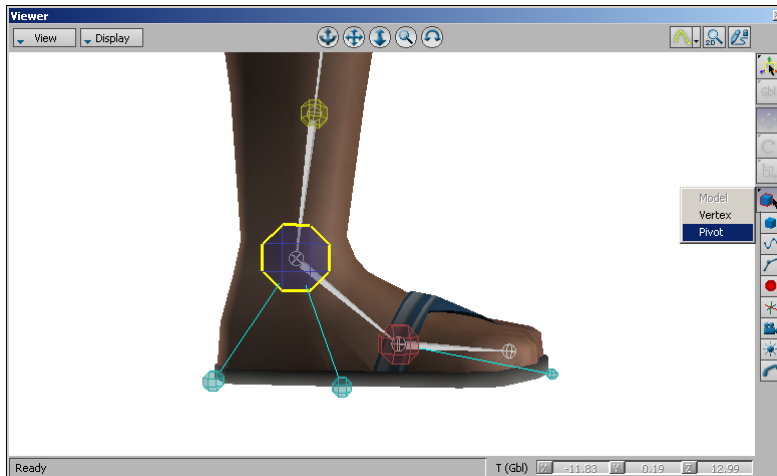
As you set keyframes, you can switch between Auxiliary pivots, making the foot rotate around the ankle, the heel, the base of the toes, the tip of the toes, and even the sides of the foot. For more information on switching between pivots, see [Setting a master Auxiliary pivot](#) on page 1285.

Auxiliary pivots are based on the position of the IK effector they are created for, so they do not have an independent position in the scene. You can think

of them as sub-controls that let you manipulate the IK effector from different vantage points. Rotating any pivot also affects the effector, just as if the effector itself is manipulated.

To manipulate Auxiliary pivots, select Pivot mode from the Selection Mode menu in the Viewer window. Pivot mode is automatically selected when you create a new Auxiliary pivot. You can then select and define offsets for the pivots by dragging them to new positions relative to the IK effector.

When you are in Pivot mode, transforming the pivot affects only the Auxiliary pivot itself. To use the pivots to manipulate an effector, switch to Model mode. For more information on the Selection Mode menu, see Viewer window.



Viewer window A. Select Pivot from the Object Mode menu.

TIP You can base poses on selected Auxiliary pivots using the Pose Controls window.

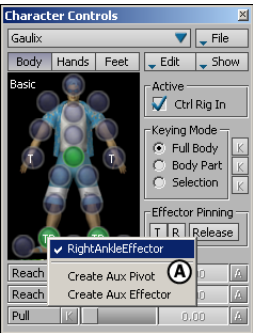
- [Control rigs](#) on page 1239
- [Pose Controls window](#) on page 1296
- [Creating Auxiliary effectors and pivots](#) on page 1281
- [Setting a master Auxiliary pivot](#) on page 1285
- [Manipulating Auxiliary pivots](#) on page 1284

Creating Auxiliary effectors and pivots

To create an Auxiliary effector or pivot:

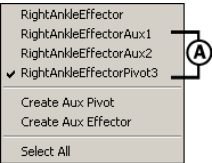
- 1 Right-click a cell in the Character representation, then choose Create Aux Pivot or Create Aux Effector from the contextual menu.

Auxiliary effectors are placed at the same position and rotation as the corresponding effector, and Auxiliary pivots are placed at a slight offset from the effector so they are easily visible.



Character Controls A. Cell contextual menu

Auxiliary effectors and pivots are named for the original effector with the suffix “Aux” or “Pivot” plus a sequential number. For example, if you create two Auxiliary effectors for the RightAnkle effector, then create one pivot, the first Auxiliary is named RightAnkleEffectorAux1, the second is RightAnkleEffectorAux2, and the first pivot is called RightAnkleEffectorPivot3.



Cell contextual menu for the right ankle effector A. All Auxiliary effectors and pivots are listed.

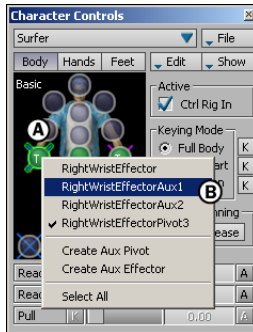
■ [Auxiliary objects](#) on page 1277

Selecting Auxiliary effectors and pivots

To select Auxiliary effectors and pivots:

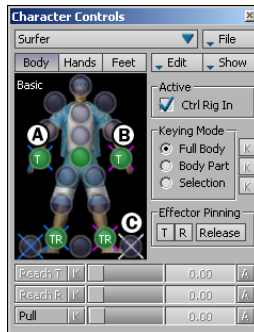
- 1 Right-click the corresponding cell in the Character representation and select them from the contextual menu.

You can also select Auxiliary effectors and pivots in the Viewer window.



Character Controls A. Auxiliary pivot is currently active on the right wrist effector. **B.** An Auxiliary effector is selected in the cell's contextual menu.

After an Auxiliary object is selected it becomes the active object in the Character representation cell. The next time you select this cell, you select the active object. A blue, purple, or white X displays on any cell that has associated Auxiliary objects to indicate which is the active object. If the effector itself is active, the X is white. For active Auxiliary pivots the X is blue, and for active Auxiliary effectors, the X is purple .



Active objects on Character representation cells A. Auxiliary pivot is active B. Auxiliary effector is active C. Effector is active

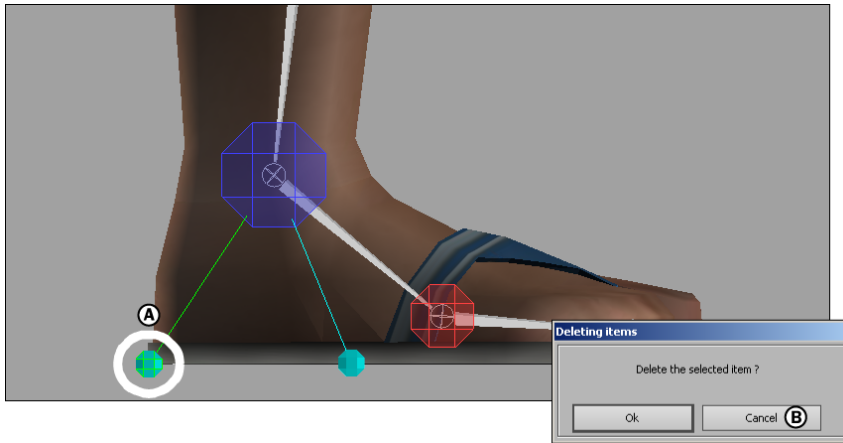
To switch back to selecting the effector itself when you click a cell, select the effector's name in the cell contextual menu.

- [Auxiliary objects](#) on page 1277
- [Creating Auxiliary effectors and pivots](#) on page 1281
- [Deleting Auxiliary effectors and pivots](#) on page 1283

Deleting Auxiliary effectors and pivots

To delete Auxiliary effectors and pivots:

- 1 Select the Auxiliary effector or pivot you want to delete in the Viewer window and press Delete.
- 2 Click Ok in the dialog box that appears.



A. Press Delete with an Auxiliary object selected in the Viewer window. B. Click Ok in the Deleting items dialog box.

- [Auxiliary objects](#) on page 1277
- [Creating Auxiliary effectors and pivots](#) on page 1281

Manipulating Auxiliary pivots

To manipulate Auxiliary pivots:

- 1 Select Pivot from the Object Mode menu in the Viewer window toolbar, then select the pivot you want to manipulate.
- 2 Use the standard transformation options to manipulate the selected pivot.

Pivot mode is automatically selected when you create a new Auxiliary pivot. You can then select and define offsets for the pivots by dragging them to new positions relative to the IK effector.

When you are in Pivot mode, transforming the pivot affects only the Auxiliary pivot itself. To use the pivots to manipulate an effector, switch to Model mode. For more information on the Selection Mode menu, see Viewer window.

- [Control rigs](#) on page 1239
- [Creating Auxiliary effectors and pivots](#) on page 1281

- [Selecting Auxiliary effectors and pivots](#) on page 1282
- Camera View toolbar

Setting a master Auxiliary pivot

After positioning the Auxiliary pivots, you can select the Auxiliary pivot around which you want other objects to rotate. Separate Reach properties for each individual pivot let you specify which pivot is the master at any given time. As you keyframe, you can use the IK and FK key buttons in the Key Controls to specify which pivot you want other objects to rotate around.

For example, if you create four Auxiliary pivots for one effector in the foot, you might first want the foot to rotate around a pivot close to the tips of the toes.

To set a master pivot:

- 1 Select the pivot you want to define as the master in the current frame.
- 2 Click IK in the Key Controls window.

This sets the Reach for the selected pivot to 100, and sets the Reach for all other pivots to 0. When you manipulate this pivot, everything else rotates around it. You can confirm that the Reach properties for the selected pivot have been set to 100 in the Properties window.

If you want to set a keyframe in which nothing rotates around the Auxiliary pivots for a body part, click the FK Key button in the Key Controls. This sets the Reach properties for all of the pivots to zero, and all of the pivots have no affect on the effector.

- [Auxiliary objects](#) on page 1277
- [Deleting Auxiliary effectors and pivots](#) on page 1283

Customizing Control rigs

8 |

There are several ways you can customize your Control rigs to suit the manipulations you want to create. You can customize the appearance of the Control rigs to suit your project, re-parent hierarchies to achieve different behaviors as you manipulate, and you can build new hierarchies to create extra body parts, such as wings or a tail. You can also create Auxiliary objects to add another level of control.

Refer to the following topics for detailed ways to customize your Control rig:

- [Changing the appearance of Control rigs](#) on page 1290
- [Customizing the Control rig hierarchy](#) on page 1289
- [Creating Auxiliary effectors and pivots](#) on page 1281

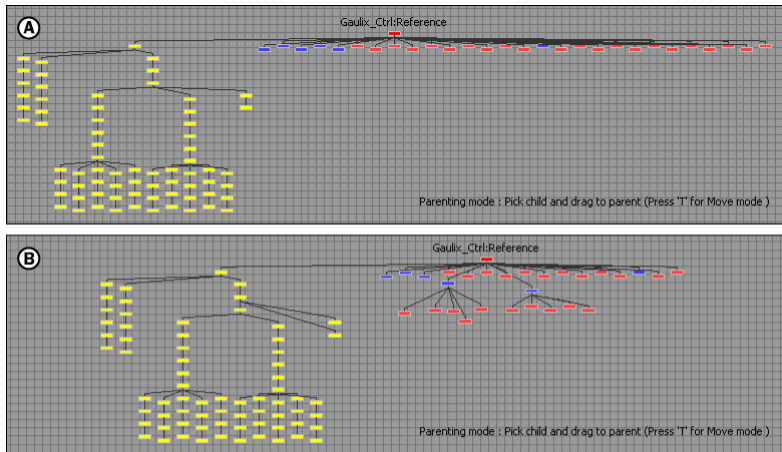
Once you have customized your Control rig you can save and re-load it for use with any other character, just as you can with any other asset.

- [Customizing Control rigs](#) on page 1287
- [Parenting and hierarchies](#) on page 249
- [The Control rig hierarchy](#) on page 1287
- [Auxiliary objects](#) on page 1277
- [Saving a Control rig](#) on page 111

The Control rig hierarchy

When you first create a Control rig, the IK effectors are global and occupy one level under the Control rig reference, while the FK effectors are arranged in a hierarchy that reflects your character's bone structure. Since effectors can act

independently at this level, the animation may produce poor interpolation results over time.



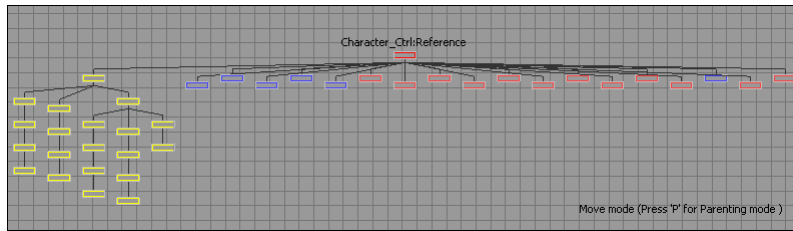
A. Basic Control rig hierarchy. B. Control rig customized with re-parenting.

You can alter how the animation interpolates by changing how effectors react relative to each other. To do this, you can re-parent effectors and change hierarchies in the Control rig.

To provide additional control, you can also create another level of Inverse Kinematics using Auxiliary effectors or pivots. For example, you can make an arm reach further toward an Auxiliary effector without changing the parenting hierarchy.

You can also create other hierarchies in a Control rig by re-parenting certain nodes to added elements. For example, you can add a null element to a Control rig as a parent, and make other effectors the children of the null. By manipulating the null, you can manipulate the hierarchy of bones.

By default when you create a Control rig, the effectors are arranged in a simple hierarchy. You can easily view, arrange, and manipulate the hierarchy of the Control rig using the Schematic view .



A Control rig hierarchy displays in the Schematic view.

- [Customizing the Control rig hierarchy](#) on page 1289
- [Nodes](#) on page 239
- [Parenting and hierarchies](#) on page 249
- [Schematic view](#) on page 240
- [Creating parent-child relationships](#) on page 251

Customizing the Control rig hierarchy

To customize a Control rig hierarchy:

- 1 In the Viewer window, switch to Schematic view (Ctrl-W).
- 2 Click in the Schematic view, then press F to frame the hierarchy.
- 3 Press P to activate Parenting mode.
- 4 Re-parent any of the Control rig effectors by selecting the nodes that represent them and dragging them to a new parent.

TIP Turn on Auto Arrange as you re-parent effectors so you can see the new hierarchies you are creating more easily. In the Schematic view, right-click and select Auto Arrange.

- [The Control rig hierarchy](#) on page 1287
- [Nodes](#) on page 239
- [Parenting and hierarchies](#) on page 249
- [Schematic view](#) on page 240

- [Creating parent-child relationships](#) on page 251

Changing the appearance of Control rigs

There are various ways in which you can change the look of your Control rigs. For example, you can change the shape and color of effectors, scale selected effectors, or change the color properties of selected nodes or bones.

To change the look of Control rig effectors:

- 1 Select the effectors you want to change, then adjust the Marker Settings properties that display in the Properties window.

You can also refer to the following topics:

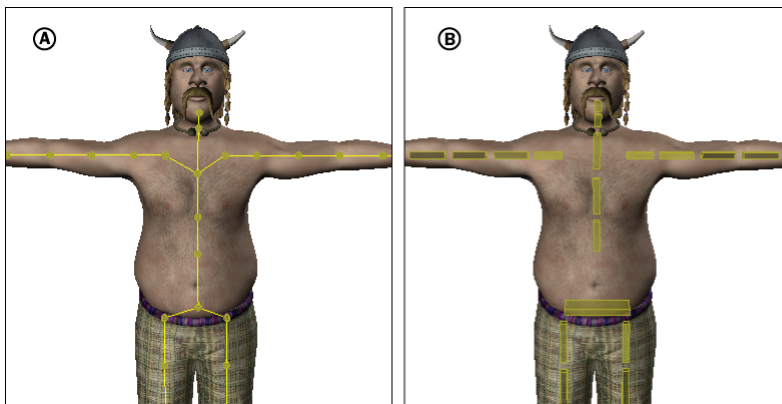
- [Changing the opacity of Control rig effectors](#) on page 1274
- [Changing the appearance of FK effectors](#) on page 1290
- [Customizing Control rigs](#) on page 1287
- [Control rig properties](#) on page 1253
- [Control rig effector properties](#) on page 1262

Changing the appearance of FK effectors

To change the appearance of FK Control rig effectors:

- 1 In the Scene browser, select the Control rig.
- 2 In the Properties window, do one of the following:
 - Click Default Look to make the effectors appear as the default yellow spheres connected by lines.

Click Solid Look to make the effectors appear as solid bone-like objects.



A. Default Look FK effectors B. Solid Look FK effectors

NOTE When you use the Default Look option, you can hide the line that connects effectors by selecting the effectors and disabling the Show Link option in the Marker Settings properties. See [Show Link](#) on page 1264 for more information.

A pose is a snapshot of a selected character's position. This may include the position of the character's entire body or only selected body parts. You can even create poses of hand and finger positions.

Since poses are created and pasted in conjunction with Control rigs, you can retarget poses onto any character that has a Control rig. Libraries of poses can be saved and loaded for use from one MotionBuilder session to another, and for use with different characters.

- [Control rigs](#) on page 1239
- [Creating a pose](#) on page 1293
- [Renaming a pose](#) on page 1294
- [Pasting a pose](#) on page 1294
- [Updating a pose](#) on page 1296
- [Deleting a pose](#) on page 1296
- [Pose Controls window](#) on page 1296

Creating a pose

To create a pose:

- 1 Arrange your character in the position you want to capture.
- 2 In the Pose Controls window, click Create.

The current character's position is copied and added to the Pose browser. The new pose displays at the end of the list, takes the name of the character, and is sequentially numbered (for example, Pose, Pose 1, Pose 2, and so on).

- 3 Rename the pose by right-clicking and selecting Rename from the contextual menu.

Keep your poses organized by creating them in a selected folder, or by them into folders.

- [Poses](#) on page 1293
- [Deleting a pose](#) on page 1296

Renaming a pose

To rename a pose:

- 1 Right-click the pose you want to rename, and select Rename from the contextual menu.
- 2 Type a new name in the Rename field that appears and press Enter.

- [Poses](#) on page 1293
- [Updating a pose](#) on page 1296

Pasting a pose

To paste a pose:

- 1 Select a character to apply poses to from the Current Character menu in the Character Controls.
- 2 Select the pose you want to paste from the Pose browser.
- 3 In the Pose Controls window, do one of the following:
 - Click Paste.
 - In the Pose browser, double-click a pose.

NOTE If no pose is selected in the Pose browser when you click Paste, the last pose stored in memory is pasted. A pose is stored in memory when you click Copy, Create, or Update.

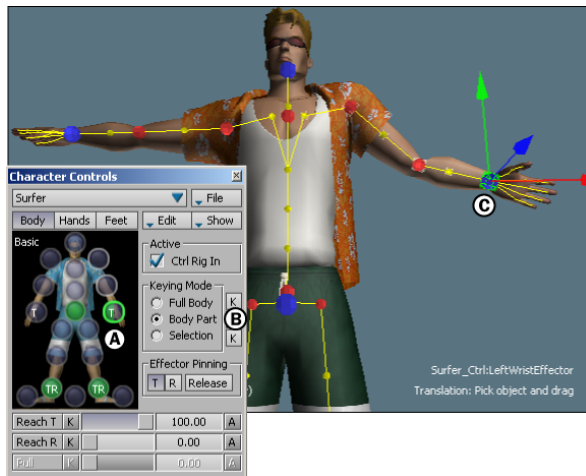
To paste a full body pose:

- 1 In the Character Controls window, select Full Body as the Keying mode.
- 2 Select any Match options you want in the Match area.
- 3 Click Paste.

To paste only part of a pose:

- 1 In the Character Controls window, select Body Parts as the Keying mode.
- 2 Select the body part on which you want to paste in the Character representation.
- 3 In the Pose Controls window, click Paste.

For example, in , the character's original pose is a T-stance position. By selecting Body Parts and the character's left arm, pasting a pose replaces only the character's left arm position, leaving the rest of the body in a T-stance.



Character begins in a T-stance A. A body part is selected. B. Body Part Keying mode is selected. C. Click Paste to replace only the left arm with the selected pose.

TIP Select Stance Pose from the Edit menu in the Character Controls to reset the position of a character to a T-stance at any time.

■ [Poses](#) on page 1293

Updating a pose

To update a pose:

- 1 Select the pose you want to update in the Pose browser.
- 2 Modify the new pose using the Control rig, and click Update.
The current pose replaces the existing pose in the Pose browser.

■ [Poses](#) on page 1293

Deleting a pose

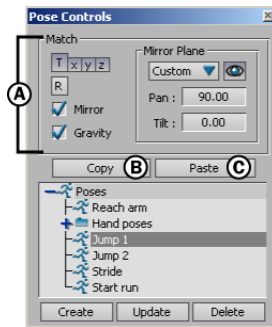
To delete a pose:

- 1 Select the pose in the Pose browser and click Delete. (To delete more than one pose, Ctrl-click additional poses.)
- 2 In the Deleting items dialog box, click Ok to delete the selection, or click Cancel to abort the operation.

You can also delete selected poses using the Delete option in the contextual menus of the Pose and Scene browsers.

Pose Controls window

This Pose Controls window , lets you create a library of poses that can be copied and pasted between characters or onto a single character.



Pose Controls window A.
Match area B. Copy C. Paste

To show the Pose Controls window, select Pose Controls from the Window menu in the menu bar, or use a layout in which the Pose Controls window displays.

Match Area

The options in the Match area determine how the pose selected in the Pose browser is pasted on the current character. See [Pose Controls Match area](#) on page 1300 for more information.

Copy

Use the Copy button to store the selected character's pose in memory, replacing any existing copied pose. Clicking Copy also deselects any selected poses in the Pose browser.

Paste

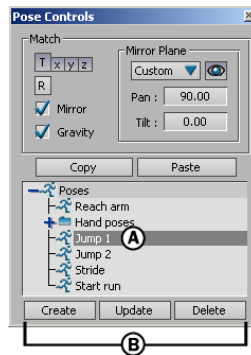
Use the Paste button to paste the selected pose from the Pose browser onto the current character. You can also paste a pose by double-clicking the pose in the Pose browser.

If no pose is selected in the Pose browser, the last pose stored in memory is pasted over the current character. A pose is stored in memory when you click Copy, Create, or Update.

When pasting, you can paste the entire pose (Full Body) or select only the body parts to be pasted (Body Parts), without affecting the rest of the character.

Pose browser

The Pose browser displays all the poses available for pasting onto selected characters. It is also where you create, update, and delete poses.



A. Pose browser B. Create, Update, and Delete buttons

By default, there is one folder in the Pose browser named Poses. You can create new folders (see [Pose contextual menus](#) on page 1299), and organize your poses by dragging poses and folders onto one another.

You can also save selected poses and build a library of poses for pasting onto characters when needed. All the poses in the Pose browser also appear in the Poses group in the Scene browser of the Navigator window.

NOTE You can select poses to save using only the Scene browser.

Create

The Create button copies the current character's position and adds the pose into the Pose browser. By default, the new pose displays at the end of the list in the Pose browser, takes the name of the character, and is sequentially numbered (for example, Pose, Pose 1, Pose 2, and so on).

You can add a pose into a selected folder or move it into a folder by dragging, and you can rename poses using the Rename option in the Pose contextual menu (see [Pose contextual menus](#) on page 1299).

Update

The Update button lets you update an existing pose in the Pose browser.

Delete

The Delete button lets you remove selected poses or folders. When you delete a selected folder, all the contents in the folder are also deleted.

Pose contextual menus

The Pose contextual menus let you insert folders and poses, rename poses, select, expand, collapse, and deselect branches within folders.

To open the Pose contextual menus, right-click a selected pose or folder in the Pose browser. There are two different contextual menus that appear, depending on whether you right-click a pose or a folder.

Insert Folder

Lets you insert a new folder in which to place poses. The folder is placed relative to the folder where you right-click.

For example, if you right-click on the Poses folder, the new folder is placed at the end of the tree in the Pose browser. If you click on another existing folder, the new folder is added at the selected folder level.

By default, the first folder that you add is named Poses Folder, and subsequent folders are named Poses Folder 1, Poses Folder 2, and so on.

NOTE The Insert Folder option only appears in the Pose contextual menu when you right-click on a folder.

Insert

Opens or switches to the Asset browser, letting you add poses or other assets to your scene. When dragging a file with saved poses into the Pose Controls window, make sure you release the *.fbx* file over a folder name or existing pose. If you do not, the poses may not be added from the *.fbx* file. Also, the *.fbx* file should only contain poses.

Delete

Lets you delete one or multiple selected poses from the Pose browser. To make multiple selections, Ctrl-click poses in the Pose browser.

Rename

The Rename option lets you rename a selected pose or folder in the Pose and Scene browsers.

Expand To Selection

Expands any folders containing a selected pose. Folders that are highlighted in light gray contain selected poses.

Collapse Branch

Collapses all branches in the tree, hiding the contents of folders. To collapse all branches, right-click a folder and select Collapse All.

Select and Deselect Branch

The Select Branch option lets you select all the contents in a folder. The Deselect branch option lets you deselect all the selected contents in a folder.

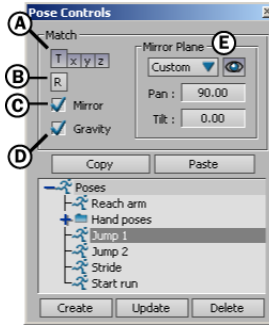
To select a branch, right-click the folder containing the poses you want to select, and choose Select Branch.

To deselect a branch, right-click the folder containing the poses you want to deselect, and choose Deselect branch.

- [Poses](#) on page 1293
- [Creating a pose](#) on page 1293
- [Pose Controls Match area](#) on page 1300

Pose Controls Match area

The options in the Match area determine how a selected pose is pasted on the current character .



Match area options A.
Translation B. Rotation C.
Mirror D. Gravity E. Mirror
Plane area

You can match a pose to the location of the current character based on IK and FK Control rig effectors, Auxiliary effectors and pivots, or any object included in a Character Extension.

Translation (T)

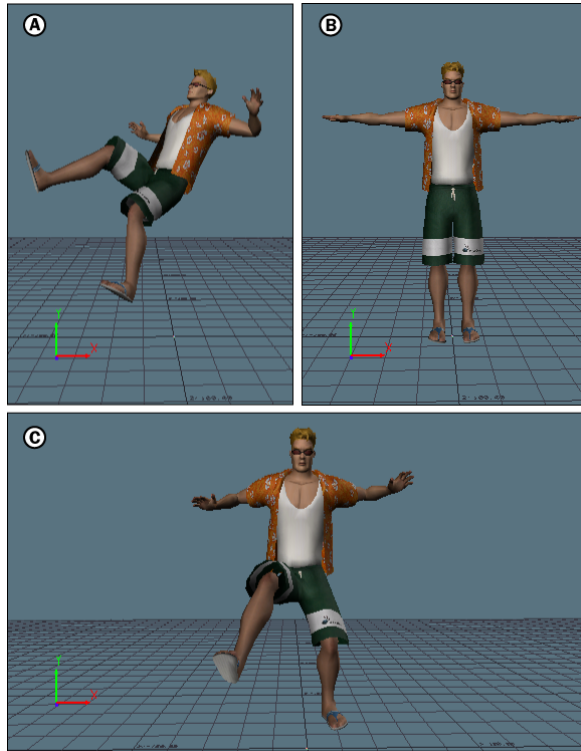
When the Translation option is active and you paste a pose onto a character, the character's current translation is preserved as the pose is pasted. The translation of the pose is made to match the translation of the selected object to which you are pasting.

To paste and match the translation of the pose to a selected character's translation on any specific axis, use the Translation x, y, and z options.

| Option | Description |
|-----------------------|---|
| Translation (x, y, z) | The Translation x, y, and z options let you specify which global axis (or axes) you want to match when pasting poses based on an object's translation. By default, all of the x, y, and z options are activated so that when you paste a pose with Translation active, the pose is pasted based on the position of the selected effector on all three axes. |

Rotation (R)

When the Rotation option is activated, you can paste and match a pose to the rotation of the selected object. For example, in the figure below, the Rotation option is active, and a character's Hips effector is selected. On the pose to be pasted, the Hips are oriented at an angle, away from the camera. On the character pose A is pasted on, the Hips are facing the positive Z-axis, or facing the camera.



Pasting with the Rotation (R) option active. A. In the pose to be pasted, the selected Hips effector is oriented at an angle from the camera. B. The character the pose is pasted on faces the camera. C. The pose is pasted and the character assumes pose A, but keeps its original orientation, facing the camera.

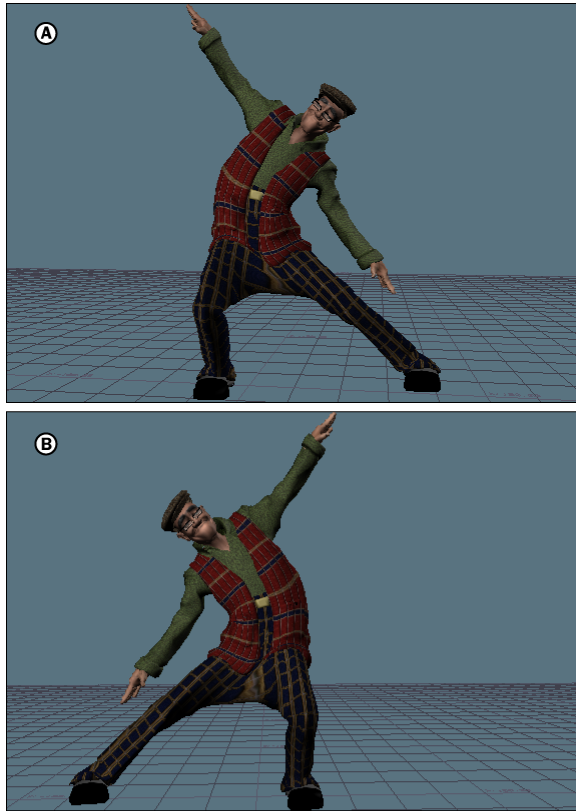
When pose A is pasted on the character in B, the orientation of the character in the resulting pose (C), is based on the rotation of the Hips effector in B. The character assumes pose A, but retains the rotation and translation of the Hips in pose B, still facing the camera.

If the Mirror option is also active, a red indicator displays on the selected effector to match, indicating that the mirror-pasted pose will be based on the rotation of this effector. To hide the red indicator, disable the Mirror Visibility option.

NOTE You cannot set a specific Mirror Plane when Rotation is active. If you want to change the orientation of the character as you paste, disable the Rotation option before you use the Mirror and Mirror plane options.

Mirror

This option lets you mirror a pose on the current character. For example, you can mirror a pose from the left side of a character's body onto the right side of the body. The Mirror option can be used with any of the other Match options to mirror-paste poses.



Pasting a Full Body pose with Mirror active
A. Original pose
B. After pasting

Activating the Translation and Rotation options with the Mirror option preserves the orientation of the selected object to match as you mirror-paste. A red indicator displays on the selected object to match when you use the Rotation and Mirror options together.

If you want to change the orientation of the mirrored pose as you paste, disable the Rotation option and use the Mirror Plane options to select a different plane on which to mirror the pose.

You can mirror full body poses, or you can mirror selected body parts. To mirror a pose on a character's whole body, select Full Body as the Keying Mode in the Character Controls window and activate the Mirror option. When both are active, pasting mirrors the whole body pose onto the selected character.

To mirror a pose on a character's selected body part, select Body Parts as the Keying Mode in the Character Controls window and activate the Mirror option. When both of these options are active, pasting a pose mirrors only on the selected body part, so you can paste finger or hand positions from one arm to another, for example.

For more information on Keying modes, see [Keying Mode menu](#) on page 673.

Gravity

When you are copy-pasting onto the same character, activating the Gravity option ensures that the feet stay at the original level of the pasted pose, keeping a natural orientation of the feet on the floor.

When the Translation (T), Rotation (R), and Gravity options are active, pasting a pose onto a character matches the translation on the global X- and Z-axes, and rotation on the global Y-axis. The original global Y translation value and the original global X and Z orientation values are preserved.

Gravity works best when you are copying and pasting poses between the same character. Pasting poses between characters of different sizes may produce undesirable results, causing the feet of the target character to lift into the air to match the pose of the larger character. For best results, disable Gravity when pasting poses between different sized characters.

You can also disable the Gravity option if you are pasting poses in a situation where you want the character's feet to remain in the air. When Gravity is disabled, you can achieve a perfect match without respect to the floor.

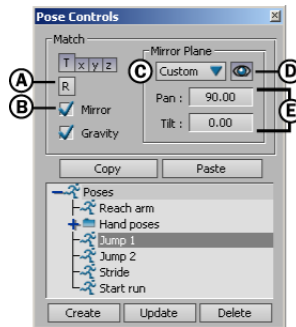
NOTE The Gravity, Translation, and Rotation options are available only when the current character's Keying mode is set to Full Body in the Character Controls window.

Mirror Plane Area

The Mirror Plane area options let you mirror a pose relative to the character's position on the global axes. You can mirror full body poses, or selected body parts.

The Mirror Plane options are only available when the Mirror option is enabled and the Rotation (R) option is disabled. This is because the Rotation option is designed to preserve the orientation of a character as you paste poses onto

it, while the Mirror plane options allow you to change the orientation of the character as you paste.



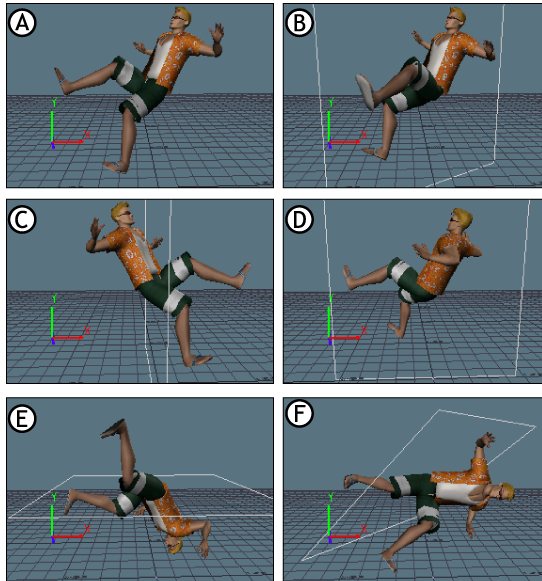
A. Rotation is disabled. B. Mirror is active. C. Mirror mode menu D. Mirror Plane visibility option E. Pan and Tilt values

To mirror a pose on the current character's whole body, select Full Body as the Keying Mode in the Character Controls window and activate Mirror in the Mirror Plane area in the Pose Controls. When both are active, pasting mirrors the full body pose onto the selected character.

For example, shows the effects of pasting a full body pose onto a character when the various mirror plane modes are active. The pose in , A is the original pose. The right side of the character is mirrored onto the left side, and the orientation of the character changes as each mirror plane mode is used.

Mirror Plane Mode Menu

When the Mirror option in the Match area is activated, and the Rotation (R) option is disabled, you can use the Mirror Plane Mode menu to select the plane on which you want poses to be mirrored.



Mirror Mode menu options *A. Original pose B. Auto Mirror mode C. Z-Y plane D. X-Y plane E. X-Z plane F. Custom plane, with Pan and Tilt values of 50*

The following table describes the options in the Mirror Plane Mode menu:

| Option | Behavior |
|--------|---|
| Auto | Calculates the mirror plane based on the selected object to be matched and the enabled Match options. |
| Z-Y | The mirror plane is defined by the global Z-Y plane. |
| X-Y | The mirror plane is defined by the global X-Y plane. |
| X-Z | The mirror plane is defined by the global X-Z plane. |
| Custom | Lets you define a custom mirror plane using the Pan and Tilt values. |

Pan

When Custom is selected in the Mirror Plane Mode menu, you can set the Pan value to rotate the Mirror plane around the global Y-axis.

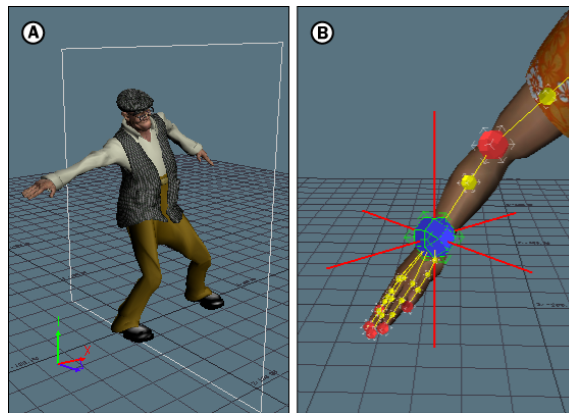
Tilt

When Custom is selected as the Mirror Plane mode, you can set the Tilt value to rotate the Mirror plane around the global X-axis.

NOTE The Pan and Tilt fields are only available if the Custom option is selected in the Mirror Plane Mode menu.

Mirror Visibility

When the Mirror option is active, you can activate and disable the Mirror Visibility option to show or hide the 3D mirror plane you have selected in the Mirror Plane Mode menu. When Rotation is active, the Mirror Visibility option shows or hides the red indicator that displays on the selected object to be matched.



Mirror visibility A. The mirror plane displays for a pose on the Z-Y plane. B. A red indicator displays on the right wrist effector to be matched.

- [Pose Controls window](#) on page 1296
- [Pasting a pose](#) on page 1294

Character settings

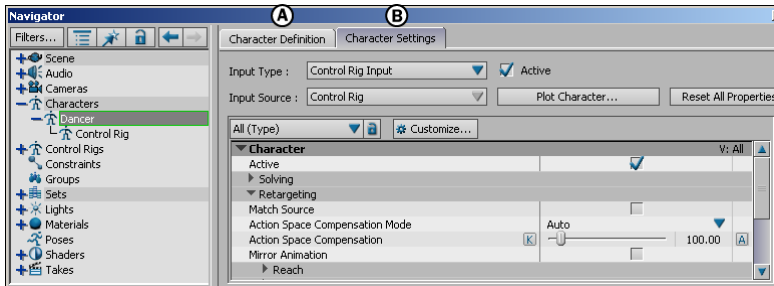
83

The Character Settings let you define your character model, link it to a motion source, and adjust the way it reacts to the motion source. They also let you create and manage your Control rigs.

Keep in mind that the Character Settings let you work with the Character asset. The Character asset works as a template to help you define your model for MotionBuilder and connect it to a motion source. The Character Settings do not adjust the character model itself.

The Character settings consist of two panes:

- [Character Definition pane](#) on page 1310
- [Character Settings pane](#) on page 1324

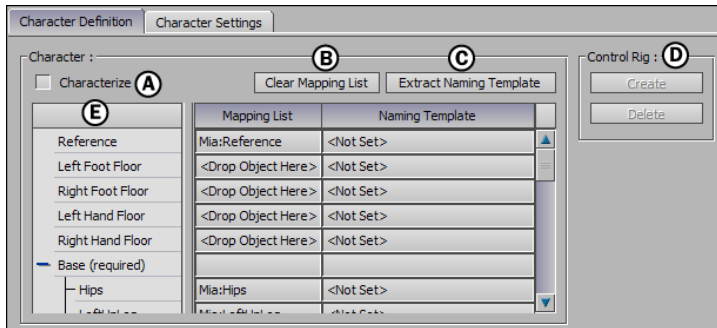


Character Settings A. Character Definition tab B. Character Settings tab

- [Character assets](#) on page 1081
- [Retargeting animation character-to-character](#) on page 1067
- [Control rigs](#) on page 1239

Character Definition pane

The Character Definition pane is where you define and characterize your model, and where you manage your Control rigs.



Character Definition pane A. Characterize option B. Clear Mapping List button C. Extract Naming Template button D. Control Rig area E. Mapping List

Characterize option

The Characterize option creates a link between the bone or joint objects defined for your character in the Mapping List and the character engine in MotionBuilder. Since all characterized characters link to this same engine, you can create a library of characters whose animation can be interchanged.

The Characterize option also stores the stance pose of your character, which can act as a starting or rest pose. When creating models for use in MotionBuilder, save your biped or quadruped model in a stance pose. There is a separate recognized stance pose for each type of model. See [Bipeds and quadrupeds](#) on page 1096.

Clear Mapping List button

The Clear Mapping List button removes all objects defined in the Mapping List. See [Mapping List](#) on page 1311.

Mapping List

The Mapping List is where you define the structure of each character model you bring into MotionBuilder.

The names of all objects that MotionBuilder recognizes as part of the structure of a character model are listed to the left. To define an object as part of your character, select it from your character's skeleton (in the Viewer window, Scene browser, or Schematic view) and Alt-drag it into the corresponding slot of the Mapping List.

For example, to define the Hips, you Alt-drag the Hips object from the character skeleton into the Hips slot of the Mapping List. This is how you tell MotionBuilder “On this character model, this is the hips bone” and so on.

The object you place in each slot of the Mapping List can be a joint, bone, null, or any other object from your model skeleton.

You can also automatically map objects in all the slots by dragging a Character asset on top of your model. This automatically matches the joints or bones in your character skeleton with the appropriate slots, provided your skeleton follows the naming conventions in the Mapping List. See [Character mapping](#) on page 1082 for more information on mapping out a character's structure.

To link your model to a motion source successfully, define a joint or bone object in each slot in the Base group of the Mapping List.

Depending on the method used to create your model, you might also have to specify a Reference object and additional Auxiliary, Spine, and Roll objects.

Slots that define particular areas of a character's body are organized into groups that you can expand or collapse as you complete the Character mapping process. The Mapping List is divided into the following slots or groups of slots:

- [Reference slot](#) on page 1312
- [Left Foot Floor/Right Foot Floor slots](#) on page 1312
- [Left Hand Floor/Right Hand Floor slots](#) on page 1312
- [Base slots](#) on page 1313
- [Auxiliary slots](#) on page 1315
- [Spine slots](#) on page 1316
- [Roll slots](#) on page 1316
- [Special slots](#) on page 1317

- [Left Hand/Right Hand slots](#) on page 1318
- [Left Foot/Right Foot slots](#) on page 1319
- [Left In-Hand/Right In-Hand slots](#) on page 1320
- [Left In-Foot/Right In-Foot slots](#) on page 1321
- [Neck slots](#) on page 1323
- [Props slots](#) on page 1323

Reference slot

While you do not need a Reference object during the mapping process, define an object in this slot to translate, scale, and rotate your entire model. The Reference object acts as the root of your entire model. The ideal reference object is a null or joint parented to your model's hips.

You should define a Reference object in the following circumstances:

- When the hips of your model are parented to another object. This parent is commonly the root of the hierarchy, and is positioned on the floor.
- When you are using data from a specific file format to map to your model. Some file formats require a Reference object.

Left Foot Floor/Right Foot Floor slots

The Left Foot Floor and Right Foot Floor slots are for markers or other objects that represent the floor. You can specify different markers for each foot. Use these slots with the Feet Floor Contact settings (see [Toes Floor Contact Setup properties](#) on page 1146).

Left Hand Floor/Right Hand Floor slots

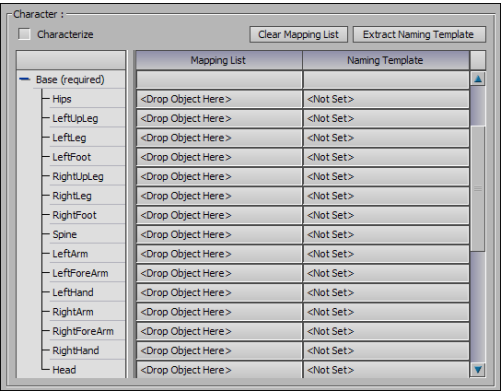
The Left Hand Floor and Right Hand Floor slots are for markers or other objects that represent the floor for the left or right hand of your character. You can specify different markers for each hand. Use these slots with the Hands Floor Contact settings (see [Feet Floor Contact Setup properties](#) on page 1136).

NOTE If you leave the floor slots blank, the plane at 0 on the Y-axis (the grid shown in the Producer Perspective camera view) is used for floor contact.

Base slots

The Base group of slots let you define the basic set of bones that are required for any skeleton loaded into MotionBuilder. Map objects into this group of slots in order for MotionBuilder to understand the structure of your character model and its skeleton.

You can name the bones of a skeleton according to MotionBuilder’s naming conventions to map objects to these slots automatically. You can also manually map bones to these slots, but either way, these 15 Base bones must be defined.



Base group of (required) objects in the Mapping List

Refer to the following table for a description of each slot in the Base group. See [Bone naming conventions](#) on page 1125 to view a simple skeleton illustrating the placement of these bones.

| Base slot | Description |
|----------------------|---|
| Hips | The joint or bone that drives the hips of your model. |
| LeftUpLeg/RightUpLeg | The joint or bone that drives the upper left/upper right leg of your model. The LeftUpLeg/RightUpLeg joint or bone must be the child of the Hips joint or bone. |
| LeftLeg/RightLeg | The joint or bone that drives the left/right knee of your model. The LeftLeg/RightLeg |

| Base slot | Description |
|--------------------------|---|
| | joint or bone must be the child of the LeftUpLeg/RightUpLeg joint or bone. |
| LeftFoot/RightFoot | The joint or bone that drives the left/right foot of your model. The LeftFoot/RightFoot joint or bone must be the child of the LeftLeg/RightLeg joint or bone. |
| Spine | The joint or bone that specifies the chest of the destination skeleton. You can use this slot with the optional Spine slots for characters with a spine. Do not position the Spine joint or bone in the same position as the hips or poor mapping might result. |
| LeftArm/RightArm | The joint or bone that drives the left/right arm of your model. The LeftArm/RightArm joint or bone must be the child of the Spine joint or bone. |
| LeftForeArm/RightForeArm | The joint or bone that drives the left/right elbow of your model. The LeftForeArm/RightForeArm joint or bone must be child of the LeftArm/RightArm joint or bone. |
| LeftHand/RightHand | The joint or bone that drives the left/right hand of your model. The LeftHand/RightHand joint or bone must be the child of the LeftForeArm/RightForeArm joint or bone. |
| Head | The joint or bone that drives the head of your model. The Head joint or bone must be the child of the Spine joint or bone. |

NOTE You are not required to create your model skeleton using the parent to child relationships described in this section. These relationships describe the recommended method of structuring your model skeleton. Feel free to define custom skeleton structures in the mapping list.

Auxiliary slots

The slots in the Auxiliary group are optional. They let you enhance your character by defining objects for the base of the toes and fingers, the neck, and the shoulders.

| | Model | Template Name |
|-----------------|-------------------------|---------------|
| Base (required) | | |
| Auxiliary | | |
| LeftToeBase | Beast 1:LeftToeBase | <Not Set> |
| RightToeBase | Beast 1:RightToeBase | <Not Set> |
| LeftShoulder | Beast 1:LeftShoulder | <Not Set> |
| RightShoulder | Beast 1:RightShoulder | <Not Set> |
| Neck | Beast 1:Neck | <Not Set> |
| LeftFingerBase | Beast 1:LeftFingerBase | <Not Set> |
| RightFingerBase | Beast 1:RightFingerBase | <Not Set> |
| Spine | | |
| Roll | | |

Auxiliary group of slots in the Mapping List

The following table describes each slot in the Auxiliary group.

| Auxiliary slot | Description |
|----------------------------|---|
| LeftToeBase/RightToeBase | The joint or bone that drives the left/right toes of your model. This joint or bone must be the child of the LeftFoot/RightFoot joint or bone. |
| LeftShoulder/RightShoulder | The joint or bone that drives the left/right shoulder of your model. This joint or bone must be the child of the Spine joint or bone, and must be the parent of the LeftArm/RightArm joint or bone. |
| Neck | The joint or bone that drives the neck of your model. This joint or bone must be the child of the Spine joint or bone, and must be the parent of the Head joint or bone. |

| Auxiliary slot | Description |
|--------------------------------|---|
| LeftFingerBase/RightFingerBase | The joints or bones that drive the left/right fingers of your model. This joint or bone must be the child of the finger base. |

Spine slots

The Spine group of slots let you specify a spine with up to ten vertebrae (nine optional spines + 1 required Spine = 10). See [Defining a spine](#) on page 1093 for more information.

| | Model | Template Name |
|---|-----------|------------------------|
| + | Auxiliary | |
| - | Spine | |
| - | Spine | Rufus:Spine <Not Set> |
| - | Spine1 | Rufus:Spine1 <Not Set> |
| - | Spine2 | Rufus:Spine2 <Not Set> |
| - | Spine3 | Rufus:Spine3 <Not Set> |
| - | Spine4 | Rufus:Spine4 <Not Set> |
| - | Spine5 | Rufus:Spine5 <Not Set> |
| - | Spine6 | Rufus:Spine6 <Not Set> |
| - | Spine7 | Rufus:Spine7 <Not Set> |
| - | Spine8 | <No model> <Not Set> |
| - | Spine9 | <No model> <Not Set> |
| + | Roll | |

Spine group

Roll slots

The slots in the Roll group let you define objects that influence the roll of the bones in the arms and legs.

| | Model | Template Name |
|---|------------------|----------------------------------|
| + | Spine | |
| - | Roll | |
| - | LeftUpLegRoll | Beast:LeftUpLegRoll <Not Set> |
| - | LeftLegRoll | Beast:LeftLegRoll <Not Set> |
| - | RightUpLegRoll | Beast:RightUpLegRoll <Not Set> |
| - | RightLegRoll | Beast:RightLegRoll <Not Set> |
| - | LeftArmRoll | Beast:LeftArmRoll <Not Set> |
| - | LeftForeArmRoll | Beast:LeftForeArmRoll <Not Set> |
| - | RightArmRoll | Beast:RightArmRoll <Not Set> |
| - | RightForeArmRoll | Beast:RightForeArmRoll <Not Set> |
| + | Special | |

Roll group

When you create your model skeleton, we recommend that you add roll bones to the skeleton structure. Roll bones let you achieve more realistic envelope

deformations by specifying a percentage of the roll axis movement on specific bones (see [Roll Extraction](#) on page 1336).

For you to transfer the roll properly, your bones or joints must be arranged as described in the following table:

| Roll slot | Description |
|----------------------------------|--|
| LeftUpLegRoll/RightUpLegRoll | The joint or bone that rolls the LeftUpLeg/RightUpLeg. The LeftUpLegRoll/RightUpLegRoll joint or bone must be the child of the LeftUpLeg/RightUpLeg joint or bone. |
| LeftLegRoll/RightLegRoll | The joint or bone that rolls the LeftLeg/RightLeg. The LeftLegRoll/RightLegRoll bone or joint must be the child of the LeftLeg/RightLeg joint or bone. |
| LeftArmRoll/RightArmRoll | The joint or bone that rolls the LeftArm/RightArm. The LeftArmRoll/RightArmRoll joint or bone must be the child of the LeftArm/RightArm joint or bone. |
| LeftForeArmRoll/RightForeArmRoll | The joint or bone that rolls the LeftForeArm/RightForeArm. The LeftForeArmRoll/RightForeArmRoll bone or joint must be the child of the LeftForeArm/RightForeArm joint or bone. |

Special slots

Depending on your model skeleton and the amount of control you want over your animation, you might want to split translation and rotation of the hips between two different joints or bones.

The Special group of slots contains the Hips Translation slot that lets you define a second object for translating your model's hips. If you define a Hips Translation object, the hips translation data goes to that object, while the hips rotation data goes to the original Hips object defined in the Base group.

| | Model | Template Name |
|-----------------|------------|---------------|
| Spine | | |
| Roll | | |
| Special | | |
| HipsTranslation | <No model> | <Not Set> |
| Left Hand | | |
| Right Hand | | |

Special group with Hips Translation slot

The object defined in the Hips Translation slot should be a child of your character's Reference object.

If you choose not to define an object in the Hips Translation slot, both translation and rotation data are sent to the object defined in the Hips slot. See [Hips Translation Mode](#) on page 1338.

If you want, you can also select the method used to transfer rotation and translation to the Hips Translation and Hips objects using the [Hips Translation Mode](#) on page 1338 option in the [Character Solving properties](#) on page 1337.

Left Hand/Right Hand slots

The slots in the Left Hand and Right Hand groups let you define objects to add realistic hand and finger movements to your character. These groups contain slots for thumb, index, middle, ring, and pinky finger objects, as well as slots for an extra finger.

| | Model | Template Name |
|----------------------|-------------------------|---------------|
| Roll | | |
| Special | | |
| Left Hand | | |
| LeftHandThumb1 | <No model> | <Not Set> |
| LeftHandThumb2 | <No model> | <Not Set> |
| LeftHandThumb3 | <No model> | <Not Set> |
| LeftHandThumb4 | <No model> | <Not Set> |
| LeftHandIndex1 | Beast 1:LeftHandIndex1 | <Not Set> |
| LeftHandIndex2 | Beast 1:LeftHandIndex2 | <Not Set> |
| LeftHandIndex3 | <No model> | <Not Set> |
| LeftHandIndex4 | <No model> | <Not Set> |
| LeftHandMiddle1 | Beast 1:LeftHandMiddle1 | <Not Set> |
| LeftHandMiddle2 | Beast 1:LeftHandMiddle2 | <Not Set> |
| LeftHandMiddle3 | <No model> | <Not Set> |
| LeftHandMiddle4 | <No model> | <Not Set> |
| LeftHandRing1 | Beast 1:LeftHandRing1 | <Not Set> |
| LeftHandRing2 | Beast 1:LeftHandRing2 | <Not Set> |
| LeftHandRing3 | <No model> | <Not Set> |
| LeftHandRing4 | <No model> | <Not Set> |
| LeftHandPinky1 | <No model> | <Not Set> |
| LeftHandPinky2 | <No model> | <Not Set> |
| LeftHandPinky3 | <No model> | <Not Set> |
| LeftHandPinky4 | <No model> | <Not Set> |
| LeftHandExtraFinger1 | <No model> | <Not Set> |
| LeftHandExtraFinger2 | <No model> | <Not Set> |
| LeftHandExtraFinger3 | <No model> | <Not Set> |
| LeftHandExtraFinger4 | <No model> | <Not Set> |
| Right Hand | | |

Left Hand group

The number of each slot corresponds with each finger joint. For example, slots numbered with a “1” correspond to the finger or toe’s first joint while slots numbered with a “4” correspond to the finger’s last joint. The last joint or bone in each finger should be mapped to the fourth slot so that the finger tips are properly defined.

To use these slots, your model skeleton must have hands with fingers.

Left Foot/Right Foot slots

The slots in the Left Foot and Right Foot groups let you define the model’s feet and add realistic foot and toe movements to your character. To use these slots, your model skeleton must have feet with toes.

The Foot groups follow the same naming conventions as the Hand groups, so they contain slots for the thumb (big toe), index (second toe), middle (third toe), ring (fourth toe), and pinky (baby toe), as well as slots for an extra toe.

For example, shows the Left Foot slots in the Mapping List for a Beast character.

| | Model | Template Name |
|----------------------|-------------------------|---------------|
| Right Hand | | |
| Left Foot | | |
| LeftFootThumb1 | <No model> | <Not Set> |
| LeftFootThumb2 | <No model> | <Not Set> |
| LeftFootThumb3 | <No model> | <Not Set> |
| LeftFootThumb4 | <No model> | <Not Set> |
| LeftFootIndex1 | Beast 1:LeftFootIndex1 | <Not Set> |
| LeftFootIndex2 | Beast 1:LeftFootIndex2 | <Not Set> |
| LeftFootIndex3 | <No model> | <Not Set> |
| LeftFootIndex4 | <No model> | <Not Set> |
| LeftFootMiddle1 | Beast 1:LeftFootMiddle1 | <Not Set> |
| LeftFootMiddle2 | Beast 1:LeftFootMiddle2 | <Not Set> |
| LeftFootMiddle3 | <No model> | <Not Set> |
| LeftFootMiddle4 | <No model> | <Not Set> |
| LeftFootRing1 | Beast 1:LeftFootRing1 | <Not Set> |
| LeftFootRing2 | Beast 1:LeftFootRing2 | <Not Set> |
| LeftFootRing3 | <No model> | <Not Set> |
| LeftFootRing4 | <No model> | <Not Set> |
| LeftFootPinky1 | <No model> | <Not Set> |
| LeftFootPinky2 | <No model> | <Not Set> |
| LeftFootPinky3 | <No model> | <Not Set> |
| LeftFootPinky4 | <No model> | <Not Set> |
| LeftFootExtraFinger1 | <No model> | <Not Set> |
| LeftFootExtraFinger2 | <No model> | <Not Set> |
| LeftFootExtraFinger3 | <No model> | <Not Set> |
| LeftFootExtraFinger4 | <No model> | <Not Set> |
| Right Foot | | |

Left Foot group of slots

The number of each group of slots corresponds with each toe joint. For example, slots numbered with a “1” correspond to the toe’s first joint while slots numbered with a “4” correspond to the last joint of the toe. Each toe’s last joint or bone should be mapped to an end slot to define toe tips properly.

See [Defining toe behavior](#) on page 1085 for more information.

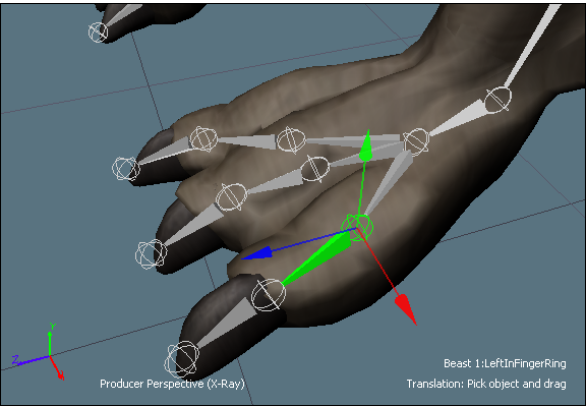
Left In-Hand/Right In-Hand slots

The Left In-Hand and Right In-Hand groups contain optional slots for defining the bones within each hand. These are the joints or bones that link the first joint or bone of each finger to the LeftHandBase or RightHandBase slots.

| | Model | Template Name |
|--------------------|--------------------------|---------------|
| Left In-Hand | | |
| LeftInHandThumb | <No model> | <Not Set> |
| LeftInHandIndex | Beast:LeftInFingerIndex | <Not Set> |
| LeftInHandMiddle | Beast:LeftInFingerMiddle | <Not Set> |
| LeftInHandRing | Beast:LeftInFingerRing | <Not Set> |
| LeftInHandPinky | <No model> | <Not Set> |
| LeftInHandExtra... | <No model> | <Not Set> |
| Right In-Hand | | |

Left In-Hand group

For example, shows a skeleton with bones that are defined in the Left In-Hand optional slots.



Model with left In-Hand bones

The Left In-Hand and Right In-Hand groups contain in-hand slots for each finger (thumb, the index, middle, ring, and pinky), as well as a slot for an extra finger.

Each Left In-Hand/Right In-Hand object must be between the LeftFingerBase/RightFingerBase object and the first joint or bone of each finger. For example, the LeftInRing object must be the child of the LeftFingerBase object. The LeftInRing object must parent the LeftHandRing1 object.

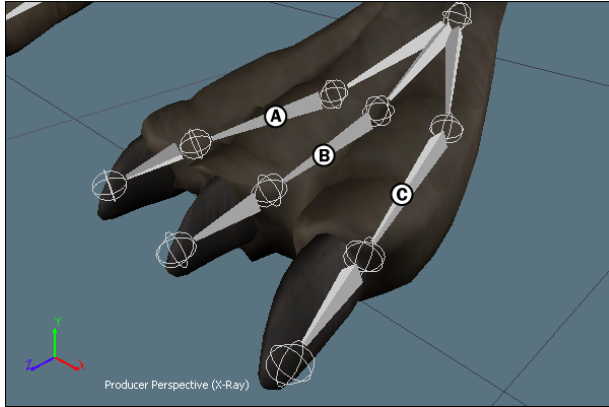
Left In-Foot/Right In-Foot slots

The Left In-Foot and Right In-Foot groups contain optional slots for defining the bones within each foot. These are the bones that link the first joint of each toe to the LeftToeBase or RightToeBase.

| | Model | Template Name |
|-----------------------|------------|---------------|
| Right In-Hand | | |
| Left In-Foot | | |
| LeftInFootThumb | <No model> | <Not Set> |
| LeftInFootIndex | <No model> | <Not Set> |
| LeftInFootMiddle | <No model> | <Not Set> |
| LeftInFootRing | <No model> | <Not Set> |
| LeftInFootPinky | <No model> | <Not Set> |
| LeftInFootExtraFinger | <No model> | <Not Set> |
| Right In-Foot | | |

Left In-Foot group

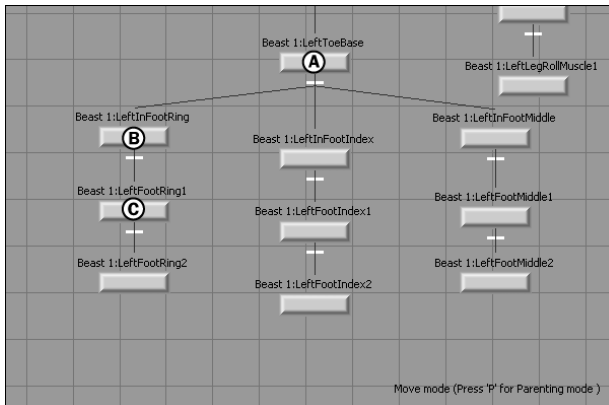
For example, shows a skeleton with bones defined in the Left In-Foot optional slots.



Left In-Foot objects A. LeftInFootIndex B. LeftInFootMiddle C. LeftInFootRing

The Left In-Foot and Right In-Foot groups contain in-foot slots for each toe (named thumb, index, middle, ring, and pinky), as well as a slot for an extra toe. The naming of these slots is based on the Left In-Hand and Right In-Hand groups as these groups are similar. The LeftInFootThumb slot represents the big toe on the left foot, the LeftInFootIndex represents the second toe on the left foot, and so on.

Each Left In-Foot/Right In-Foot joint or bone must be between the LeftToeBase/RightToeBase and the first joint or bone of each toe. For example, in the following figure, the LeftInFootRing object (B) must be the child of LeftToeBase (A) and the LeftInFootRing object (B) must parent the LeftFootRing1 object (C).



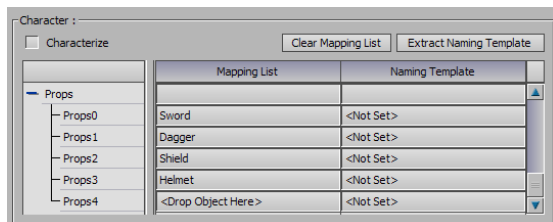
Hierarchy of Left In-Foot objects A. LeftToeBase object B. LeftInFootRing object C. LeftFootRing1 object

Neck slots

The Neck group contains ten slots that let you define multiple neck bones. A biped commonly uses only one neck joint or bone, while a quadruped commonly uses many neck joints or bones.

Props slots

The slots in the Props group let you add up to five prop objects, such as a weapon, umbrella, cane, or other items associated with your character.



Props group

Extract Naming Template button

The Mapping List gives you default naming conventions for all skeleton objects. If you have characters built with bones that have different naming conventions, use the Extract Naming Template button to create your own template of names. See [Creating a bone-naming template](#) on page 1127.

A naming template is an *.fbx* file that contains the naming conventions you used on a skeleton. Later, you can use this template to map the bone objects of other skeletons that use your naming conventions automatically. See [Applying a bone naming template](#) on page 1128.

Template Names column

This column lists the names of bones that are included in your custom bone-naming template. See [Creating a bone-naming template](#) on page 1127 for more information.

Control Rig area

The Control Rig area lets you create and delete Control rigs.

Create

Creates a Control rig for a selected, characterized character. A character can have multiple Control rigs, but only one Control rig can be attached to the character at a time.

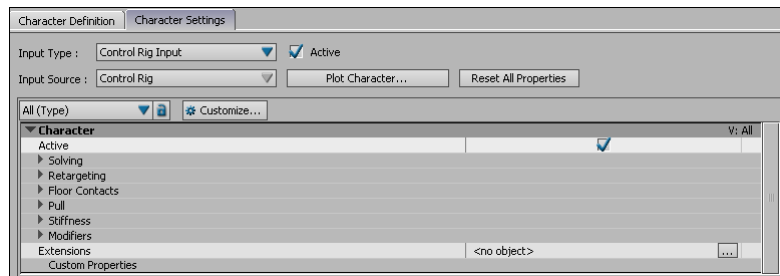
Delete

Deletes a selected Control rig.

- [Character settings](#) on page 1309
- [Control rigs](#) on page 1239
- [Attaching a Control rig to a character](#) on page 1247

Character Settings pane

The Character Settings pane lets you adjust character mapping between a selected data source and your characterized character.



Character Settings pane

The Character settings contain the following main areas:

- [Input Type menu](#) on page 1325
- [Active option](#) on page 1326
- [Plot Character button](#) on page 1326

- [Reset All Properties button](#) on page 1327
- [Character Properties area](#) on page 1327

Input Type menu

Lets you select the type of motion source you want to drive your character. After selecting the Input Type, then select the specific source from the Input Source menu.

Input Source menu

Lets you choose the specific motion source you want to drive your character. You can choose between the following four input types and one output type.

| Option | Function |
|--------------------|--|
| Actor Input | Actor Input lets you choose an Actor as the motion source. Actors are used as a link between a character and motion data. |
| Character Input | Character Input lets you select another character as the source of motion data. For example, you can load one characterized character with animation plotted to its skeleton, then select that character as the input source to drive another character in the same scene. |
| Control Rig Input | Control Rig Input lets you use a Control rig to manipulate, position, and keyframe your character. You can use Control rigs to create keyframe animation or to modify existing animation. To modify existing animation on a character skeleton, first create a Control rig and plot that animation to the Control rig. |
| Control Rig Output | Control Rig Output lets you transfer animation from your model skeleton to a Control rig so you can edit it. |

| Option | Function |
|--------------|---|
| Stance Input | Stance Input resets a selected character to its stance pose. In some situations, you might need to redefine your Mapping List and characterize again. For example, if you have irregular envelope deformations caused by characters with conflicting bone rolls, you would need to map between the two characters. Or, you might have a source that is much larger or smaller than the model to which you are mapping. In these cases, select Stance Input, disable Characterize, drag the necessary bones or joints into the list again, then activate Characterize. |

Active option

Use Active to enable the link between your model and the input type and source. Once active, you can use the options in the Character Properties area to adjust how your character reacts to the input source.

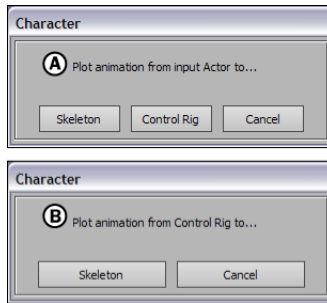
Active also enables the Control rig and lets you use the Character Controls window to begin animating your character.

Plot Character button

Plot Character transfers animation from the selected input source to your model skeleton or Control rig.

Depending on what you select as the input type and source, the dialog box that appears when you click Plot Character presents different options.

For example, in the following figure, the first dialog (A) displays when your input source is an Actor and the second dialog (B) displays if your input source is a Control rig. When your input source is an Actor or another character, you can also plot directly to your model skeleton.



Plotting options for different input sources *A. Input source is an Actor* *B. Input source is a Control rig*

Reset All Properties button

The Reset All Properties button lets you reset all the mapping options in the Character settings pane to their default values. You can choose to reset all solving and definition properties, only solving properties, or only definition properties.

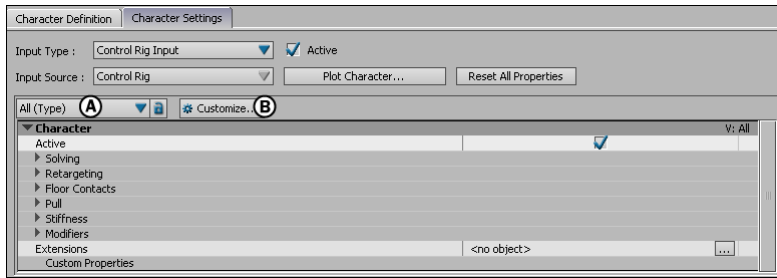
Solving properties include Pull, Resist, Reach, and Stiffness, while Definition properties include Hand Contact Positions and Feet Contact Positions.

Character Properties area

The Character Properties area lets you browse and adjust all of the properties associated with a selected character. You can change how your character reacts to the input source, how the Control rig behaves, whether floor contact for hands and feet are active, and many other properties.

There are seven Property views that list the same options as the Default view. Each view is organized to make it easier to find certain properties. For example, the Pull view only lists properties that pertain to effector pulling in the Control rig.

Use the Property View menu to select the view containing properties you want to work with. You can also click the Customize button to start creating your own view.



Character Settings pane A. Property views menu B. Customize button

The Character Properties area includes the following main groups of properties:

- [Character Solving properties](#) on page 1337
- [Character Retargeting properties](#) on page 1328
- [Floor Contact properties](#) on page 1133
- [Pull properties](#) on page 1332
- [Stiffness properties](#) on page 1333
- [Modifiers](#) on page 1335
- Extensions (See [Character Extension properties](#) on page 1159.)
- [Character Solving properties](#) on page 1337
- [Character Retargeting properties](#) on page 1328
- [Floor contact](#) on page 1131
- [Pull](#) on page 1384

Character Retargeting properties

The Retargeting group of properties lets you define special settings for Actor or character sources. The options in the Actor folder apply only to Actors.

Match Source

Match Source lets you adapt the stride and the position in space of a model to the selected source.

For example, a large model occupies more space when walking than a smaller model. Activating Match Source adapts the motion so that the strides and space between the two models are the same.

When Match Source is disabled, you can translate and rotate your model anywhere in your scene, and retain its mapping to the selected source.

When Match Source is active, you can only scale your model. To translate, rotate, or scale your model, define a Reference object (see [Reference slot](#) on page 1312).

Action Space Compensation Mode

This menu lets you choose how you want the Action Space Compensation property to work. By default, the Action Space Compensation Mode is set to Auto.

| Option | Function |
|--------|---|
| Off | Turns off Action Space Compensation. |
| Auto | Action Space Compensation automatically calculates and applies action space to the character and source. |
| User | Lets you change the value of Action Space Compensation. The higher the value, the longer the character strides are when it walks. The smaller the value, the smaller the strides. |

Action Space Compensation

Calculates and compensates for the action space between a character and its source. It moves the character's feet and legs with the movement of the source's feet, but makes adjustments to the feet and leg movements based on scale differences. When Match Source is active, Action Space Compensation is set to 100%.

Match Source must be active for Reach Hands, Reach Feet, and Reach Chest to reach for the source.

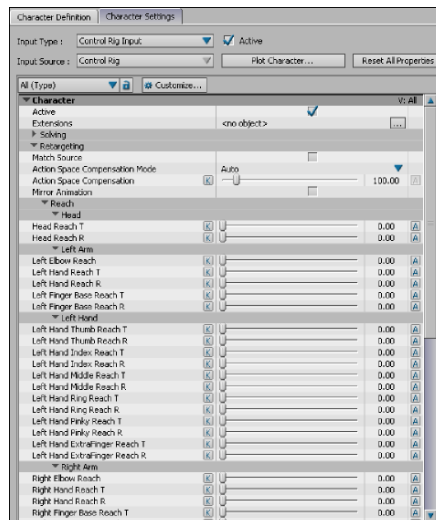
Mirror Animation

Activate Mirror Animation to mirror a character's position along the X-axis. For example, you can activate this option to transfer the source data on the left arm to the right arm, and vice versa.

If your source is a Control rig, activating Mirror Animation mirrors your motion as your animation is plotted from your model skeleton to the Control rig.

Reach

The Reach settings let you specify the percentage you want each specific bone of your character's skeleton to reach toward its motion source. Use the Reach settings when your character's source is either an Actor or another character.



Retargeting > Reach settings

Almost all Reach T and Reach R settings are also accessible from the Character Controls window. Reach is different when your character's source is set to Control Rig In. See [Reach and Pull area](#) on page 1380 for more information.

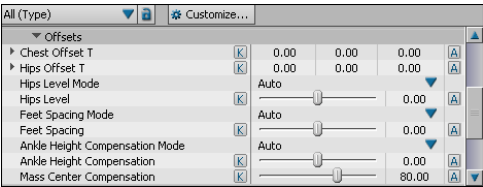
To control the amount of reach, drag the setting's slider, or type a value in the numerical field. Use the following guidelines when manipulating reach with the sliders:

- At 100%, the character's body part reaches fully toward the source's body part.

- At 50%, the character’s body part averages between the body part of the source and the character’s position.
- At 0%, the effect on the model’s specified body part is the same as disabling the option.

Offsets

The Offsets settings let you offset the body parts of your character.



Retargeting > Offsets settings

| Setting | Function |
|---------------------|--|
| Chest/Hips Offset T | Use the Chest and Hips Offset Translation options to precisely apply and adjust offsets to the chest and hips. For the offset to affect the chest, the Reach Chest option must be set to any value other than 0. |
| Hips Level Mode | When set to Off, Hips Level is disabled. When set to User, you can manually adjust the level of the hips by changing the value of the Hips Level. When set to Auto, Hips Level is automatic. By default, the Hips Level Mode is set to Auto. |
| Hips Level | Lets you control the level of the hips relative to its center of gravity. You can select User, Off, and Auto options from the Hips Level Mode menu. |
| Feet Spacing Mode | When set to Off, Feet Spacing is disabled. When set to User, you can manually adjust the spacing of the feet. When set to Auto, |

| Setting | Function |
|--------------------------------|---|
| | the Feet Spacing is automatic. By default, the Feet Spacing Mode is set to Auto. |
| Feet Spacing | Lets you adjust the amount of spacing between the feet of the model relative to the spacing between the feet of the source. |
| Ankle Height Compensation Mode | When set to Off, Ankle Height Compensation is disabled. When set to User, you can adjust the distance between the model's feet and the floor manually. By default, Auto mode ensures the feet relate correctly to the floor. |
| Ankle Height Compensation | If the scale of your model and the selected source differ, use Ankle Height Compensation to adjust the distance between the model's foot and the floor. You may also have to adjust this option if your model's feet are large, or if your model has special height requirements (for example, shoes with high heels or boots). |
| Mass Center Compensation | Smooths leg movements by preventing a character's hips from pulling down too quickly when the legs are moving, and by preventing heavy footfalls. |

Actor

The settings in the Actor group apply to an Actor input source. See [Retargeting - Actor properties](#) on page 1349.

Pull properties

In the Character Settings, the Pull group of properties let you determine the extent to which certain body parts are affected when other parts of the body are moved. For example, in the Left Arm group of Pull properties, you can

adjust the Left Hand Pull Chest slider to adjust the amount that moving the left hand pulls the chest of the character.

These properties are identical to the Pull sliders found in the Character Controls window, with one exception. The “Extra” folder in the Pull group of properties includes the Pull Iteration Count option. The Pull Iteration Count can be animated, and it lets you set the number of times Pull is calculated. The greater the number of iterations, the more accurate the Pull calculation. However, a higher number of iterations may decrease system performance. By default, the Pull Iteration Count is set to 10.

NOTE When your input source is a Control rig and Full Body or Body Part keying mode is selected, Pull values are ignored during character manipulation. Pull settings are only observed when you play your animation. To view the effects of Pull while manipulating your character, disable Reach Override in the Character Controls window.

- [Character settings](#) on page 1309

Stiffness properties

In the Character Settings, the Stiffness group of properties let you determine the extent to which certain body parts resist when being transformed.

By default, the stiffness settings are set to replicate human movement. Some body parts that typically start by moving slowly, such as the hips, take more time or a more exaggerated movement to move quickly.

To control the amount of stiffness, drag the setting’s slider, or type a value in the numerical field. Use the following guidelines when manipulating stiffness:

- At 100%, the body part is stiff and resists transformations.
- At 50%, the body part averages between fully stiff and fully fluid movement. Transformations start off slow and gradually speed up.
- At 0%, the body part moves fluidly and constantly without a slow start.

NOTE When your input source is a Control rig and Full Body or Body Part keying mode is selected, stiffness values are ignored during character manipulation. Stiffness settings are only observed when you play your animation. To view the stiffness while manipulating your character, disable Stiffness Override in the Character Controls window.

Some body parts have additional stiffness settings or function differently than described above. Additional settings and exceptions are described in the rest of this section.

Hips Stiffness

The Hips Stiffness setting lets you set the percentage of resistance for the hips. You can also expand the Hips stiffness setting to view the Enforce Gravity setting.

| Setting | Description |
|-----------------|--|
| Enforce Gravity | Forces the character's hips between its feet. By default, Hips Enforce Gravity is set to 60%. You must set Hips Stiffness to a value other than zero to take advantage of the Enforce Gravity setting. |

Left/Right Arm Stiffness

The left/right arm stiffness settings include additional settings for adjusting the stiffness and limits of elbow bending. Left/Right Arm Stiffness must be set to a value other than zero to take advantage of these additional stiffness limits.

| Setting | Description |
|-------------------------------------|---|
| Left/Right Elbow Max Extension | Use this setting to damp the left or right arm as it fully extends, to prevent elbow and limb snapping. The higher the value, the more gradually the limb extends. By default, a value of 50 corrects most limb snapping. |
| Left/Right Elbow Compression Factor | Use these settings to change the stiffness of an extended arm as it bends. At 100% (full effect) the extended arm doesn't bend, but instead pushes the character's chest, moving the character. |

Spine Stiffness

Spine Stiffness is effective on Characters that have complicated spines. This option stiffens the rotation of a Character's spine so that bending the character appears more rigid when bending.

At 100%, the spine is rigid. Bending is not compensated for by every spine object. At 0%, the effect is the same as disabling the option, so the spine bends freely.

Left/Right Leg Stiffness

The left/right leg stiffness settings include additional settings for adjusting the stiffness and limits of knee bending. Left/Right Leg Stiffness must be set to a value other than zero to take advantage of these additional stiffness limits.

| Setting | Description |
|------------------------------------|--|
| Left/Right Knee Max Extension | Use these settings to damp the leg as it fully extends, to prevent knee and limb snapping. The higher the value, the more gradually the limb extends. By default, a value of 50 corrects most limb snapping. |
| Left/Right Knee Compression Factor | Use these settings to change the stiffness of an extended leg as it bends. At 100% (full effect) the extended leg doesn't bend, but instead pushes the character's hips, moving the character. |

■ [Stiffness Override](#) on page 1370

Modifiers

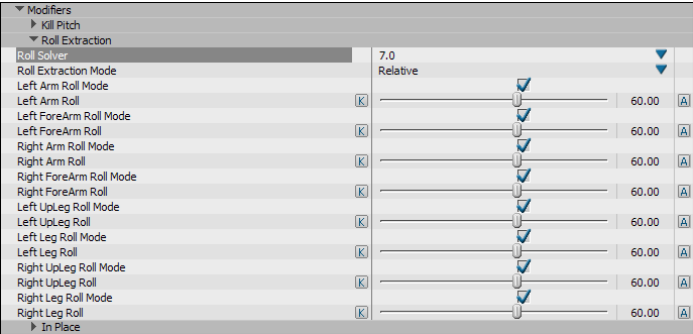
In the Character Settings, the Modifiers group of settings let you alter movements in various ways.

Kill Pitch

The Kill Pitch options let you remove the pitch axis on the left or right knees and elbows.

Roll Extraction

The settings in the Roll Extraction group adjust the roll of arms and legs, and work with the optional roll bones defined in the Roll group of slots (see [Roll slots](#) on page 1316).



Modifiers > Roll Extraction settings

Roll Solver

This menu lets you choose to use the MotionBuilder 7.0 Roll Solver or the MotionBuilder 7.5 Roll Solver. The Roll Solver is set to version 7.0 by default.

Select the 7.5 Roll Solver if you want the local axes of IK effectors for the elbows and knees to always sync with the local axes of the first FK roll objects in the arms and legs, and if you want to ensure that upper arm and leg Roll Extraction solving is always done correctly as you manipulate the elbows and knees.

Roll Extraction Mode

This menu lets you select Absolute or Relative.

The rest of the Roll Extraction settings let you specify the bones that receive a percentage of the roll axis movement. For example, if your model's forearm

includes a roll bone, you can transfer part of the roll animation onto the roll bone using the Left or RightForeArm Roll settings.

To specify how much of the roll transfers from the limb to the roll object (the default setting is 60%), set a percentage using the following guidelines:

- At 100%, all of the roll transfers from the original limb to the roll bone, moving the roll bone and its parent.
- At 50%, the roll is equally distributed between the limb and the roll bone.
- At 0%, none of the roll is transferred to the rest of the limb, moving only the roll bone.

Solvers

Solving is the process of calculating the position of objects, then applying these results to the linked model. In MotionBuilder, solving is a term for the result of all calculations, rigs, and settings when using the character or physical solving engine.

Character Solving properties

The Solving group of properties in the Character Settings let you define how specific movements are solved.

Character Type

Switches your Control rig and Character type between a biped or quadruped posture type. Since biped and quadruped characters are different in structure, changing the posture type may produce unexpected results.

Fingers Solving

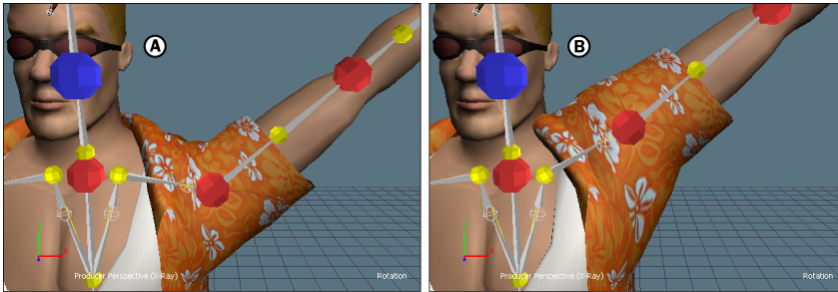
Use the Fingers Solving setting to enable or disable IK solving for fingers. In certain cases, for performance reasons, you may want to disable IK solving.

Realistic Shoulder Solving

When human shoulders rotate, they move upwards. To replicate this behavior, use the Realistic Shoulder Solving setting to adjust the amount of rotation that is applied to the shoulders when the upper arms rotate.

For example, in the following figure (A), displays a character when its upper arm is rotated with Realistic Shoulder Solving set to 0 (disabled). When the upper arm rotates, the rotation is not properly transferred to the shoulder bone, resulting in poor movement.

In the following figure, B, the character's upper arm is rotated with Realistic Shoulder Solving set to 100 (full). When the upper arm rotates, 100 percent of the rotation is transferred to the shoulders. Since the shoulder bones rotate, the character's shoulders appear to translate upwards in the same manner as human shoulders.



Upper arm rotated A. With Realistic Shoulder Solving disabled (set to zero). Rotation is not transferred to shoulders. B. With Realistic Shoulder Solving set to full (100). Rotation is transferred to the shoulder bones.

By default, Realistic Shoulder Solving is set to 0.

Hips Translation Mode

If you have defined a Hips Translation object in the Special group of slots, the Hips Translation Mode setting lets you select whether rotation data is applied to that object.

If you select World Rigid as the Hips Translation mode, rotation data is applied only to the Hips object defined in the Base group of slots. If you select Body Rigid as the Hips Translation mode, rotation data is applied to both the Hips object defined in the Base group of slots, and to the Hips Translation object defined in the Special group of slots.

in the Base group *and* the Hips Translation object defined in the Special group, or if it is applied *only* the Hips object defined in the Base group.

This is useful when you have defined a second object for translating your model's hips and you do not want the second object to receive rotation data.

To use this setting, you must define a Hips Translation object (see [Special slots](#) on page 1317).

| Setting | Description |
|-------------|--|
| Body Rigid | Sends rotation to both the Hips and Hips Translation objects. |
| World Rigid | Sends rotation only to the Hips object, but not the Hips Translation object. |

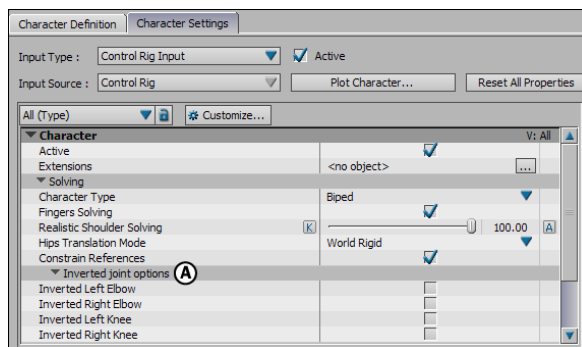
Constrain References

Activate this option if you are working with a project created in a previous version of MotionBuilder. Activating Constrain References constrains the Control rig reference object to the character Reference object.

Inverted joint options

The Inverted joint options let you change the way a character's knees and elbows bend as you manipulate the legs and arms.

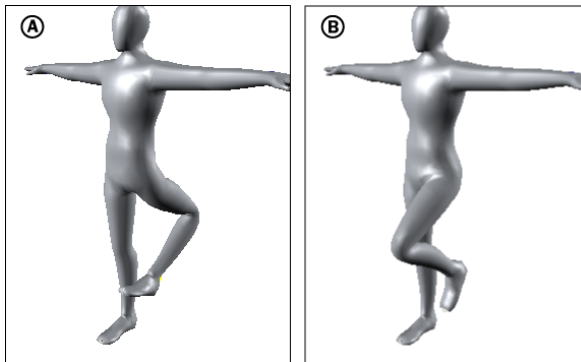
These options can be especially useful if you are animating a bird, such as a flamingo or ostrich.



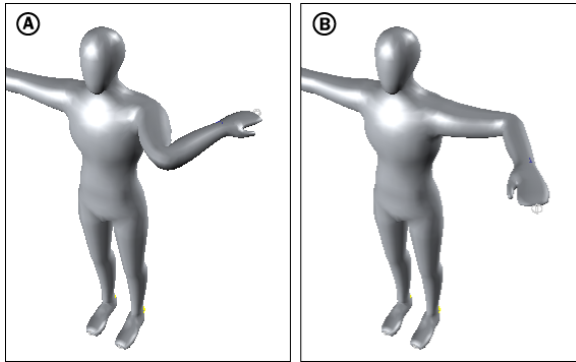
Character Settings A. Inverted joint options

WARNING Always turn the Inverted joint options on or off before manipulating your character.

| Option | Description |
|----------------------|---|
| Inverted Left Elbow | When this option is activated, the character's left elbow bends backward as you manipulate the arm. When disabled, the character's left elbow bends normally. |
| Inverted Right Elbow | When activated, the character's right elbow bends backward as you manipulate the arm. When disabled, the character's right elbow bends normally. |
| Inverted Left Knee | When this option is activated, the character's left knee bends backward as you manipulate the leg. When disabled, the left knee bends normally. |
| Inverted Right Knee | When this option is activated, the character's right knee bends backward as you manipulate the leg. When disabled, the right knee bends normally. |



The left leg is manipulated A. With Inverted Left Knee turned on. B. With Inverted Left Knee turned off.

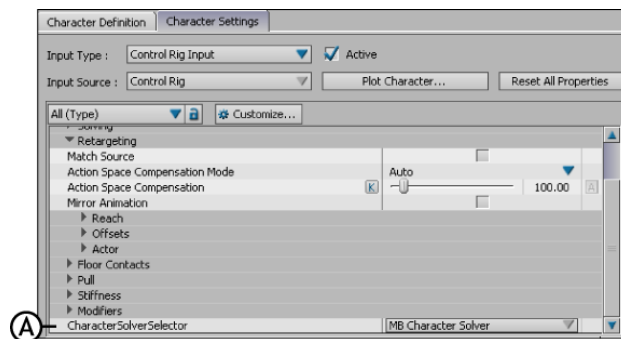


The left arm is manipulated A. With Inverted Left Elbow turned on. B. With Inverted Left Elbow turned off.

Character Solver selector

The Character Solver selector menu lets you choose between MotionBuilder's default Character solver and any additional HumanIK libraries you may have added.

For more about HumanIK, see [HumanIK \(HIK\) character solving](#) on page 1347.



Character Settings pane A. Character Solver menu

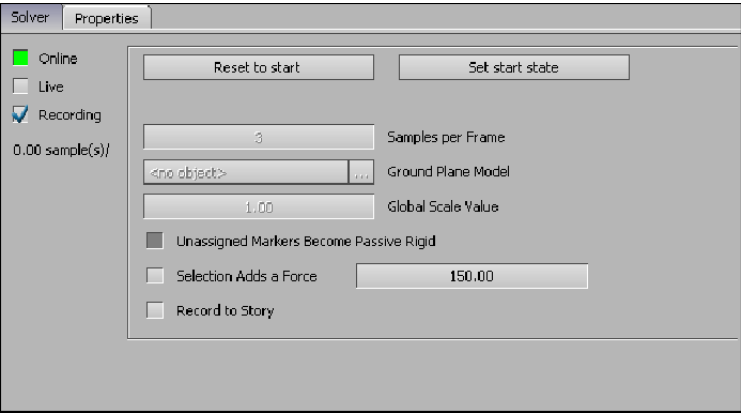
NOTE You must add an additional HIK solver to the character to view any solvers other than the Default Character solver. You can add HIK 3.6 example into the scene by default.

Physics solver

The Physics world is a reflection of dynamic elements from a scene, that is any object with a property attached to it.

Solver pane

The Physics Solver pane are the controls you use to activate and record Rigid Body and Ragdoll solving.



Physics solving indicators

These indicators are also buttons you can use to activate or disable Physics solving.

| Indicator | Function |
|-----------|--|
| Online | Activates or “turns on” physics solving. |
| Live | Starts the physics solving behavior. Use the Live button as a testing area where you can activate the solve independently of the timeline so you can test the manipulations and interaction of the objects. When the physics solving behavior is tuned appropri- |

| Indicator | Function |
|-----------|--|
| | ately, click Record to record the key-frame data. |
| Recording | Indicates that the physics solving is ready for recording. |

NOTE When you want to record solving, make sure that the Online, Live, and Recording indicators are active and then press the Record in the Transport controls. See [Ragdoll workflow](#) on page 1480 and [Creating collision effects](#) on page 1491 for how to record solving behavior.

Reset to Start

Click the Reset to Start button to define the position from where your animation starts.

Set Start State

Click the Set Start State button to restore the affect object or model to its Start State.

NOTE If the Live button is active, the solving begins immediately after you click Reset to Start. To restore the object or model to the starting position without starting to immediately solve, disable the Live button.

Sample per Frame field

Set a value in this field to increase or decrease the precision of the solve record. This field sets the number of keys/samples that you are going to take per frame. By default it is set to 3 so that the solve takes 3 keys per frame.

TIP The more you capture, the better the solve, and you can avoid problems like tunnelling. However, setting a higher amount to create high-quality solve creates performance speed issues.

Currently this field does not support decimal values, such as 0.5, as it increases the occurance of tunnelling problems.

Ground Plane Model field

Alt-drag an object or objects from the Viewer window or Schematic view into this field to define it as the “floor” to which the Physics solve will refer. You can also select an object from the Asset Selection list.

Global Scale Value

Sets a global scale.

Unassigned Models become Passive Rigid Bodies option

Activate this option when you want to create rigid, non-active assets from any un-assigned objects in the scene.

Selection adds a Force

When this option is active, the Physics solving creates a reaction whenever you click an object or model with the mouse. Activate this option to “tickle” or “poke” the object or model to provoke action. This is useful for testing Physics settings; activate Live, let objects fall, and click them to push them around. This way you can test things like friction, slip, and their interaction.

Record to Story

Record the solve to the story window as an animation track.

Properties pane

The Physics solver Properties pane lets you specify basic constraints or default conventions that govern the solving behavior.

| Physics | |
|------------------------------|--------------------------|
| Gravity | X: 0.00 Y: -9.81 Z: 0.00 |
| Global Strength (ERP) (0-1) | 0.50 |
| Global Elasticity (CFM) (>0) | 0.00 |
| Iteration Per Step (>0) | 64 |

| Auto-Disable | |
|------------------------|-------------------------------------|
| Enable | <input checked="" type="checkbox"/> |
| Linear Threshold (>0) | 0.30 |
| Angular Threshold (>0) | 0.30 |
| Steps (>0) | 30 |

Reset to Default

Physics area

The following options are in the Physics area.

Gravity

This is Global gravity force vector for the X, Y, Z axes. The default setting is -9.8 meters squared along the Y-axis.

Global strength/elasticity fields

Lets you enter a value to specify how globally flexible or rigid you want the solve be.

Iterations per Step

Lets you set the number of iterations per one simulation step. The more iterations per step you use, the better the result.

Autodisable area

The Autodisable area contains settings for creation of thresholds beyond which the Physics solver will cease to solve. This lets you save system resources by disallowing solving behavior that is no longer visible.

Enable

You can activate or disable every simulated object. When you disable an object, it does no longer participates in the simulation, and is not updated. You can only perform Collision detection with two enabled objects, or an enabled object and a disabled object.

NOTE When you activate auto-disabling, any object that comes to rest is then disabled. This is also used manage key amounts; when you disable an object, keys are no longer added to FCurves.

Linear Threshold

Lets you set a linear velocity limit for disabling an object. When you specify a Linear Threshold value, you create a limit so that when the Linear Velocity goes below this clamp, it is disabled.

Angular Threshold

Let you sets angular velocity limit for disabling an object. Once the Angular velocity goes below a specific value, it clamps and disables the object.

Steps

Let you set the number of simulation steps that an object requires to be idle before it is disabled. Set a value for how many steps the action performs before the object is considered dropped. The lower the number, the faster it becomes inactive.

Overwriting animation data

When you use the Physics solver to write animation data to an object, it writes the data into the Translation and Rotation channels of the object. For a Character it writes the data on the Control rig effectors.

If you do not want this to happen, store the animation you want to use in the solve in another Take. Then, use this take as an input and record onto yet another Take. (You can also copy the take and record over it.)

The overwrite occurs when you plot or record, and a dialog box appears to ask if you want to overwrite the current take. If you choose yes, and you are on the same track, your animation data is overwritten.

HumanIK (HIK) character solving

MotionBuilder uses the HumanIK 3.6 middleware library as a plug-in to perform Character solving. This way, users can benefit from the latest HumanIK technology.

The Character Solver Selector menu, located in the Character Settings pane lets you select between HumanIk libraries (if applicable). See [Character Solver selector](#) on page 1341 for more on switching solver libraries.

NOTE You must have an additional HumanIK library to view anything other than the MotionBuilder default Character Solver

What is HumanIK?

Autodesk® HumanIK® animation middleware is a run-time full-body inverse kinematics (IK) solver. It is also a run-time retargeting engine for characters of differing size, proportions and skeletal hierarchy.

HumanIK is a highly modular, multi-threaded library, optimized for PlayStation® 3, Xbox® 360™, PowerPC®, PC, PlayStation® 2, and Xbox® platforms. HumanIK offers developers a modular component for the development of their animation tool-chain and run-time game engine.

Designed for integration into existing animation engines, HumanIK works in unison with third-party solvers and middleware components, such as physics and simulation engines. See [Switching to HIK solving](#) on page 1348.

MotionBuilder HumanIK limitations

The following are not currently supported by the MotionBuilder HumanIK library:

- No support for Align Control rig
- No support for Double evaluation
- No support for Output Control rig
- Character Poses continues to use internal evaluation
- Story continues to internally retarget on the Character

NOTE Refer to the MotionBuilder readme for the latest updates on HumanIK integration.

The MotionBuilder HumanIK library does not support:

- Old (MotionBuilder 5.5) Limits

Switching to HIK solving

To switch to HIK solving:

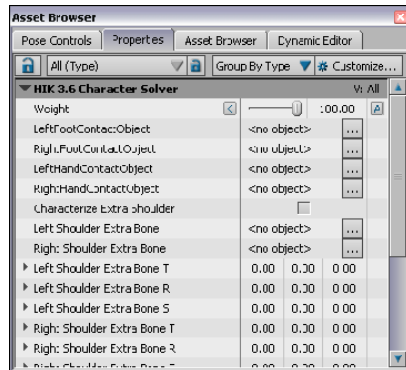
- 1 Drag an HIK solver from the Asset browser Solvers folder on top of a character in the Viewer window or Scene browser.

This adds the HIK constraint to the solver list for this character.

- 2 In the Navigator window, expand the Characters folder, expand the Character that you applied the solver to, and double-click it.

NOTE You can also expand the Solver folder in the Navigator window and double-click the solver.

- 3 To view the HIK solver properties, expand the HIK solver in the Properties window. The solver features displays in the Properties window.



HIK properties

In Place

When the In Place options are activated, you can lock the overall translation of a character's animation on any axis. This lets you visualize a smooth loop

of sequences such as walk cycles without having the character jump from one position to another as the play cursor reaches the end of the timeline.

Lock X

Locks the translation of the character's animation on the X-axis.

Lock Y

Locks the translation of the character's animation on the Y-axis.

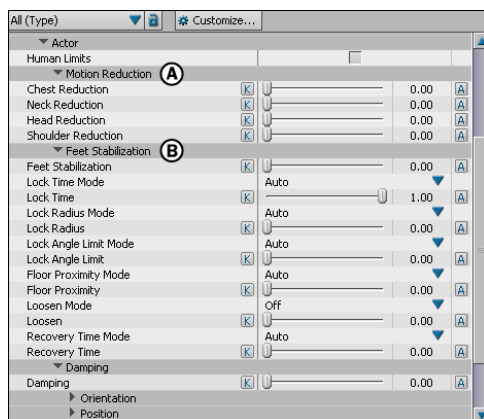
Lock Z

Locks the translation of the character's animation on the Z-axis.

■ [Character settings](#) on page 1309

Retargeting - Actor properties

In the Retargeting group of properties within the Character Settings, the Actor properties can adjust a character's Actor input source.



Retargeting > Actor settings A. Motion Reduction group B. Feet Stabilization group

Human Limits

Human Limits prevent a character from bending a body part in an unrealistic way, while still reaching with its hands and feet.

While the character's movement may change slightly when Human Limits is activated, it is better to have a character that moves correctly than to exactly match your model's movement without considering physical human limits.

Motion Reduction

The Motion Reduction group of settings lets you reduce the amount of motion transferred between the chest, neck, head, and shoulder body parts of your Actor to the corresponding object of your character.

Use Motion Reduction if, for example, the chest, neck, head, or shoulder sensors of your Actor are poorly captured, or when the Actor's Marker set does not provide good capture data.

Increasing the Motion Reduction percentage is similar to applying damping. For each Motion Reduction property, use the following guidelines:

- At 0%, the full movement is transferred between the Actor and character. There is no motion reduction.
- At 50%, half the movement is transferred resulting in damping between Actor and character. For example, setting Head Reduction to 50% results in half the character's head movement coming from the Actor's head. The other half of the movement is based on other objects in the character hierarchy.
- At 100%, no movement is transferred, and the character's movement is based entirely on the other objects in the hierarchy.

Chest Reduction

A reduction percentage between 0% and 100% averages the movement between the chest object and the Hips object. Chest refers to all required and optional Spine objects. This means that Chest Reduction also affects all Spine objects.

Neck Reduction

A reduction percentage between 0% and 100% averages the movement between the Neck object and the chest. When set to 100% the neck moves at a set distance from the chest, and may result in stiff, unnatural movement since no movement is transferred to the Neck object.

Head Reduction

Adjusts the percentage of reduction when transferring motion from the Actor's head to the character's head object.

Shoulder Reduction

A reduction percentage between 0% and 100% averages the shoulder movement between each Shoulder object and the Chest object.

Feet Stabilization

The settings in the Feet Stabilization group of settings let you stabilize the feet of your model. This may be necessary in certain situations, such as when you have data with noise that causes your model's feet to jitter.

Lock Time Mode

When set to Off, Lock Time is disabled. When set to User, you can manually specify the number of frames for the Lock Time. By default, Auto mode is selected, and Lock Time calculates the number of frames automatically.

Lock Time

Sets the feet to stationary after a specified number of frames, where the feet have not moved outside the specified range (Lock Radius and Lock Angle Limit).

Lock Radius Mode

When set to Off, Lock Radius is disabled. User mode lets you change the Lock Radius property manually. Auto mode is selected by default, and automatically calculates the Lock Radius.

Lock Radius

Sets the radius tolerance before foot stabilization is unlocked.

Lock Angle Limit Mode

When set to Off, Lock Angle Limit is disabled. Selecting User mode lets you manually adjust the angle tolerance. Auto mode calculates the angle tolerance for you, and is the default option.

Lock Angle Limit

Sets the angle tolerance before foot stabilization is unlocked.

Loosen Mode

When set to Off, the Loosen property is disabled. The User mode lets you manually adjust the Loosen property. By default, Auto mode is selected, automatically setting the Loosen property.

Loosen

Loosens the effect of stabilization, resulting in a less rigid effect.

Recovery Time Mode

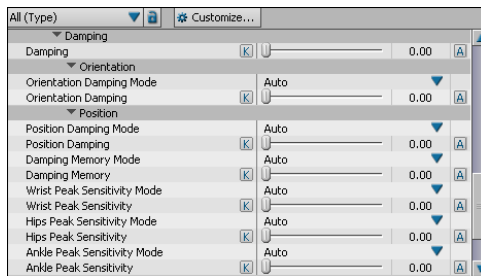
When set to Off, the Recovery Time property is disabled. By default, Auto mode is selected, which automatically calculates the Recovery Time. Select User mode to define a customized Recovery Time.

Recovery Time

Sets the number of frames to move the foot to a new position after unlocking stabilization.

Damping

The Damping group of settings consists of the Orientation and Position Damping settings.



Retargeting > Actor > Damping group of settings

Orientation

There are two properties in the Orientation group.

| Property | Description |
|--------------------------|---|
| Orientation Damping Mode | When set to Off, Orientation Damping is disabled. When set to User, you can manually define damping values for the hips and ankles. By default, Auto mode is selected, and automatically defines Orientation Damping. |
| Orientation Damping | Lets you damp the orientation of hips and ankles. |

Position

The Position properties for the Damping group include the following options.

| Option | Description |
|-----------------------|--|
| Position Damping Mode | If Position Damping Mode is set to Off, Position Damping is disabled. User mode lets you change the Position Damping property manually. Auto mode is selected by default, and automatically calculates the Position Damping. |

| Option | Description |
|-----------------------------|---|
| Position Damping | Clamps positions, prevents sudden changes in movement, and removes peaks and filter noise. |
| Damping Memory Mode | When set to Off, Damping Memory is disabled. Selecting User mode lets you customize the time across which damping applies. Auto mode calculates the Damping Memory for you, and is selected by default. |
| Damping Memory | Specifies the time (in frames) across which damping applies to the hips and feet. |
| Wrist Peak Sensitivity Mode | When set to Off, Wrist Peak Sensitivity is disabled. User mode lets you manually adjust the level of sensitivity for quick wrist movements. By default, Auto mode is selected, and automatically sets Wrist Peak Sensitivity level. |
| Wrist Peak Sensitivity | Specifies the sensitivity to quick movements of the wrists. |
| Hips Peak Sensitivity Mode | When set to Off, Hips Peak Sensitivity is disabled. By default, Auto mode is selected, which automatically calculates the level of Hips Peak Sensitivity. Select User mode to define a customized level. |
| Hips Peak Sensitivity | Specifies the sensitivity of the hips to quick movements. |
| Ankle Peak Sensitivity Mode | When set to Off Angle Peak Sensitivity is disabled. Selecting User mode lets you manually adjust the level of sensitivity. Auto mode calculates the level of Ankle Peak Sensitivity for you, and is the default option. |

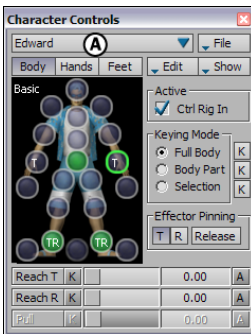
| Option | Description |
|------------------------|---|
| Ankle Peak Sensitivity | Specifies the sensitivity to quick movements of the ankles. |

■ [Character settings](#) on page 1309

Character Controls

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The Character Controls window helps you animate a character model using a Control rig, lets you select the motion source for the current character, and lets you plot animation to the character model.



Character Controls window
A. Current Character menu

The Character Controls window is made up of the following main options and areas:

- [Current Character menu](#) on page 1358
- [File menu](#) on page 1358
- [Character Representation](#) on page 1359
- [Edit Menu](#) on page 1365
- [Show menu](#) on page 1370
- [Active area](#) on page 1373
- [Keying Mode area](#) on page 1374
- [Effector Pinning area](#) on page 1379
- [Reach and Pull area](#) on page 1380

Current Character menu

The Current Character menu displays the name of the selected character. Use this menu to select a character from your scene. You can also select characters in the Scene browser.

File menu

The File menu contains the following two options, which let you quickly save and load character animation.

Load Character Animation

Lets you automatically retarget, copy, or plot animation to the current character.

When you select this option, an Open File dialog box appears to let you select the animation you want to load. For best results, select an *.fbx* file that contains motion capture or keyframe animation that was saved using the Save Character Animation option. If you select more than one *.fbx* file to load at the same time, the files are loaded in alphabetical order.

When you click Open in the Open File dialog box, the [Load Character Animation Options dialog box](#) on page 1386 appears. See [Load Character Animation Options dialog box](#) on page 1386.

Save Character Animation

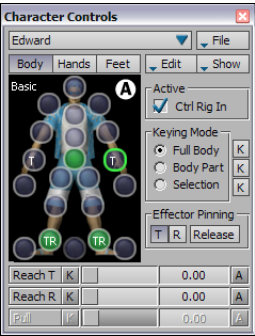
Lets you quickly save the current character's animation. You can choose to save the Control rig with one or multiple takes.

When you select this option, the Save File dialog box opens, which lets you specify the *.fbx* file name and saving location. When you click Save, the [Save Character Animation Options dialog box](#) on page 1391 appears.

See [Saving character animation](#) on page 115 for more information.

Character Representation

The Character representation displays an image of a biped character and all the effectors you can use to animate its Control rig. Each effector in the Control rig is represented by a circular cell on the Character representation. These cells provide visual feedback on the pinning, reach, and pull defined for each effector, and also let you create and select Auxiliary effectors and pivots.



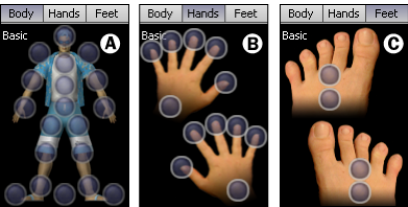
Character Controls window
A. Character representation

All effectors in the Character representation work in conjunction with the Control rig, Keying Mode area, Effector Pinning area, and Reach areas.

Before you can use any of the cells in the Character representation, the current Character must be characterized and Active.

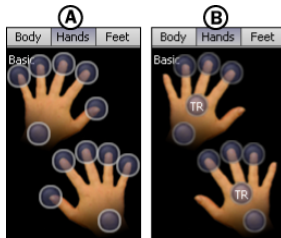
Body, Hands, and Feet

The Body, Hands, and Feet options above the Character representation let you choose to display effectors for the body, hands, or feet.



A. Body effectors B. Hand effectors C. Foot effectors

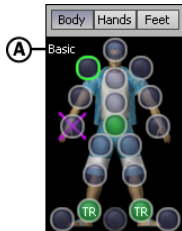
When the source of the current Character is a Control rig, only the character's defined fingers and toes display cells in the Hand and Foot representations. For example, in the following figure B shows the Hand representation for a quadruped with only three fingers.



A. Default Hand effectors with no active character B. Hand effectors for a quadruped character with only 3 fingers defined.

Basic and Expert Modes

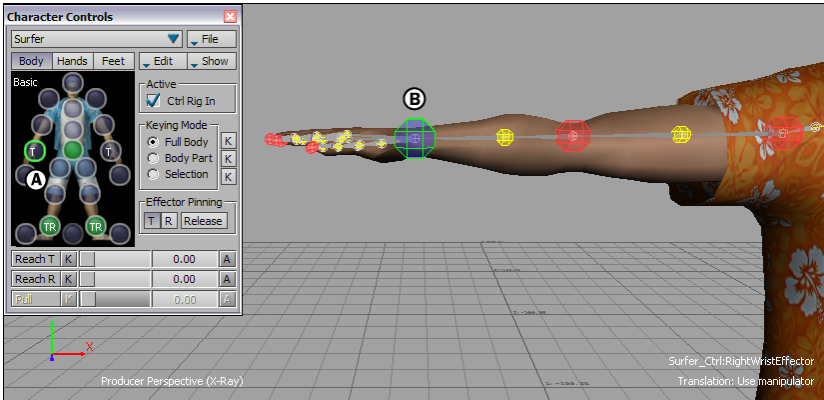
At the top left corner of the Character representation, the Basic or Expert label displays, indicating whether you are in Basic or Expert mode. See [Expert Mode](#) on page 1369 for more information.



Character representation A. The Basic mode label

Effector cell feedback

When you select an effector cell, its corresponding IK rig effector is selected in the Viewer window. In the Character representation display with a green circle.



Selecting cells A. Selected cell for Right Wrist effector in Character representation B. Effector shown in the Viewer window

When the source driving your character is a Control rig, cells in the Character representation also indicate whether each effector is pinned in translation or rotation. The following table describes the various visual feedback that can display on Character representation cells:

| Feedback | Meaning |
|--------------|---|
| T | The corresponding effector has translation pinning. |
| R | The corresponding effector has rotation pinning. |
| T and R | The corresponding effector has both translation and rotation pinning. |
| Empty | An empty cell indicates that the corresponding effector has no translation or rotation pinning. |
| White circle | The corresponding effector is part of a selected body part. This is most visible when in Body Part Keying mode. |
| Green circle | The corresponding effector is selected. |

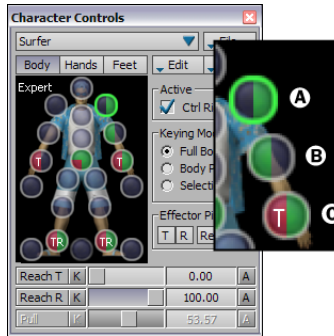
| Feedback | Meaning |
|----------|--|
| Blue X | The corresponding effector has a selected Auxiliary pivot. When you click a cell with a blue X, the Auxiliary pivot is selected, not the effector itself. See Selecting Auxiliary effectors and pivots on page 1282. |
| Purple X | The corresponding effector has a selected Auxiliary effector. When you click a cell with a purple X, the Auxiliary effector is selected, not the effector itself. See Selecting Auxiliary effectors and pivots on page 1282. |
| White X | The corresponding effector has Auxiliary objects, but the effector itself will be selected if you click this cell. |

Reach and Pull Feedback

Cells in the Character representation can also display the amount of reach between the Control rig's IK and FK effectors, and each effector's amount of pull.

NOTE When you select Control rig as the input source, the pull slider and pull feedback are only available in Expert mode.

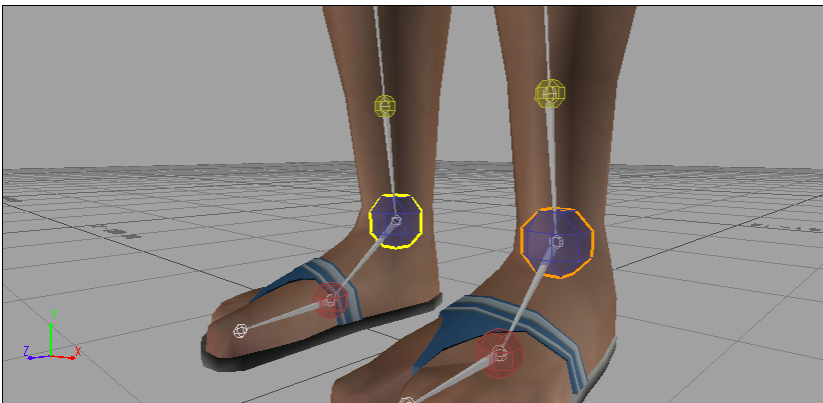
Each cell's left half indicates the amount of translation reach while each cell's right half indicates the amount of rotation reach between the IK rig and the FK rig. For example, the Left Shoulder cell reaches fully towards the FK rig translation (no green) and its rotation reaches fully towards IK (full green). Pull is disabled because shoulder effectors do not have pull.



Reach and Pull feedback A. Rotation reaches fully towards IK rig. **B.** Translation reaches fully towards IK rig. **C.** Translation and Rotation reach fully towards IK rig, Pull at 100%.

Each cell's left half indicates the amount of translation reach between the IK rig effector and the FK rig effector. For example, the Left Elbow cell reaches fully towards the IK rig translation (full green), rotation reaches fully towards FK (no green), and the pull is set to zero (no red).

In the Viewer window, a colored outline displays on effectors that have adjusted Reach settings. You can show, hide, or change the visual feedback on Control rigs, including the Reach outlines, using the Properties window.



Colored outlines display around objects that have Reach values defined.

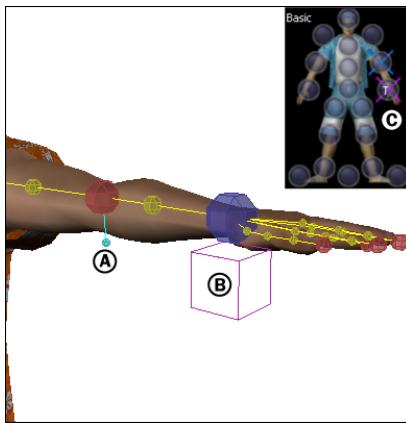
Since Pull is applied over IK translation, if the effector does not reach towards the IK rig, then the Pull slider has no affect. For example, the Left Wrist cell

reaches fully towards the IK rig translation and rotation (both full green) and pull is set to 100% (full red).

Auxiliary objects

In addition to the cells representing IK effectors, the Character representation displays Auxiliary effectors and pivots, which are Auxiliary objects that provide another level of IK control.

You can create up to fourteen Auxiliary objects for each IK effector on a Control rig. On the cells of the Character representation in the Character Controls window, Auxiliary effectors display as a purple cross, and Auxiliary pivots display as a blue cross.



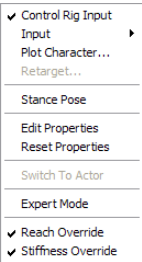
A. An Auxiliary pivot on the elbow effector. B. An Auxiliary effector on the wrist effector. C. A blue cross representing the Auxiliary pivot and a purple cross representing the Auxiliary effector display in the Character Controls.

In the Viewer window, Auxiliary pivots display as a light blue marker connected to the regular IK effector. Auxiliary effectors display as a purple wireframe cube. You can change the size and appearance of these Auxiliary objects using the Properties window.

Refer to [Auxiliary objects](#) on page 1277 for more information.

Edit Menu

This section describes the Edit menu options that let you select a Character’s input type and source, override the default Control rig behavior, switch to Expert mode, and so on.



Character Controls Edit menu

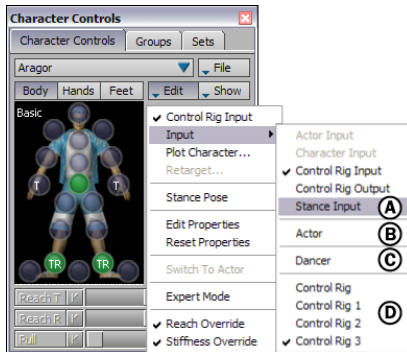
The remainder of this section describes each item in the Edit menu as it appears.

Control Rig Input

Selecting Control Rig Input activates the Control rig as the motion source type that drives the character. You can also select Control Rig Input in the Input menu in the Character Settings. If the current Character does not have any Control rigs, this menu item is disabled.

Input

The options in the Input menu let you choose the motion source that you want to drive your character.



Character Controls Input menu A. Stance Input is selected B. One Actor is available. C. A "Disco Dancer" character is available. D. Four Control rigs are available.

The type of motion source can be an Actor (Actor Input), another character (Character Input), a selected Control rig (Control Rig Input), an additional Control rig, or a reset to the character's stance position (Stance Input).

Choosing an Actor source in the Input menu automatically switches the input type to Actor Input. Similarly, choosing a character as the source in the Input menu switches the input type to Character Input.

You can also choose Input options in the [Character settings](#) on page 1309. For detailed information on each type of motion source, see [Motion sources](#) on page 1062.

You can select from the following Input options:

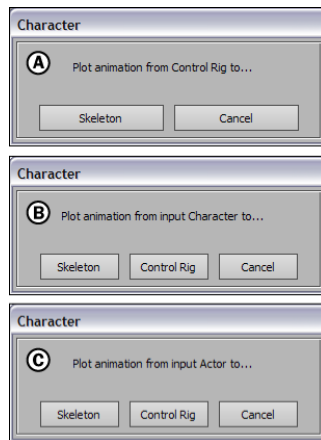
| Input option | Description |
|-------------------|--|
| Actor Input | Lets you choose an Actor as the source of mapping data to constrain your character. |
| Character Input | Lets you select another character as the source of mapping data. |
| Control Rig Input | Lets you use a Control rig as the source of mapping data to constrain the character. |

| Input option | Description |
|--------------------|---|
| Control Rig Output | Lets you plot and output the animation on your model's skeleton to a Control rig for editing. |
| Stance Input | Resets the selected character to a T-stance. |

Plot Character

Selecting Plot Character opens a dialog box that lets you transfer the motion data from the Control rig to your model's skeleton, the selected source to the character's Control rig, or from the Input Actor to either a Control rig or the model's skeleton.

When you plot animation to a model's skeleton, the motion data can come from another character (Character Input), or the character's Control rig (Control Rig Input).



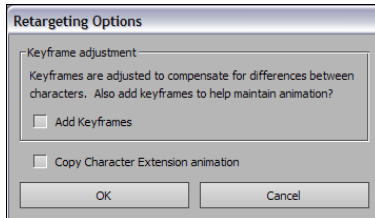
A. Plot Control rig animation to the skeleton. B. Plot animation from the character to a Control rig. C. Plot data from an Actor source to the character or Control rig (MotionBuilder only.)

When you plot animation to a Control rig, the animation can come from an Actor, another character, or the model's the skeleton itself (Control Rig Output).

Retarget

Selecting Retarget copies keyframe animation from the Control rig of the character selected as the Input Source to the Control rig of the current character. See [Retargeting animation character-to-character](#) on page 1067 for more information.

When you select the Edit > Retarget option, the Retarget Options dialog box appears. This dialog box lets you choose whether you want to allow added keyframes during retargeting, and whether you want to copy Character Extension animation.



Retargeting Options dialog box

Activating the Add Keyframes option is recommended if you are concerned with retargeting your original animation as precisely as possible. While the retargeting process copies animation nearly exactly, slight adjustments to the data are required to compensate for differences between the source and target characters. If you can tolerate these slight changes and you do not want any added keyframes, disable the Add Keyframes option.

Stance Pose

The Stance Pose item is only available when the Character's input is set to Control Rig. Selecting Stance Pose resets the Control rig to the default T-stance position without changing the Input type and source to Stance Pose.

The Stance Pose for biped and quadruped characters are different. See [Bipeds and quadrupeds](#) on page 1096 in [Models](#) on page 1095.

Stance Pose only resets rotational offsets. These offsets remain if you translate or scale the character.

Edit Properties

Select Edit Properties to display the current character's properties in the Properties window.

The properties shown in the Properties window are the same as the options in the Character Settings. For more information, see [Character settings](#) on page 1309.

Reset Properties

Select Reset Properties to reset the current character's definition and/or solving properties back to their default values. Selecting Reset Properties creates the same result as clicking the Reset All Properties button in the Character Settings pane. See [Reset Properties](#) on page 1369.

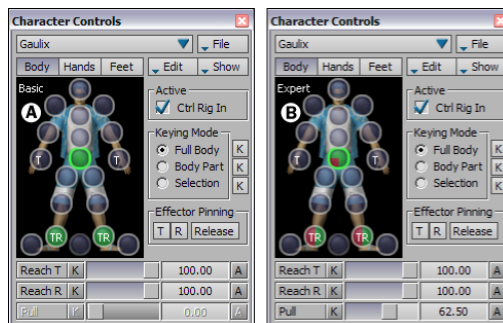
Switch to Actor

Lets you switch between the current character and its Actor. If you select Switch to Actor, the Character Controls window changes to the Actor Controls window.

The Switch to Actor option only appears in the Edit menu when the current character's Input type is set to Actor.

Expert Mode

Lets you switch between Basic mode and Expert mode as you work with characters that are driven by Control rigs. When Expert mode is activated, the Pull and Stiffness options are available and the Pull slider is active (B, C). When Expert Mode is disabled, the Character Controls are in Basic mode, and the Pull and Stiffness settings are disabled.



Character Controls window A. Basic mode B. Expert mode C. The Pull slider is available in Expert mode.

Adjusting the Pull and Stiffness settings while Expert mode is active can have unpredictable results if you are using the Sync button in the Key Controls.

You should only use Expert mode if you have a good understanding of how the Sync button works.

If you load animation files created in MotionBuilder version 5.6 or earlier, the Character Controls are automatically placed in Expert mode, since the old animation may include animated Pull settings. Otherwise, the Character Controls are in Basic mode by default.

NOTE The Character representation displays a Basic or Expert label in the top left corner depending on which mode you are in.

Reach Override

The Reach Override option determines the state of the effector pinning and how your character behaves in conjunction with Pull values during manipulation.

Reach Override is active by default, which means that each effector's Pull value is ignored during character manipulation. You can only see your Pull settings when you play your animation.

To view the effects of Pull while applying transformations to your character, disable Reach Override. Effector pinning is also disabled since the character's behavior is based on each effector's Pull values rather than its effector pinning.

Reach Override is only effective in Full Body or Body Part mode.

Stiffness Override

The Stiffness Override option determines how your character behaves when it is manipulated in relation to the Stiffness values.

Stiffness Override is active by default, which means that the character does not use the Stiffness values (see [Stiffness properties](#) on page 1333) during character manipulation. Stiffness settings are only applied when you play your animation.

Stiffness Override is only effective when in Full Body or Body Part mode.

Show menu

This section describes the options in the Show menu that let you show and hide interface items associated with the model's skeleton, the character's Control rig, and the character's source. You can also use this menu to lock the translation and selection of the FK rig and the model's skeleton.



Character Controls Show menu for MotionBuilder

Skeleton

Shows or hides the model's skeleton. Use the skeleton to define the nodes used by the character. The Control rig is created based on your model's skeleton. To hide the skeleton, disable Skeleton in the Show menu.

FK

Shows or hides the FK rig of the current character.

The FK rig is one-half of the Control rig. It is based on the original skeleton of your model. To hide the FK rig, disable the FK option in the Show menu.

IK

Shows or hides the IK effectors on the character's Control rig. To hide the effectors, disable the IK option.

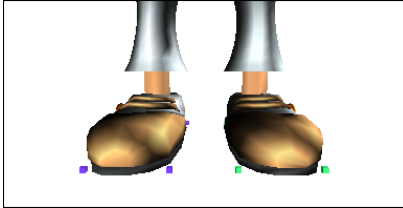
The IK rig is an Inverse Kinematics system that lets you transform your character using IK effectors. Manipulating a character using this system moves the body relative to its hierarchy, similar to the way a human body reacts.

Auxiliary

Shows or hides Auxiliary effectors and pivots. To hide Auxiliary objects, disable the Auxiliary option. Unless you create an Auxiliary object for one of the effectors on the IK rig, no Auxiliary objects display. See [Creating Auxiliary effectors and pivots](#) on page 1281.

Floor Contact

Hides or shows the markers that define the floor contact. To hide the floor markers, disable the Floor Contact option. See [Floor contact](#) on page 1131 for more information on setting up floor contact for a character.



Floor Contact shows green and blue markers around the character's feet.

You can activate [Scaling mode](#) on page 524 or use the [Floor Contact properties](#) on page 1133 to change the size of the hand and toe contact markers.

Finger Tips

Hides or shows the contact spheres used for the character's finger tips or toes. The finger tips for a quadruped character display in the following image.



Finger Tips option is active, finger tip markers display.

See [Hands Contacts Size](#) on page 1143 and [Hands Contacts Size](#) on page 1143 in [Floor contact](#) on page 1131.

Actor Hide and Show Options

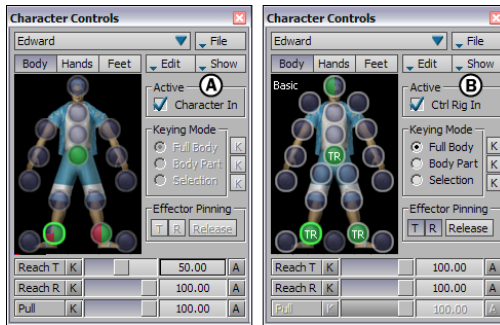
Beneath the Finger Tips option in the Show menu, five additional Actor options let you hide or show interface items related to an Actor.

These options are only available if your character's input type is an Actor. These options are also available in the Actor Controls window.

| Option | Description |
|-------------------|--|
| FK Lock Sel | Lets you lock or unlock FK markers for selection. When activated, you cannot select the FK markers. To select FK markers, disable FK Lock Sel. |
| FK Lock Trs | Locks or unlocks FK markers for transformation. When FK Lock Trs is active, you cannot transform the FK markers, although you can still select them. To unlock the markers, disable FK Lock Trs. You need to disable FK Lock Trs to use of MotionBuilder's squash and stretch feature. See Squash and Stretch. |
| Skeleton Lock Sel | Locks or unlocks the skeleton for selection. When Skeleton Lock Sel is active, you cannot select the skeleton. To unlock the skeleton for selection, disable Skeleton Lock Sel. |
| Skeleton Lock Trs | Lets you select the skeleton, but locks the position and rotation so that you cannot transform it. To unlock the skeleton for transformation, disable Skeleton Lock Trs. |

Active area

The Active area corresponds to the input type selected from either the Edit menu or the Input Type field in the Character settings. Enabling this option activates the input source.



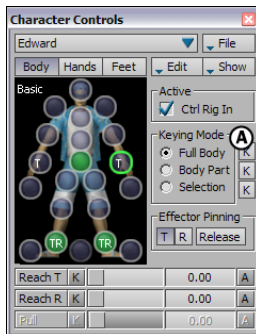
Character Controls Active area A. Character Input as source B. Control rig Input as source

For example, if the Input type is set to Character Input, the option in the Active area switches to Character. If the Input type is set to Control Rig In, the option in the Active area switches to Ctrl Rig In.

For more information, see [Input Type menu](#) on page 1325 in [Character settings](#) on page 1309.

Keying Mode area

The Keying Mode area lets you set manipulation and keyframing modes for setting keyframes on a character's Control rig. You can manipulate and set keyframes on the character's entire body ([Full Body](#) on page 1375), a part of the body ([Body Part](#) on page 1376), or only on the selected effector ([Selection](#) on page 1377). For more general information, see [Keying modes](#) on page 657.



Character Controls window A. Keying Mode area

Both IK and FK effectors can be manipulated in any keying mode, giving you quick, precise control over all types of manipulations, including those of the spine, neck, and finger bones.

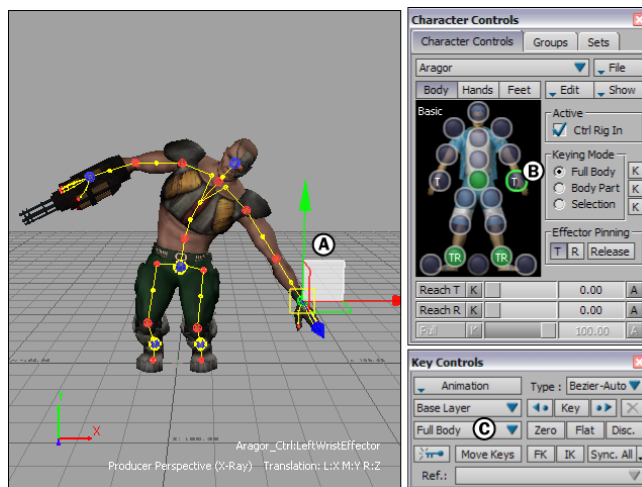
Keyframe (K) buttons next to each of the Keying modes let you set keyframes on any of the modes at any time, regardless of which mode you have currently selected.

For example, if you are working in Body Part keying mode, you can click the Keyframe (K) button next to the Full Body keying mode at any time to set keyframes on a character's entire body without having to switch keyframes.

See [Keyframe \(K\) and Animate \(A\) buttons](#) on page 642 for more information on the Keyframe buttons.

Full Body

Full Body Keying mode lets you use individual effectors to manipulate the entire body of a character. For example, translating a character's wrist effector in Full Body mode affects the whole body as it moves to reach that effector.



A. The entire body follows the IK system when manipulated. B. Full Body keying mode is active in the Character Controls. C. Full Body keying mode is also indicated in the Key Controls.

The active Keying Mode also determines what is keyed, so it is also displayed in the Key Controls window. When Full Body is selected in the Key Controls Keying Mode menu, it indicates that keyframes will be set on the character's entire body.

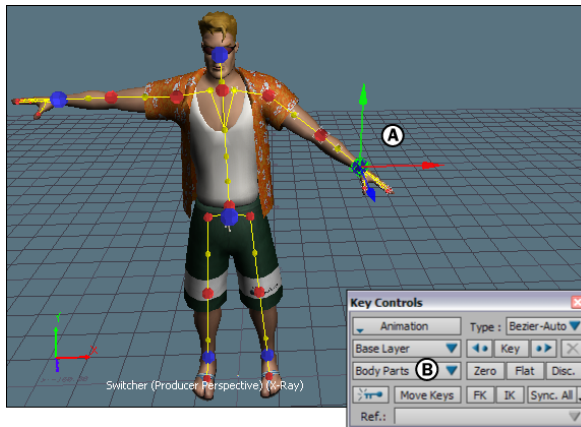
How your character reacts to manipulation when in Full Body mode depends on the pinning of various effectors, and whether Override Reach and Override Stiffness are active. See [Effector Pinning area](#) on page 1379, [Reach Override](#) on page 1370 and [Stiffness Override](#) on page 1370.

When in Full Body mode with Override Reach active, the Pull settings for your character are not shown during manipulation.

Body Part

Body Part Keying mode lets you use individual effectors to manipulate only the selected body part. The effectors on the rest of the body are not affected.

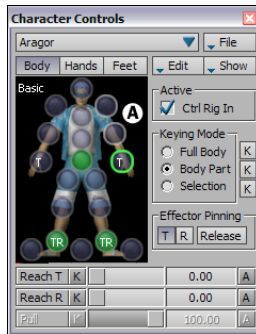
For example, translating a character's left wrist effector in Body Part mode affects only the left arm. The right arm, hips, chest, head, and all other effectors do not move.



Body Part Keying mode is active. A. Selecting the left wrist effector lets you translate all the effectors in the chain for the left arm. B. The Key Controls window displays Body Parts.

In Body Part mode, the keying mode in the Key Controls window is set to Body Part, and keyframes are set on the effectors that comprise the selected body part. For example, if you set keyframes with the left wrist effector selected in Body Part Keying mode, you set keyframes on the left wrist, left elbow, and left shoulder.

The effectors of the selected body part are highlighted in the Character representation with white circles. Keyframes are set on the these highlighted effectors.



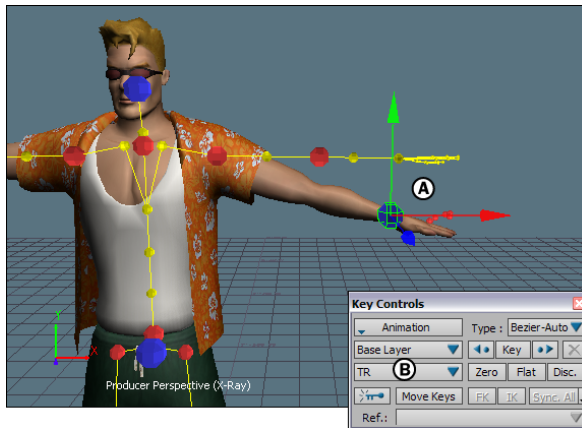
Character Controls A. The left wrist effector is selected in Body Part mode, so the other effectors for the left arm are also highlighted in pale white.

To select more than one body part, Ctrl-click each additional body part in the Character representation.

Selection

When Selection is active, you can manually select what you want to manipulate and keyframe on a character. As you manipulate your character, the Control rig does not synchronize and update in real time as it does in Full Body and Body Part modes.

For example, selecting a character's left wrist effector in Selection mode lets you translate only the selected effector, independent of any pre-defined manipulation mode (Full Body and Body Part), rig setup, or effector pinning.



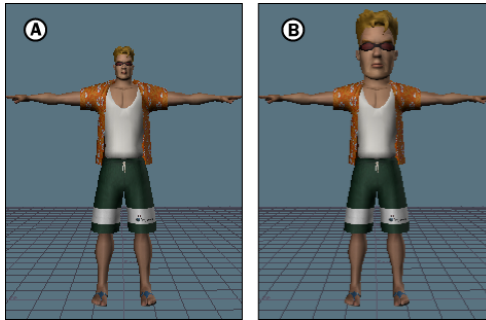
Selection Keying mode is active **A**. Selecting the left wrist effector lets you independently manipulate that effector. **B**. Keying Mode in the Key Controls displays the previous selection (in this case, TRS.)

NOTE When in Selection Keying mode, an effector does not move if its Reach T value is set to zero. An effector also does not rotate if Reach R is set to zero.

In Selection mode, the keying mode in the Key Controls corresponds to the previous selection. For example, if the translation, rotation, and scaling properties were previously selected, TRS displays in the Key Controls.

You can keyframe additional properties by selecting them in the Properties window (see [Properties window](#) on page 585).

| Property | Description |
|--------------------|---|
| Squash and Stretch | In Selection mode, you can shrink or stretch selected body parts using the FK rig. For example, to stretch only the head of a character, select the head's corresponding FK node while in Selection mode, and scale it to a larger value. |

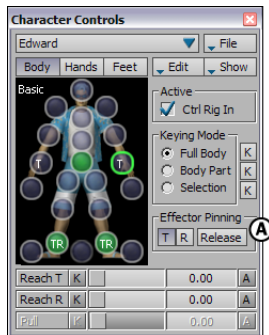


A. Head is normal size. B. Only the head is stretched.

NOTE FK Lock Sel and FK Lock Trs must be disabled in the Edit menu for squash and stretch to work.

Effector Pinning area

The Effector Pinning area lets you activate, disable, or temporarily release pinning on effectors.



Character Controls A.
Effector Pinning area

See [Pinning](#) on page 1267 for more information.

T and R

The T (Translation) and R (Rotation) options let you activate and disable translation and rotation pinning on effectors. When T is active, the selected

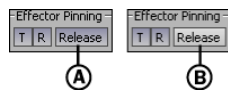
effector has translation pinning. Similarly, when R is active, there is rotation pinning on the corresponding effector.

When multiple effectors are selected, a highlighted T or R indicates that at least one of the selected effectors are pinned in either translation (T) or rotation (R).

Release

The Release option lets you temporarily remove the translation or rotation pinning related to the selected effector and effectors down the chain.

Activate Release to temporarily release pinned effectors. You can also press and hold the Q key. All effector pinning is released while the Q key is pressed.

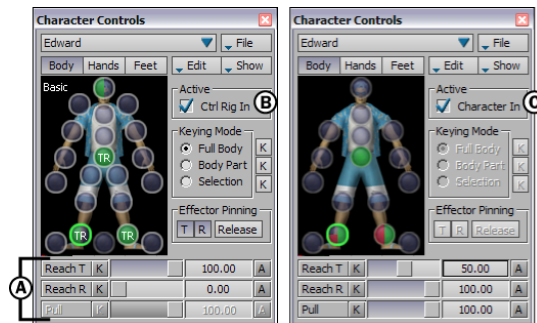


A. Release is active, releasing the pinning for all selected effectors. B. Release is disabled.

Disable Release to return pinning to its previous state.

Reach and Pull area

The Reach and Pull area lets you set the amount of reach between the IK and FK Control rig systems, or between your character and its motion source.



A. Reach and Pull area B. Control rig as motion source C. Character as motion source

The Reach and Pull area is contextual to whatever type of source your character uses. If your character has an Actor or character as its source, the Reach area lets you define the reach between the current character and its source (Actor or character).

This section is split into the following topics:

- [Animating Reach and Pull](#) on page 1381
- [Reach T and R](#) on page 1381
- [Reach Actor/Character](#) on page 1385

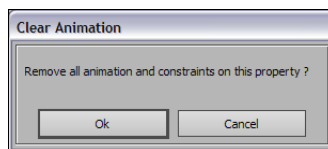
Animating Reach and Pull

Each slider in the Reach area lets you set each reach or pull value for animation or inclusion in a Relations constraint. Each slider also lets you set keyframes for each reach or pull value.

The Animate (A) button lets you set keyframes, use Reach values in constraints, and remove animation from a Reach property. To use a Reach value in a Relations constraint, click the Animate (A) button.

To set a keyframe on a Reach value, click the Keyframe (K) button.

To remove animation from a Reach property, click the Animate (A) button and click Ok in the Clear Animation dialog box that appears.



Clear animation dialog box

Reach T and R

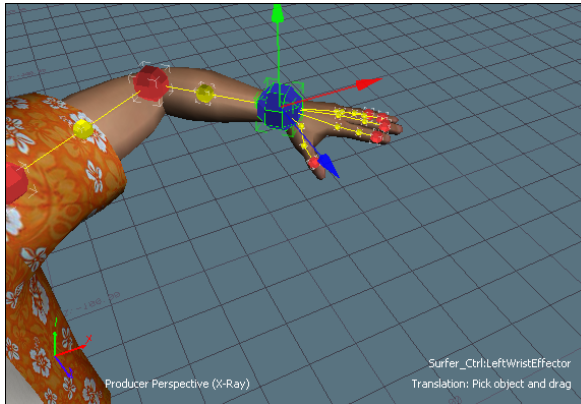
The Reach T and Reach R sliders in the Reach area solve differences between the FK and IK rigs on a character.



Character Controls Reach area

NOTE If the Control rig is IK Only, the Reach options are not available.

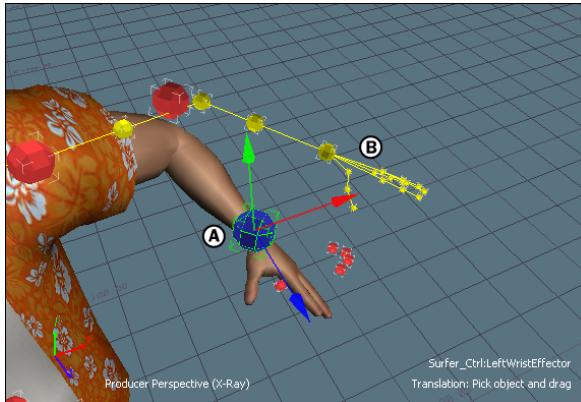
When you set keyframes using the Control rig, both the IK rig and FK rig are synchronized: the IK and FK rigs appear on top of each other in the Viewer window.



The IK rig and FK rig are synchronized at keyframes.

NOTE When the Align Control Rig option is active in the Control rig properties, the IK and FK systems always appear together, even if they interpolate differently between keyframes. Disable this option if you want to view separate interpolation paths for the IK and FK systems.

However, when you play your animation, the interpolation of the IK rig and the interpolation of the FK rig may not match, because each rig solves differently. Between keyframes, the IK rig and FK rig may not occupy the same space.



Between keyframes, the IK rig (A) and the FK rig (B) do not match since each rig uses a different method of solving.

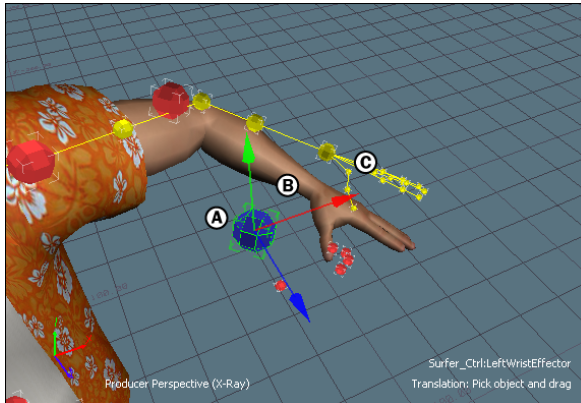
The Reach T and Reach R sliders in the Character Controls let you adjust the amount of influence each system (IK or FK) has on a body part when the two systems get out of sync. This gives you complete control of what happens between keyframes.

To adjust the influence each system has, select an effector in the Character representation, then adjust the percentage of translation and rotation reach between the IK and FK rigs using the Reach T and Reach R sliders.

Use the following guidelines when adjusting reach:

- At 100%, the skeleton follows the IK system.
- At 50%, the skeleton averages between the FK and IK systems.
- At 0%, the skeleton follows the FK system.

For example, in the picture below, a value of 30% is assigned to the Reach T (Translation reach). When the character's wrist effector is translated, the model follows the FK rig more closely (A to B=70%, B to C= 30%).



A. Blue IK wrist effector is selected. B. Character's arm reaches towards the FK rig since the wrist effector's IK translation reach is set to 30%. C. Yellow FK rig

If the Reach T value was set to 50%, the skeleton appears between the FK and IK rigs. The solution of the IK rig and the FK rig is blended together equally to influence the body part.

NOTE The amount of reach also displays in the corresponding cell in the Character representation.

Pull

The Pull slider lets you determine how much pull each effector has on other parts of the body.



A. Pull slider

NOTE When a Control rig is selected as the input source, the Pull slider is only available if you are in Expert mode.

To control the amount of pull, select an effector in the Character representation and drag its pull slider, or type a value in the numerical field.

Use the following guidelines when changing an effector's pull:

- At 100%, the effector has full pull. This means that moving other body parts that normally transform the effector has no effect. If all body parts

have full pull, translating only moves the selected effector. If the effector is further up the hierarchy, such as the character's chest or hips, the other effectors down the chain react to the translation.

- At 50%, the effector has half pull. This means that moving other body parts that normally transform the effector have a damping effect.
- At 0%, the effector has no pull. This means that moving other body parts transforms identically.

The effect of each effector's pull value is contingent on the IK Reach T value. For example, if Pull is set to 100%, but Reach T is set to 0%, the Pull value has no effect because Reach is set to the FK rig.

Pull is also based on a virtual hierarchy of your model's skeleton which means that if you re-parent your IK rig, Pull is still based on the original hierarchy. For example, the hips have priority and a stronger effect over chest nodes. The chest has priority over the arms and legs.

Reach Actor/Character

When the input source is an Actor or Character, the Reach area lets you define the translation and rotation reach between the current character and the Actor or character source.

Reach values can be set per effector for the following body parts:

- head (Reach T and Reach R)
- chest (Reach T)
- left and right elbow (Reach T)
- left and right wrist (Reach T and Reach R)
- left and right hand (Reach T and Reach R)
- left and right knee (Reach T)
- left and right ankle (Reach T and Reach R)
- left and right foot (Reach T and Reach R)

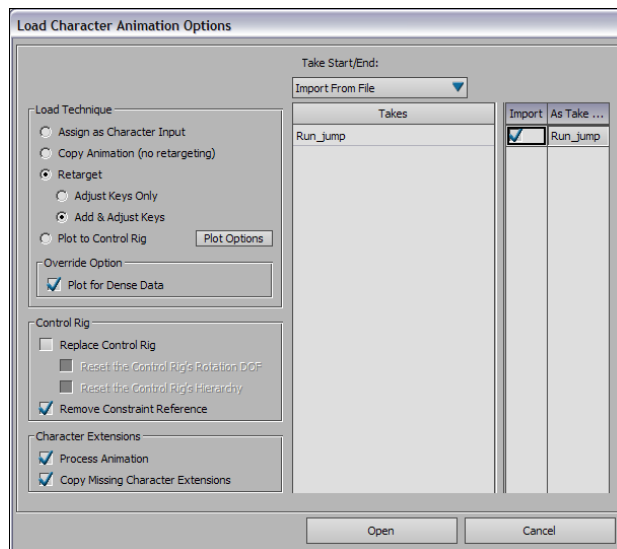
NOTE You can use Finger reach settings for Actor retargeting but Actor toes will not be affected.

To adjust the reach of a body part, select the effector and adjust the Reach T slider in the Character Controls window, or the Reach sliders in the Character settings.

- [Animating Characters](#) on page 1061
- [Character setup](#) on page 1079
- [Load Character Animation Options dialog box](#) on page 1386
- [Save Character Animation Options dialog box](#) on page 1391
- [Troubleshoot loading character animation](#) on page 1073

Load Character Animation Options dialog box

When you load animation onto a character using the File > Load Character Animation option in the Character Controls, the Load Character Animation Options dialog box appears.



Load Character Animation Options dialog box

The Load Character Animation Options dialog box consists of the following areas:

- [Load Technique area](#) on page 1387

- [Control Rig area](#) on page 1388
- [Character Extensions area](#) on page 1389
- [Merge Takes area](#) on page 1390

NOTE If you load animation onto a character with the Load Character Animation option, shoulder FK effectors may be offset If you select the Assign as Character Input option as the Load Technique. To workaround this problem, instead select Retarget as the Load Technique.

Load Technique area

The Load Technique area consists of options that let you load animation in different ways.

| Option | Function |
|---------------------------|--|
| Assign as Character Input | The Assign as Character Input option loads the selected .fbx file into your scene, and assigns the loaded character as the Character Input for the current character. A group called Imported Character is created. This group contains all imported assets, so that you can easily find or delete them. |
| Copy Animation | The Copy Animation option lets you copy animation from one character to another without retargeting or plotting. The copied animation is the same as the original animation only when the characters and their control rigs are exactly the same. |
| Retarget | The Retarget option lets you retarget character animation to the current character. Use this option to retarget keyframe animation where each keyframe is important. |
| Add Keyframes | Activate this option if you want to allow extra keyframes to be added during retargeting. Keyframes are adjusted when ne- |

| Option | Function |
|---------------------|--|
| | cessary during retargeting to compensate for differences between the two characters. Allowing added keyframes helps to preserve the original animation as closely as possible. |
| Plot to Control Rig | Use the Plot to Control Rig option when you want to retarget and plot motion capture data. You can also use this option with keyframe animation when individual keyframes are not important. Use the Retarget option instead, if you want to keep individual keyframes the way they are. |
| Plot Options | Click the Plot Options button to open the Plot Options dialog box and select plotting options. These options are the same as in the Plot Properties window. See Plot Properties window for more information. |
| Override Option | The Override Option area contains the Plot for Dense Data option, which lets you override retargeting options under specific conditions. When the Plot for Dense Data option is active, if dense data (such as motion capture data or plotted animation) is detected, the animation is automatically plotted to the current character, not only retargeted. This option works with the Retarget option (see Retarget). |

Control Rig area

The Control Rig area contains options that affect the characters' control rigs.

| Option | Function |
|----------------------------|---|
| Replace Control Rig option | The Replace Control Rig option lets you replace the current character's Control rig |

| Option | Function |
|-------------------------------------|--|
| | with the Control rig in the .fbx file you are loading. The current character's old Control rig is detached from the character, but is not deleted from the scene. Replacing the Control rig lets you retarget the animation with more accuracy. This option is available only if the current character has a Control rig. When Replace Control Rig is activated, the following two options become available: Reset Control Rig's Rotation DOF, which lets you reset the DOF Rotation Properties on the Control rig to default values, and Reset the Control Rig's Hierarchy, which Resets the Control rig to the default hierarchy. See The Control rig hierarchy on page 1287 for more information. |
| Remove Reference Constraints option | The Remove Reference Constraints option lets you disable the Constrain Reference property for source and target characters. The Constrain References property can affect the result of retargeted character animation when it is active for either the target and source characters. |

Character Extensions area

The Character Extensions area contains two options that let you copy Character Extension animation and copy missing Extensions.

| Option | Function |
|-------------------|--|
| Process Animation | The Process Animation option copies Character Extension animation onto the Character Extensions of the current character, but only when the source Character Extension and the Character Extension in the current scene are exactly the same. If they are not exactly the same, the animation is not copied. |

| Option | Function |
|-----------------------------------|---|
| Copy Missing Character Extensions | The Copy Missing Character Extensions option copies Character Extensions that do not exist in the current character. For example, if the source file contains a character with two wings and a tail, and the current character has two wings, the tail extension is copied onto the current character. If the current character already has a tail, but it has a different name than the tail in the source file, the character has two tails. If both Character Extensions have the same name but are made differently, they merge. In this case, a dialog box appears listing the parts of the Character Extension that will merge and asking you if you want to continue. Click Continue to merge the Character Extensions or Cancel to abort the operation. |

Merge Takes area

The Merge Takes area shows all the takes stored in the *.fbx* file that you are merging.

Use the Take Start/End field to select how the start and end of takes are set when they are merged. Take Start/End gives you the following options:

| Option | Description |
|------------------|---|
| Leave As Is | Leaves the take start and end times unchanged. If you are creating a new take, the take start and end times are imported from the file. |
| Import From File | Uses the start and end time codes specified by the <i>.fbx</i> file being loaded. |
| Frame Animation | Frames the start and end of the animation for each take. |

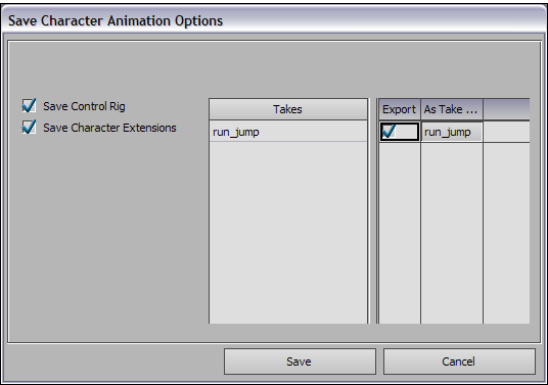
Take List

The Take list is split into the following columns:

| Column | Function |
|-----------|---|
| Take name | Shows the name of the take as it was saved in the .fbx file. You cannot rename takes using this column. |
| Import | Marks the take for merging. When active, the corresponding take replaces any takes with the same name. When disabled, the take is not merged. |
| As Take | Changes the name of the take when merged. This is useful if your scene has a take with the same name and you don't want to replace it with the take being merged. |

Save Character Animation Options dialog box

Selecting Save Character Animation opens the Save File dialog box, which lets you specify the .fbx file name and saving location. When you click Save in the Save File dialog box, the Save Character Animation Options dialog box appears.



Save Character Animation Options dialog box

Save Control Rig

Lets you save the Control rig with the animation. Disable this option if you only want to save the character animation.

Save Character Extensions

Lets you save any Character Extension with the animation. Disable this option if you want to save Character Extensions without the animation.

Take List

The Take list is split into the following columns:

| | |
|-----------|--|
| Take name | Shows the name of the take as it was saved in the <i>.fbx</i> file. You cannot rename takes using this column. |
| Export | Marks the take for saving. When active, the corresponding take is saved to the <i>.fbx</i> file. |
| As Take | Renames the take as it is saved to the <i>.fbx</i> file. If the Save One Take Per File option is active, the name of the take in the As Take column is used over the take name in the scene. |

■ [Character Controls](#) on page 1357

Animating Faces

In every day interactions with people, we look to a person's face for visual cues to help us assess what they are thinking or feeling. This is why facial animation is so important.

The intricate movements of the face can make the difference between a character that is believable and a character that does not engage the audience.



Various facial expressions on a bird character face.

Creating a face that moves in complex ways can convey realistic, believable emotion.

MotionBuilder lets you accomplish this by animating head models with keyframes, voice recognition, and motion data using a combination of the Character Face settings, Actor Face settings, and the Voice device.

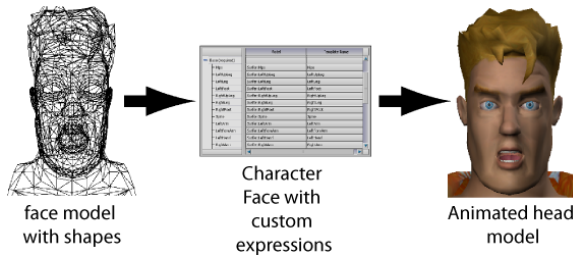
In order to create facial animation, you must create shapes on your character head models, then map those shapes to MotionBuilder's pre-defined expressions.

Once you have a head model with shapes set up, there are three main workflows possible when animating character faces:

- [Facial keyframing workflow](#) on page 1394
- [Facial motion capture workflow](#) on page 1395
- [Audio-driven facial animation workflow](#) on page 1396
- [Creating shapes](#) on page 1411
- [Creating cluster shapes](#) on page 1413
- [Voice device](#) on page 1455
- [Plotting facial animation](#) on page 1663

Facial keyframing workflow

The most basic method of creating facial animation is to define and keyframe a set of custom expressions.



Keyframing facial animation workflow

This process can be summarized in the following steps:

- 1 Load a head model that has shapes or cluster shapes.
- 2 Add a Character Face to the scene. See [Adding a Character Face](#).
- 3 In the Character Face Definition pane of the Character Face settings, add and define custom expressions. See [Defining a custom expression](#).

NOTE The custom expressions you define in the Character Face Definition pane are listed as Custom Properties in the Character Face Animation pane.

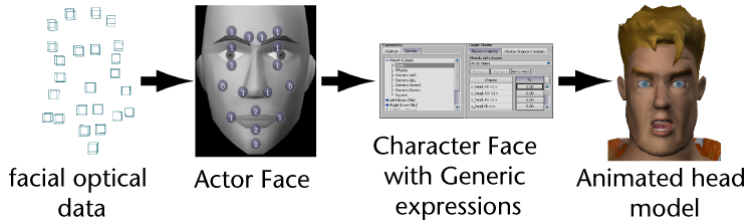
- 4 Switch to the Character Face Animation pane, select your custom expressions, change their values, and set keyframes to animate the face model. See [Setting keyframes](#) on page 639.

NOTE It is a good idea to add new keyframes on a separate layer using the Layer menu of the Key Controls If you are using keyframes to modify animation. This way, you do not overwrite the original animation.

- [Head models](#) on page 1401
- [Shapes](#) on page 1402
- [Clusters and cluster shapes](#) on page 1412

Facial motion capture workflow

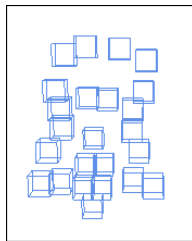
The process of animating a head model with motion capture data is similar to the process of animating a character with motion capture data. While an Actor is used to map motion data to a character, an Actor Face is used to map motion data to a Character Face.



Character face animation using motion capture data workflow

The process of animating a face with motion capture data can be summarized in the following steps:

- 1 Load a motion data file containing optical markers or magnetic sensors with animation, and ensure that the motion data markers are facing the positive Z-axis.



NOTE Compatible motion file formats include .aoa, .mcd, .trc, and .c3d.

Facial motion data markers

- 2 Add an Actor Face to the scene. See [Adding an Actor Face to the scene](#) on page 1417.
- 3 Connect the motion capture data to the Actor Face. See [Connecting an Actor Face to motion capture data](#) on page 1418.

- 4 Add a Character Face to the scene and define the generic expressions in the Character Face settings. See [Adding a Character Face and Defining a generic expression](#).
- 5 Connect the Actor Face to the Character Face. See [Connecting an Actor Face to a Character Face](#) on page 1398.

The optical marker data is now set up to drive the expressions on your character's face.

Audio-driven facial animation workflow

Using a Character Face and the Voice device, you can set up a character to “talk” with an audio file or live audio input as its voice. Through the Voice device, the phonemes in the audio input drive the expressions on the character's face.



Audio-driven facial animation workflow

The process of driving facial expressions using audio data can be summarized in the following steps:

- 1 Load a head model with shapes or cluster shapes.
The shapes on your head model should be appropriate for the number of phonemes you need to make the character convey your audio input, and they should correspond with the sound parameters of the Voice device. See also [Phoneme shapes](#) on page 1406.
- 2 Add a Character Face to the scene. See [Adding a Character Face](#).
- 3 In the Character Face Definition pane, add a custom expression for each phoneme, then map the phoneme shapes you created for your head model to these custom expressions.

- 4 Link the Character Face to a Voice device. See [Linking a Character Face to a Voice device](#) on page 1456.
- 5 Add sound parameters, or phoneme sounds, in the Voice device settings. See [Adding sound parameters](#) on page 1461.

When you add additional sound parameters (phoneme sounds) to the Voice device, custom expressions automatically appear in the Expressions pane.

NOTE To fine-tune facial animation driven by the Voice device, change the values of automatically added operators, add additional operators, or add other devices to trigger facial expressions.

- [Phoneme shapes](#) on page 1406
- [Voice device](#) on page 1455
- [Specifying gender in the Voice device](#) on page 1458
- [Activating all phonemes and instruments](#) on page 1468
- [Refining a model's face movements](#) on page 1458

Expression

The combination of various facial features positioned to create a specific facial expression.

A generic expressions is a preset facial expression, such as a smile, that you link to your shapes using a Character Face. MotionBuilder uses expressions to drive the various shapes or cluster shapes, creating expressions for your facial models.

Channels

A channel is a preset MotionBuilder facial expression that links the Actor Face with the Character Face.

While it is not absolutely necessary that you use these channels, they are the ones you will mostly likely need. You'll want to have all of these channels mapped to shapes on your model. You can also consult the Character Face

representation in the Preview pane, which demonstrates the expression you want each channel to create.

If Open is set to 100%, you get exactly what you modelled this shape into. MB records the rate at which the change takes place when you move the slider. So this one channel can drive multiple shapes: including face shapes, tongue shapes, and teeth shapes. It's driving three different parameters. You set those three parameters for one channel. You set these parameters to percentages that look normal for your model, not necessarily what we recommend in the manual.

There are two types of expression in Character Face settings: Generic and Custom expressions.

Connecting an Actor Face to a Character Face

To connect an Actor Face to a Character Face:

- 1 Double-click a Character Face in the Scene browser to display the Character Face Settings.
- 2 Switch to the Character Face Animation pane.
- 3 Select an Actor Face from the Actor Face Source menu, and enable the Active option if it is not automatically enabled.

Selecting the Actor face in the Actor Face Source menu constrains the Actor face to the Character face, so the defined Character Face can be driven with the animation data on the Actor Face.

TIP If you want, you can play animation mapped to the Actor Face and watch it play on your character's head model.

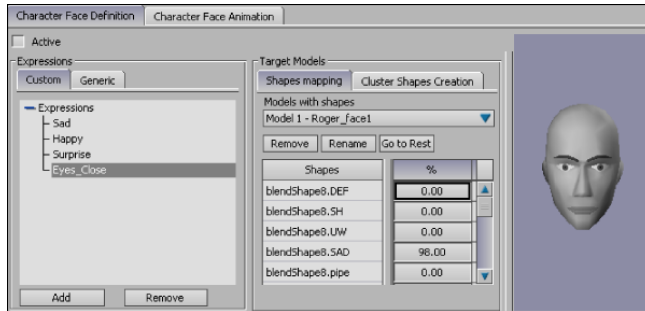
- [Facial motion capture workflow](#) on page 1395

Defining a custom expression

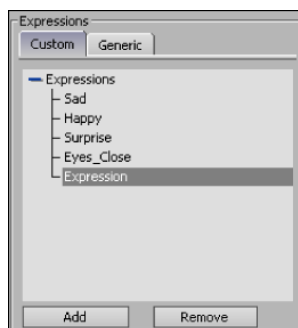
Once you have a Character face loaded, you can define custom expressions to give your character a “vocabulary” of facial movements.

To create a custom expression:

- 1 Select the character face from the Navigator window. The Character Face Definition pane opens.
- 2 Disable the Character Face Definition pane Active option.



- 3 **NOTE** When the Character Face Definition pane Active option is enabled, you cannot preview or define facial expressions on the model in the Viewer window.
- 4 Select the Custom tab in the Expressions area and click Add. A new custom expression is added. Rename it for the expression you want to create.



- 5 In the Target Models area, switch to the Shapes Mapping tab and modify the shape values to make the expression you want to create.
For example, to create the expression “MAD”, the eye, eyebrow, and mouth shape values were increased.

Head models

85

A head model is the model of a face composed of a geometric mesh using shapes or clusters for different facial expressions.



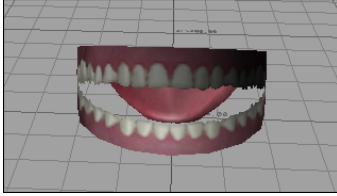
A head model

This section covers the following topics:

- [Submodels](#) on page 1402
- [Generic shapes](#) on page 1404
- [Choosing shapes to create](#) on page 1411
- [Choosing shapes to create](#) on page 1411
- [Creating shapes](#) on page 1411
- [Voice device](#) on page 1455

Submodels

Submodels are the smaller parts that make up a character's head model. For example, you might create separate submodels of a character's teeth or tongue.



Sub-models for the upper teeth, lower teeth, and tongue.

If your character's head is made up of more than one model, you need different shapes for each submodel affected by each expression.

For example, if you have a head model with separate teeth and tongue submodels, when you create a "Mouth Open" shape, then you need to create separate "Mouth Open" shapes for the teeth, tongue, and any other submodel that is part of the "Mouth Open" expression.

Even if you do not need to modify a submodel for a specific expression, you should still create an independent shape. This allows consistent shape numbering for all of the submodels that compose the face. For example, if the teeth are the same for the default shape and the "AA" phoneme shape, you should duplicate the default teeth shape for the "AA" phoneme.

■ [Head models](#) on page 1401

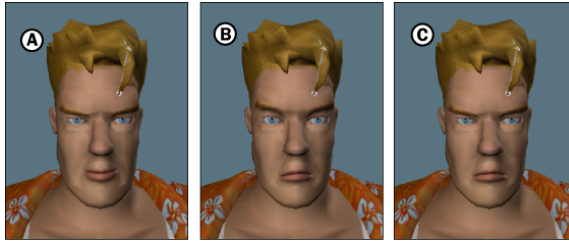
Shapes

A shape is the position of one or more of the facial features on a head model. Every facial expression is created with a combination of shapes, with the facial features (such as the eyes, nose, mouth) each positioned in a particular way. By creating different combinations of these shapes, you can create any kind of expression on a head model.

NOTE You cannot create facial animation within MotionBuilder unless you have a head model with shapes or cluster shapes.

Shapes can also be referred to as gizmos or morph targets. Most often, face shapes change the position of the model's mouth, eyebrows, eyes, cheeks, or nostrils. The type and number of shapes you create depends on your project.

For example, you can blend the “Brow Down” shapes with the “Mouth Corner Down” shapes to create an angry facial expression on the model.



A. Brow Down shapes B. Mouth Corner Down shapes C. Resulting angry expression.

- [Choosing shapes to create](#) on page 1411
- [Creating shapes](#) on page 1411

Facial rest pose

The facial rest pose is the default expression your character's face assumes when there is no specific facial expression applied. The rest pose consists of a closed mouth, open eyes, and eyebrows that are at mid-level.

Whatever shapes you need, the first shape you should create is the rest pose (Shape 0). You can then start with a copy of the rest pose as you create all of the other shapes your project requires.



The face in a rest position consisting of a closed mouth, open eyes, and eyebrows at mid-level.

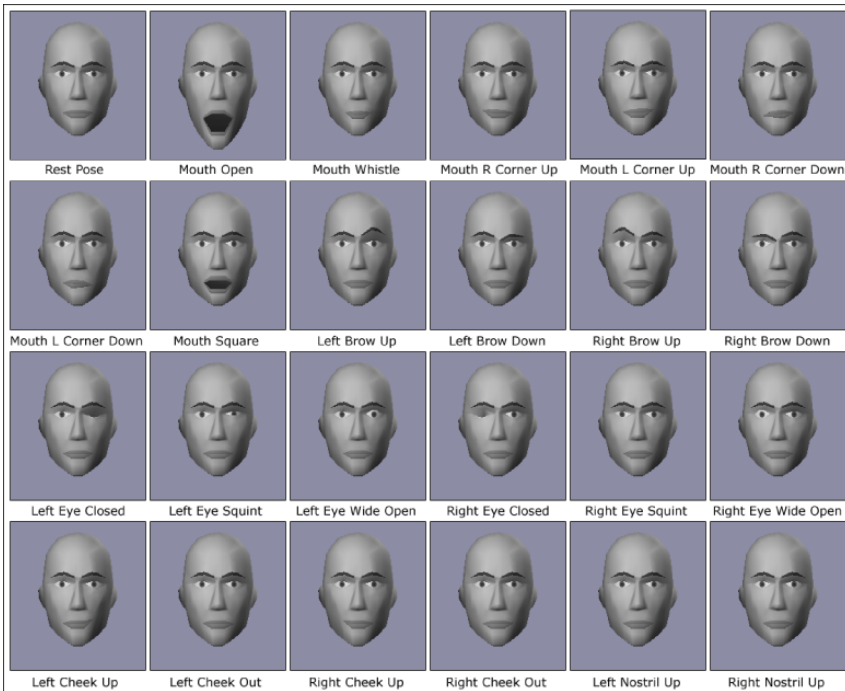
- [Generic shapes](#) on page 1404
- [Creating shapes](#) on page 1411

Generic shapes

Generic shapes correspond to the Generic channels used by the Actor Face settings to animate a head model connected to a motion capture source. See [Animating generic channels](#) on page 1429.

If you do not plan to use an Actor Face to connect to a motion capture source, you do not have to create Generic shapes for your head model.

Use and the following descriptions as guidelines when creating Generic shapes.



Generic shapes

Rest Pose

Mouth is closed, eyes are open, eyebrows at mid-level.

Mouth Open

Jaw is dropped, teeth are open or do not show.

Mouth Square

Mouth is open, teeth can be closed.

Mouth Whistle

Mouth is closed, lips are pursed.

Mouth Corners (four shapes)

Left and right corners of the mouth in up and down positions.

Eyes (six shapes)

Both eyes in closed, squint, and wide open positions.

Eyebrows (four shapes)

Both eyebrows in up and down positions.

Cheeks (four shapes)

Left and right cheeks in up and out positions.

Nostrils (two shapes)

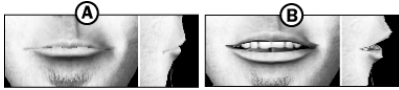
Both nostrils in up positions.

- [Choosing shapes to create](#) on page 1411
- [Creating shapes](#) on page 1411
- [Choosing shapes to create](#) on page 1411
- [Animating Faces](#) on page 1393
- [Actor Face asset](#) on page 1417

Phoneme shapes

Phonemes are the smallest individual units of sound that are combined to form speech. A phoneme shape refers to the position of the lips, teeth, tongue, and jaw required to utter a phoneme, or a specific sound of speech.

For example, the phoneme shape for the phoneme /m/ consists of lips that are pressed together, whereas the phoneme shape for /l/ consists of lips that are unrounded and slightly apart, with the tip of the tongue pressed lightly to the gums behind the upper teeth.



Phoneme shapes A. /m/ phoneme B. /l/ phoneme

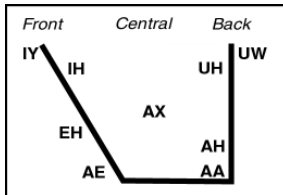
Phoneme shapes are needed when you use the Voice device, in conjunction with the Character Face asset, to drive your facial animation. Refer to as a guide for creating phoneme shapes supported by the Voice device.

However, you can also drive phoneme shapes as you would custom shapes, using keyframes or devices such as joysticks and keyboards.

Create as many phoneme shapes as you need. If you create only a few phoneme shapes, they can be blended to simulate other shapes. However, the more phoneme shapes you create for a model, the better quality the final animation.

In speech, vowels are particularly important because they comprise the majority of visual cues in spoken language.

How vowels are articulated depends on the different movements of the mouth and tongue, such as the front or back placement of the tongue and the movement of the lips.



English vowel system (partial) in a scale ranging from front unrounded (IY) to back rounded (UW) vowels. Most other vowels fall in between these two extremes (IY and UW). AX is approximately in the middle, and represents the sound that is made when the tongue and mouth are at complete rest.

Phonemes are not always pronounced in the same way and may fall between vowels. To compensate for this, or if your model was created without a specific shape, MotionBuilder weights the nearest vowels to generate a mix of shapes that approximates the position of your model's lips.

If your model says a vowel that falls outside the range that your shapes cover, MotionBuilder chooses the closest vowel.

You should select the vowels that correspond to your shapes. Ideally, you should create your model with the shapes for the extreme ends of the vowel range, then uniformly space more vowels in between. See the following figure for a visual example of phonemes and their shapes.



Phoneme shapes

For example, if you want your character to slightly open and close its mouth, you could use only one vowel such as AX (as in “the”). If you want more subtle movement to represent the sound between different vowels, use more than

one. Accordingly, if your model has three shapes that say “beat”, “bat”, and “boot”, use IY, AE, and UW. If your model has six shapes saying “bit”, “bet”, “bob”, “boat”, “book”, and “seat”, use IH, EH, AA, OW, UH, and S respectively.

The following table lists the phoneme shapes available in MotionBuilder and gives an example illustrating their pronunciation.

| Phoneme | Example |
|---------|---------|
| AE | cat |
| AO | fought |
| AX | alas |
| B | bike |
| D | dam |
| F | fox |
| G | gate |
| H | hat |
| IY | heat |
| K | cake |
| KG | concur |
| L | lock |
| M | moon |
| N | new |
| OW | goat |

| Phoneme | Example |
|---------|----------|
| P | point |
| S | site |
| SH | shape |
| T | tap |
| UH | look |
| UW | loot |
| V | veer |
| Z | zoo |
| ZH | pleasure |

Custom shapes

You can create custom shapes for additional facial expressions and animation that do not match the Generic and Voice shapes. For example, you can create custom shapes for additional eyebrow, nostril, and cheek movements.

Custom shapes should be independent from the supported Generic and Phoneme shapes so that you can blend them to other shapes.

For example, a custom forehead expression should have its own shape. This lets you blend it with other facial expressions and phonemes, instead of only applying it to a specific movement.

Refer to [Choosing shapes to create](#) on page 1411 for a guide to creating phoneme shapes supported by the Voice device.

- [Smoothing phoneme transitions](#) on page 1465
- [Animating Faces](#) on page 1393

- [Choosing shapes to create](#) on page 1411

Choosing shapes to create

The shapes you need to create depend on the method you plan to use to animate your head model.

For example, if you want your head model to be connected to a live performer, you must create shapes that match the Generic expressions in the Actor face generic expressions. If you want your head model to be connected to the Voice device, you need to create shapes that match phonemes. These shapes are referred to as voice shapes.

The types of shapes that you can create are divided into the following categories:

- Rest Pose, which is the expression of your model at rest.
- Generic shapes, which are basic facial expressions that let you use motion capture data to drive facial animation.
- Phoneme shapes, which are basic mouth shapes that let you use audio files and the Voice device to drive facial animation.
- Cluster shapes, which let you create shapes for models with clusters.

You are not restricted to creating shapes that match only the generic and voice shapes, you can create any shape that you want.

Once you create all your shapes, you are ready to export your model(s) to MotionBuilder.

- [Creating shapes](#) on page 1411
- [Clusters and cluster shapes](#) on page 1412

Creating shapes

Shapes for head models are created using software external to MotionBuilder, then imported using the File > Import function.

Techniques for creating shapes may differ between software. For example, some 3D software may require that you save each shape on the head model

at different frames. In others, you create duplicates of your head model with different shapes.

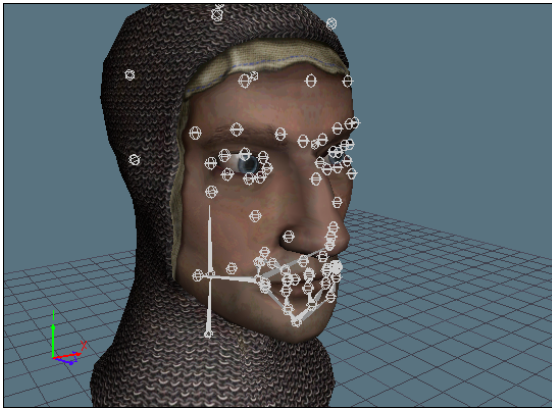
In general, when creating each new shape, start with a copy of the facial rest pose so that each shape starts from the same rest position. Then when you create transitions between facial expressions, the shapes blend together smoothly because they are all created from the same basic template.

- [Choosing shapes to create](#) on page 1411
- [Head models](#) on page 1401
- [Choosing shapes to create](#) on page 1411

Clusters and cluster shapes

Clusters are moveable sections of geometry on a face model that are set up to mimic the movement of muscle under skin and define the appearance of the face.

Cluster shapes are simply groups of clusters. When blended together, they create realistic facial expressions.



Clusters appear on a head model

NOTE If your model has clusters instead of shapes, you can use MotionBuilder to create cluster shapes from groups of clusters. See [Creating cluster shapes](#) on page 1413.

You create clusters on a head model using MotionBuilder-compatible modelling software. Using a Character Face asset in MotionBuilder, you then group clusters together to create cluster shapes which can be mapped to custom or generic expressions. Model your cluster shapes to correspond with Generic and Voice channels, as you would ordinary generic and phoneme shapes.

NOTE You can only make cluster shapes with a model that has existing clusters.

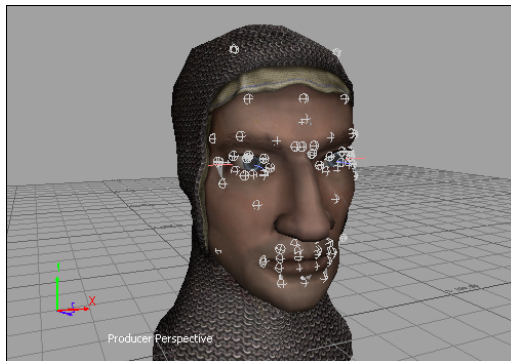
- [Creating cluster shapes](#) on page 1413
- [Changing the rest pose for cluster shapes](#) on page 1415
- [Renaming cluster shapes](#) on page 1415

Creating cluster shapes

These are general guidelines for creating shapes from groups of clusters. Once clusters are grouped, they can be mapped to expressions from the Shapes Mapping pane, just like regular shapes.

To create cluster groups and cluster shapes:

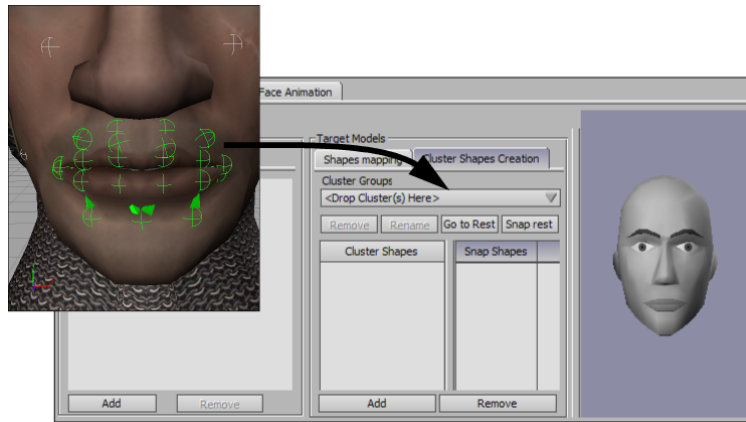
- 1 Load a head model with clusters into the scene.



A head model with cluster shapes.

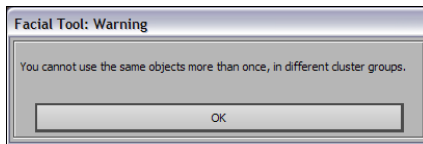
- 2 Create cluster groups by doing the following:
 - Select any number of unused clusters, such as all the clusters for the mouth.

- Alt-drag the selected clusters into the Cluster Groups menu of the Cluster Shapes Creation pane.



Drag a new cluster group into the Cluster Groups menu.

A new cluster group is created. If you attempt to create a cluster group with a cluster already added to another cluster group, a dialog box appears. Each cluster can only belong to one cluster group.



Facial Tool: Warning dialog box

- 3 Rename the cluster group and click Add to add a new shape to the Cluster Shapes list.
- 4 Translate, rotate, and scale the clusters belonging to the cluster group to define the Cluster Shape.

NOTE Make sure that the Active option is disabled, otherwise you will not be able to transform clusters.

- 5 Click Snap for each new shape. Only clusters belonging to the selected Cluster Group are defined as the shape.

To see the shapes you have created, click on their names in the Cluster Shapes list.

- [Clusters and cluster shapes](#) on page 1412
- [Changing the rest pose for cluster shapes](#) on page 1415
- [Renaming cluster shapes](#) on page 1415

Changing the rest pose for cluster shapes

To change the rest pose:

- 1 Click Rest Pose to work from the current rest pose, move the clusters to a new position, and click Snap Rest.

The model's rest pose is the position in which the face is at rest. By default, a cluster shape's rest pose is the position of the clusters when you drag them into the Cluster Groups menu.

You can use the cluster shapes in the Shapes Mapping pane of the Character Face settings. See [Shapes Mapping pane](#) on page 1446 for more information.

- [Clusters and cluster shapes](#) on page 1412
- [Choosing shapes to create](#) on page 1411

Renaming cluster shapes

To rename cluster shapes:

- 1 Double-click on the default name.
- 2 Type in a new name.
- 3 Type Enter to confirm the change.

- [Clusters and cluster shapes](#) on page 1412

Actor Face asset

The Actor Face asset lets you animate a character's face by transferring animation data from a motion source to a Character Face.

You can use an Actor Face to define a facial Marker set for a motion capture device or for facial motion capture data, then connect the Actor Face as the motion source of a Character Face.

An Actor Face is mapped to motion data using a set of markers called a facial Marker set. This facial Marker set maps markers or sensors of motion data to the specific locations on the Actor Face that they control. You can manipulate and plot the marker or sensor data to the Generic channels of the Actor Face, then clean-up the data by keyframing directly on the Generic channels before plotting the animation to your character head model.

- [Attaching an Actor Face to a head model](#) on page 1418
- [Actor Face Settings](#) on page 1431
- Character Face asset

Adding an Actor Face to the scene

To add an Actor Face to the scene:

- 1 In the Asset browser, open the Characters folder and drag an Actor Face asset into the Viewer window.

Nothing appears in the Viewer window, but a new Actor Face is added to the Scene browser.

When you drag an Actor Face over a head model with shapes, a contextual menu appears letting you select the Attach Facial option. Selecting Attach Facial also adds a Character Face to your scene and connects it to the Actor Face.

- [Actor Face asset](#) on page 1417
- [Attaching an Actor Face to a head model](#) on page 1418

Attaching an Actor Face to a head model

To attach an Actor Face to a head model with shapes:

- 1 Drag an Actor Face from the Characters folder of the Asset browser onto a head model with shapes.
- 2 Select Attach Facial from the contextual menu that appears.

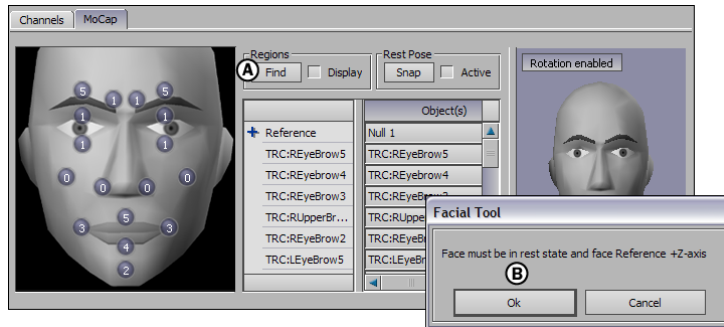
- [Actor Face asset](#) on page 1417
- [Voice device](#) on page 1455

Connecting an Actor Face to motion capture data

Once you have imported some facial motion capture data and added an Actor Face to the scene, you can set up the motion data to drive the Actor face.

To connect an Actor Face to motion capture data:

- 1 Drag a null into the scene and set it up as the Reference object for the face. See [Creating a face reference](#) on page 1421.
- 2 Create a facial Marker set. See [Creating a facial Marker set](#) on page 1423.
- 3 In the Regions area of the MoCap pane, click the Find button, then click Ok in the dialog box that appears reminding you that the face must be in the rest pose and facing the Z-axis.



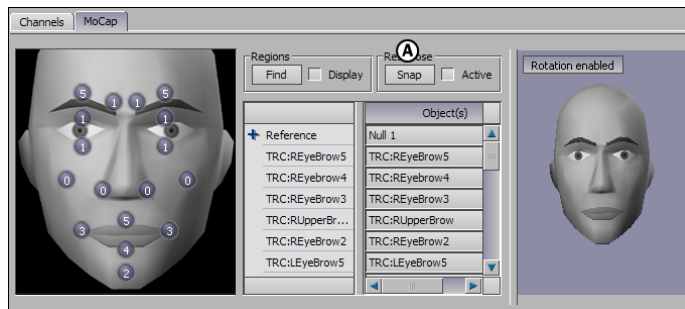
Defining facial regions. A. Click Find. B. Click Ok.

MotionBuilder automatically defines the zone of movement for the facial markers.

You can scale the global movement using the bounding boxes that define specific zones for the mouth, eyes, and eyebrows. For example, you can scale up the bounding box for the mouth to decrease the range of movement.

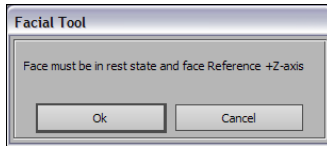
TIP To view the bounding boxes in the Viewer window, activate Display in the Regions area.

- 4 With the motion data in a neutral pose, click Snap in the Rest Pose area.



Actor Face settings A. Snap option

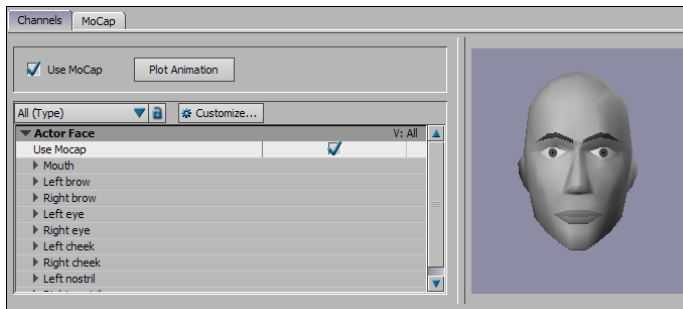
- 5 Click Ok in the dialog box that appears.



Facial Tool dialog box

The starting pose of the face is set, and the mapping is activated. The Active option is automatically enabled, and the other options in the Regions and Rest Pose areas are disabled. To make any changes to the mapping, you must disable Active.

- 1 Switch to the Channels pane to verify that the Use MoCap option is active.



The Use MoCap option is activated in the Channels pane.

The motion capture source can now drive the channels. When you play the animation, the channel sliders move and show their active values, and the Preview pane shows the effect of the motion capture data.

When you have completed these steps, you can continue setting up your Actor Face to drive a Character Face. See [Facial motion capture workflow](#) on page 1395.

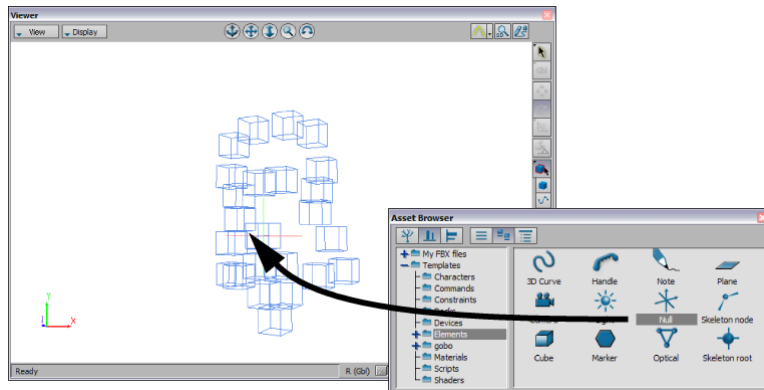
Note: You can use multiple motion files on different takes by creating a new take, selecting the optical root of the motion data, and loading another file from File > Import.

Creating a face reference

Once you have loaded the facial motion data you want to work with, you need to create a Reference object for the face.

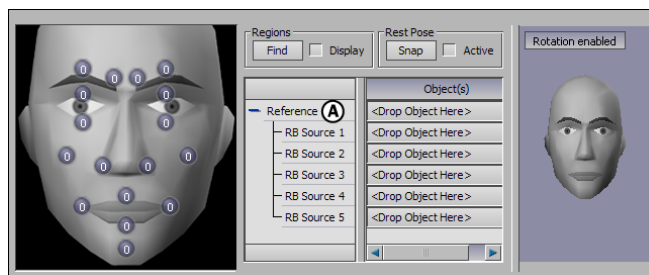
To create a face reference:

- 1 From the Elements folder in the Asset browser, drag a null into the scene. Since the null will be the Reference object, make sure it faces the same direction as the motion data markers.



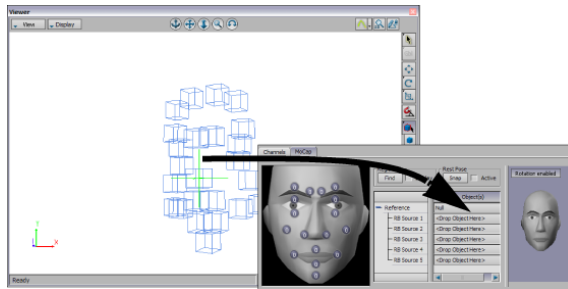
Drag a null into the scene to act as the Reference object for the face.

- 2 If you have not already done so, drag an Actor Face into the scene. See [Adding an Actor Face to the scene](#) on page 1417.
- 3 In the Actor Face settings, switch to the MoCap pane and expand the Reference group.



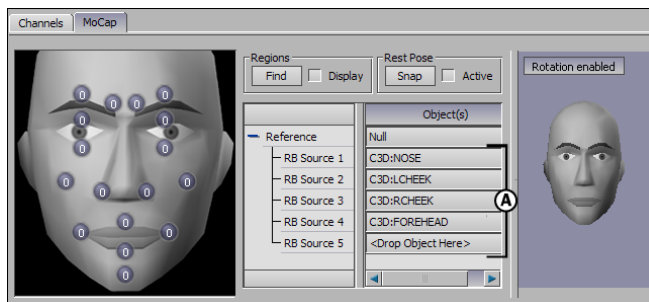
MoCap pane in the Actor Face settings A. Expand the Reference group.

- 4 Alt-drag the null from the Viewer window into the Reference slot.



Alt-drag the null into the Reference slot in the Actor settings.

- 5 Identify a group of markers that do not move relative to each other, such as the forehead markers, and drag them into the series of Rigid body slots (RB Source 1, RB Source 2, and so on) in the Reference group.



Actor Face settings A. Rigid body sources

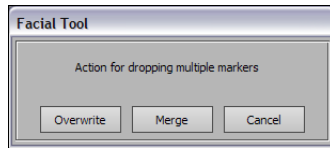
After you set up the face reference, you can go on to define the rest of the facial Marker set. See [Creating a facial Marker set](#) on page 1423.

When you play the motion data after setting up the Marker Set list and defining regions, the reference moves with the markers.

To add multiple Rigid body markers simultaneously:

- 1 Select multiple markers and Alt-drag them into a Rigid body slot.

- 2 A dialog box appears giving you the choice to Overwrite, Merge, or Cancel.
 - Select Overwrite to replace any existing sources in the Rigid body fields with new markers. For example, if you Alt-drag three markers at the same time, the first three Rigid body fields are replaced in the Marker Set list.
 - Select Merge to append the markers to existing markers in the list. No Rigid body sources are replaced, so only the remaining empty fields are defined.
 - Select Cancel to abort the operation.



Overwrite, Merge, or Cancel the Rigid body sources.

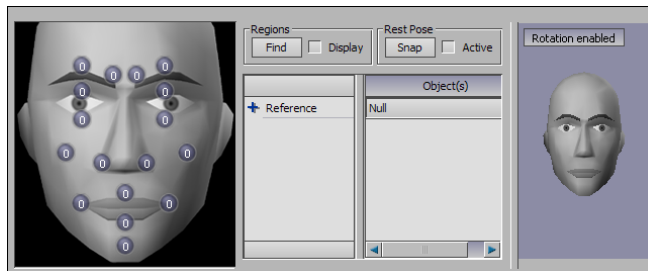
- [Connecting an Actor Face to motion capture data](#) on page 1418

Creating a facial Marker set

After you have loaded facial motion data in the scene, added an Actor face, and defined a Reference object, you can create a facial Marker set.

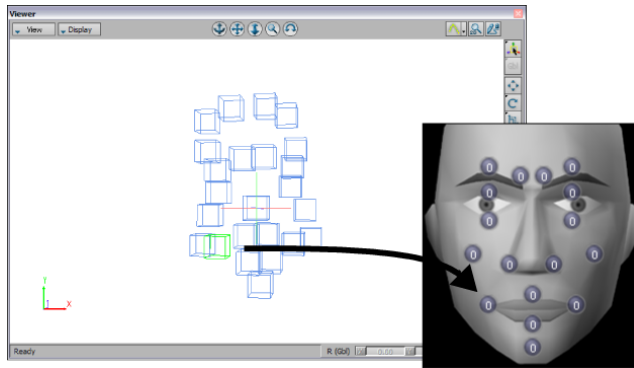
To create a facial Marker set:

- 1 In the Actor Face settings, switch to the MoCap pane.



MoCap pane of the Actor Face settings

- 2 Alt-drag one or more selected objects containing motion data from the Viewer window into the corresponding cell of the Mapping model in the Actor Face settings.

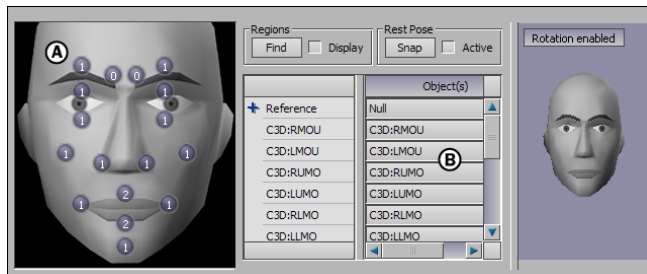


Alt-drag markers into the Mapping model.

NOTE Be sure to deselect each marker before going on to select the next one.

As you add markers, the cells of the Mapping model display the number of markers that affect each part of the face. Each cell can have up to five markers.

The objects are also added to the Marker set list in the MoCap pane.



A. Mapping model displays numbers of markers B. Mapping Set list displays list of marker names.

To view a list of the markers that affect each part of the face:

- 1 Select a cell in the Mapping model.

A green outline displays around the cell and the list of markers influencing that part of the face displays in the Mapping Set list.

To view all markers in the Marker Set list:

- 1 Click the background of the Mapping model to deselect all cells.

To delete markers from a cell:

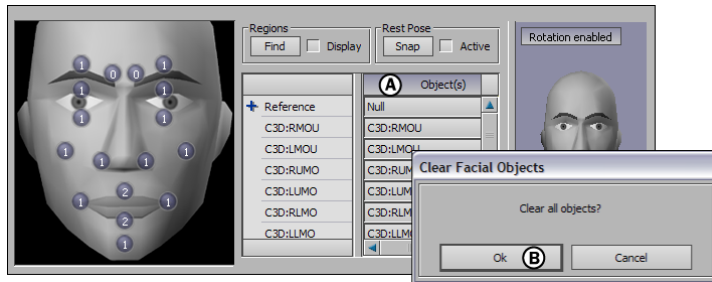
- 1 Select the marker in the Marker Set list and press Delete. For information on clearing all markers from the Marker Set, see [Creating a face reference](#) on page 1421.

See [Connecting an Actor Face to motion capture data](#) on page 1418.

Clearing all markers in a facial Marker set

To clear all markers in a facial Marker set:

- 1 Click the heading “Object(s)” at the top of the Marker Set list, then click Ok in the dialog box that appears.



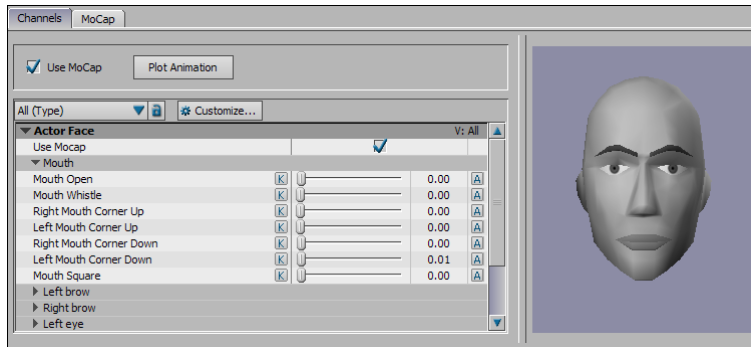
Clearing the facial Marker set A. Click the Object(s) heading B. Click Ok.

Editing facial motion capture data

To edit facial motion capture data, you first have to plot the data to the Actor face channels.

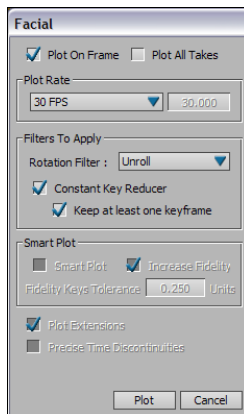
To edit facial motion capture:

- 1 Transfer the motion capture to the Actor Face channels by clicking Plot Animation in the Channels pane.



Click Plot Animation.

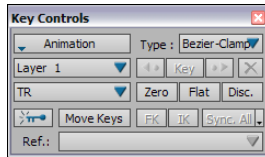
- 2 Click Plot in the Facial dialog box that appears.



Click Plot in the Facial dialog box.

In the Channels pane, the Animate (A) option is activated for all generic channels, making each channel available for editing.

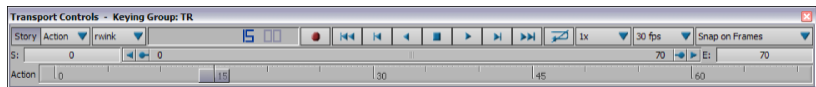
- 3 In the Key Controls window, select Layer 1 from the Layer menu.



Select Layer 1.

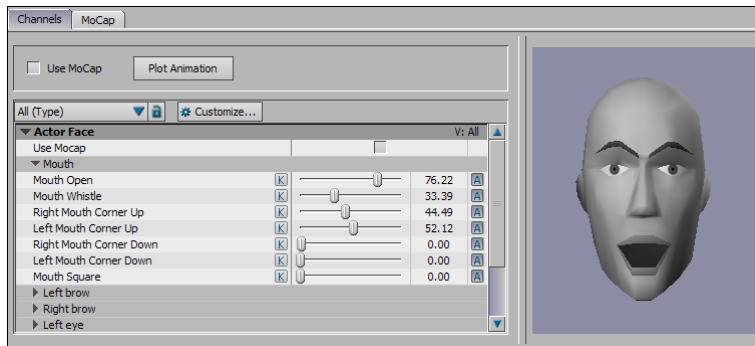
By animation on a new layer, you can modify the animation without changing the plotted animation. When your satisfied with your changes, you can merge the layers.

- 4 Move the Timeline indicator to where you want to change the animation.



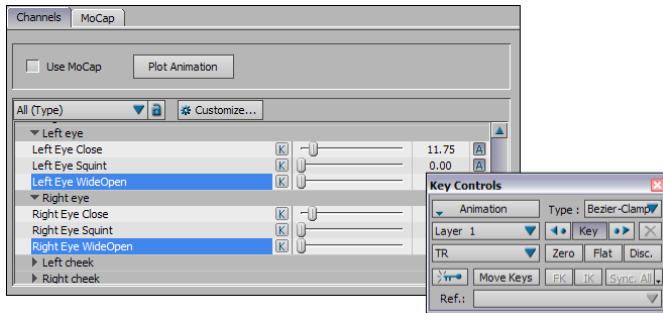
Move the Timeline indicator.

- 5 Modify the animation by adjusting the channel sliders.



Adjust the Channel sliders.

- 6 Select the channels you want to keyframe, then click Key.



Select the channels you have changed, then click Key to set a keyframe.

- 7 Play your animation to see the changes.

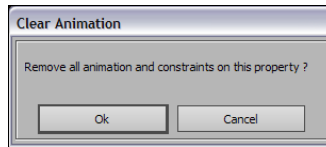


Review the changes you have made.

Removing animation from a channel

To remove animation from a channel:

- 1 In the Channels pane of the Actor Settings, disable the Animate (A) option next to the channel.
- 2 Click Ok in the Clear Animation dialog box that appears to confirm that you want to delete all of the animation and remove the channel from any related constraints.



Clear Animation dialog box

This removes the channel from constraints and deletes all animation associated with the channel.

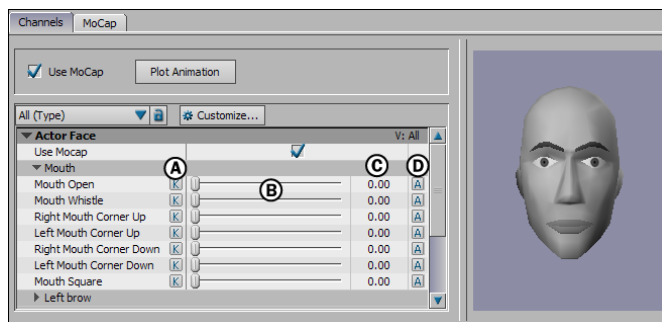
- [Channels pane](#) on page 1432
- [Animating generic channels](#) on page 1429

Animating generic channels

To animate generic channels:

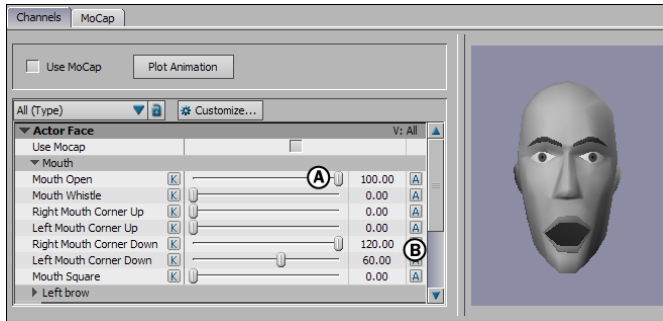
- 1 In the Channels pane of the Actor Settings, enable the Animate (A) option next to the channels you want to animate.

When the Animate (A) option is enabled, the channel can be keyframed and used within a constraint.



Actor Settings, Channels pane A. Keyframe (K) button B. Channel slider C. Value field D. Animate (A) option

- 2 Change the value of the channel using the slider or value field. To display the full effect of a channel, drag its channel slider fully to the right. The maximum value of a channel slider is 100%, but you can use values higher than 100 and lower than 0 in the value field.



A. Channel at 100% B. Value field at 120.

- 3 Set a keyframe by clicking the Key (K) button next to the selected channel, or clicking Key in the Key Controls window.

- [Channels](#) pane on page 1432
- [Actor Face Settings](#) on page 1431

Actor Face Settings

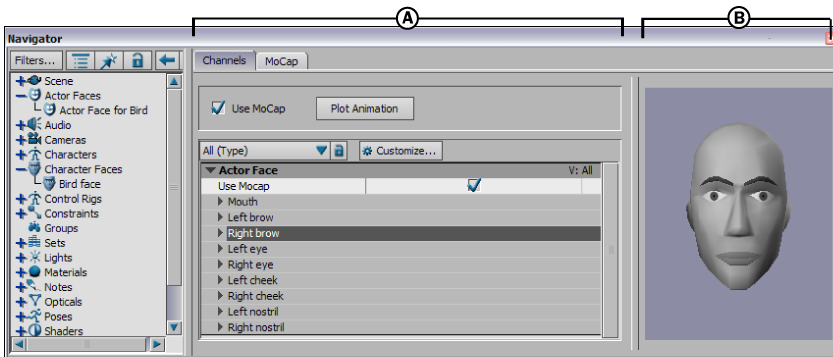
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The Actor Face lets you do the following:

- Connect motion capture data from a live or recorded source to an Actor Face.
- Plot motion capture data from a live or recorded source to an Actor Face.
- Animate expressions plotted to an Actor Face using keyframe animation and constraints.
- Use as a motion source for a Character Face to animate the shapes of a head model with live or recorded motion capture data.

The Actor Face settings consist of the following areas:

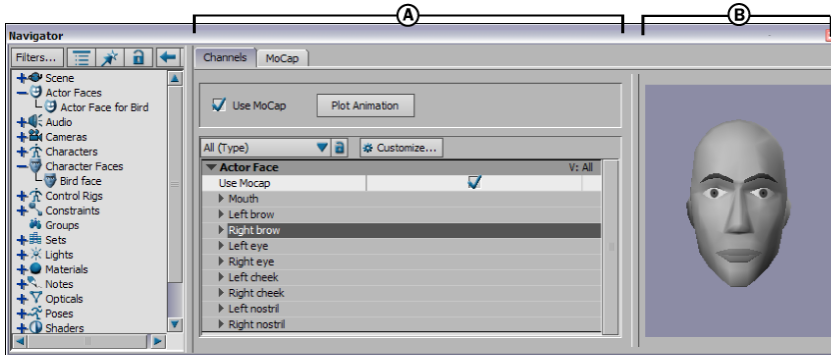
- [Channels pane](#) on page 1432
- [MoCap pane](#) on page 1434
- [Preview pane](#) on page 1440



Actor Face settings A. Channels pane B. Preview pane

Channels pane

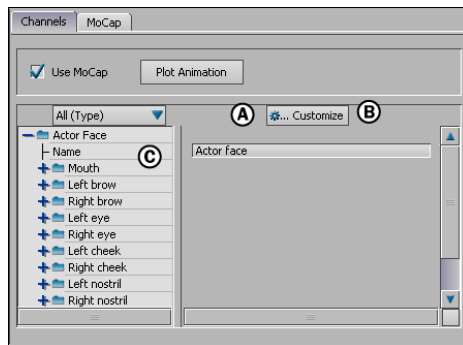
The Channels pane lets you drive and animate channels using keyframes, motion capture, and devices in Relations or Expressions constraints. These channels are defined in the Character Face settings.



Actor Face settings A. Channels pane B. Preview pane

The Channels pane consists of the following:

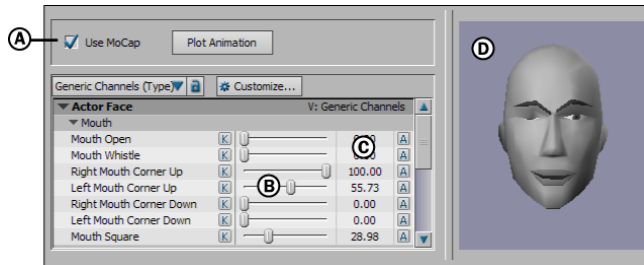
- [Use MoCap option](#) on page 1433
- [Plot Animation button](#) on page 1433
- [Channels List](#) on page 1433



Channels pane A. Use MoCap option B. Plot Animation button C. Channels list

Use MoCap option

When Use MoCap is enabled, the motion capture source drives the channels. The motion capture source is set up in the Mocap pane. See [MoCap pane](#) on page 1434.



A. Use MoCap is enabled and motion capture data drives the channels. B. The sliders move. C. The value fields change. D. The Preview pane shows the effects of the motion capture.

As the animation plays, the channel sliders move in conjunction with the motion capture data, and the current values display in the value field. The Preview model also shows the effect of the motion capture data.

NOTE You cannot use the channel sliders in the Channels pane when the Use MoCap option is activated.

Plot Animation button

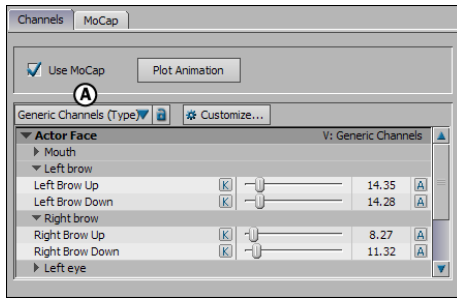
The Plot Animation button plots the motion capture data to the channels of the Actor Face. Plotting activates all Animate (A) options, making the channels available for keyframing and for use in constraints.

After you plot, the Use Mocap option is disabled since the Actor Face no longer uses the motion capture data as a source, but instead uses the generic channels.

Channels List

The Actor Face and Character Face use a set of twenty-three generic channels to communicate with each other. The channels in the Actor settings consist of various positions of the mouth, eyebrows, eyes, cheeks, and nostrils, and they correspond to the generic expressions you define in the Character Settings.

In the Actor Face settings, each generic channel in the list has a Key (K) button, Channel slider, Value field, and Animate (A) option.



Channels pane of the Actor Settings A. The Generic Channels view is selected in the View menu.

- Defining a generic expression
- [Animating generic channels](#) on page 1429

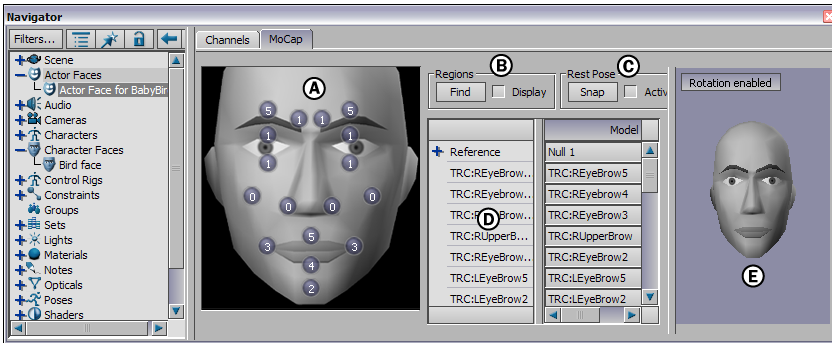
MoCap pane

The MoCap pane lets you map markers to drive the Actor Face. The markers can be, for example, a set of optical markers imported from a Vicon *.c3d* file, or a set of sensors connected to a live device.

The mapping process involves defining nodes that control the movement of certain face regions. In the Actor Face settings, these nodes control areas such as the eyebrows, eyes, cheeks, nose, mouth, and so on.

The MoCap pane consists of the following:

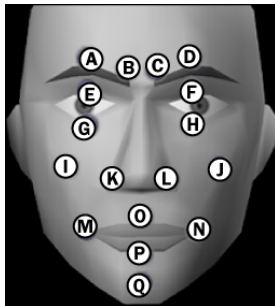
- [Mapping model](#) on page 1435
- [Marker Set list](#) on page 1436
- [Regions area](#) on page 1437
- [Rest Pose area](#) on page 1439



MoCap pane A. Mapping model B. Regions area C. Rest Pose area D. Marker Set list E. Mocap Preview area

Mapping model

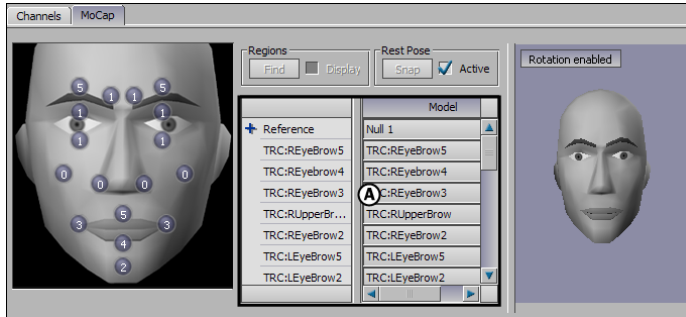
The Mapping model is a visual representation of the Actor Face that shows the number of markers affecting each facial part. The mapped markers are collectively called a Marker set. The following figure identifies the cells in the Mapping model that represent each facial part.



A. Right outer eyebrow B. Right inner eyebrow C. Left inner eyebrow D. Left outer eyebrow E. Right upper eye F. Left upper eye G. Right lower eye H. Left lower eye I. Right cheek J. Left cheek K. Right nostril L. Left nostril M. Right mouth N. Left mouth O. Upper mouth P. Lower mouth Q. Chin

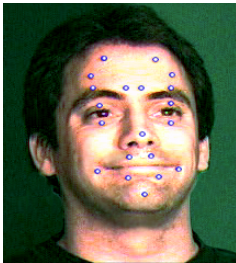
Marker Set list

The Marker set list lets you define a Marker set for mapping motion data to the Actor Face. The mapped areas define the facial parts on your source model that relate to the motion sensors on a performer.



MoCap pane A. Marker set list

For example, you can see motion sensors on the performer's face in the following image. The marker names in the list indicate where the sensors or markers drive the model, and where they eventually drives the Character's facial shapes.



Performer with facial motion sensors.

The first item in the Marker Set list is the Reference field. Setting a reference with Rigid body sources lets you stabilize the head movement. The reference represents the head bone from which the markers move.

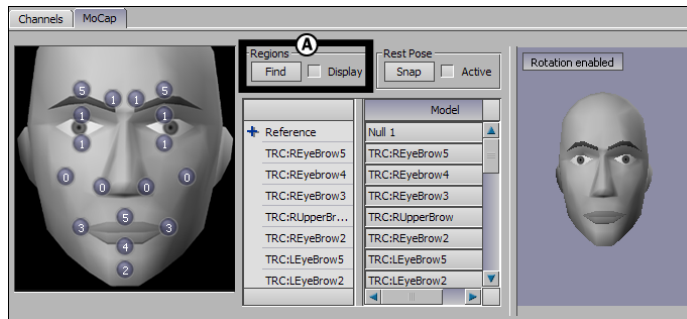
To scroll through the Marker Set list, you can Shift-drag up or down. You can rename a marker in the Marker Set list by double-clicking the marker to select it, typing a new name, and pressing Enter.

To delete a marker, select the marker in the Marker Set list, then press Delete. To delete all models in the Marker Set list, click the Model heading at the top

of the column. In the dialog box that appears, click Ok to delete all models in the list.

Regions area

After setting up the Marker Set list, use the Regions area to define the zone of movement for the model's main facial components. The Regions area is available only when the Active option in the Rest Pose area is disabled, and consists of the Find button and the Display option.



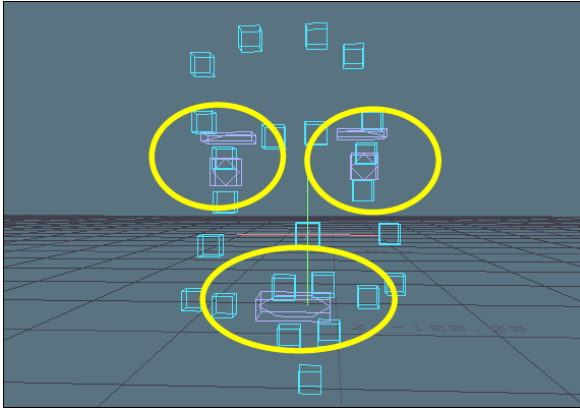
MoCap pane A. Regions area

Find

The Find button automatically defines the zone of movement for the facial markers using bounding boxes around the mouth, eyes, cheeks, nostrils, and eyebrows. The face must be in the rest pose and be pointed towards the Reference positive Z-axis.

Display

To display the bounding boxes in the Viewer window, activate Display after clicking Find. Bounding boxes appear as purple cubes around the eyes, eyebrows, cheeks, and mouth of your face model.



Bounding boxes display in purple around the eyes, eyebrows, and lips of the optical sensors. Cheeks and nostrils are not defined for this Marker set.

Bounding boxes are Rigid bodies that limit the area in which of your face model can move. If the shapes are set to move outside of a bounding box region, they do not reach to their full values.

You can scale the global movement using the bounding boxes. For example, if there are not enough face markers, you may want to define facial areas so that they fit the boxes more accurately.

When you scale bounding boxes, you affect the volume and shape that the box defines. For example, increasing the size of the bounding box for the mouth decreases the range of movement. Conversely, decreasing the size of the box increases the range.

The data for the bounding boxes comes from the optical sensors that you used to define your Marker set.

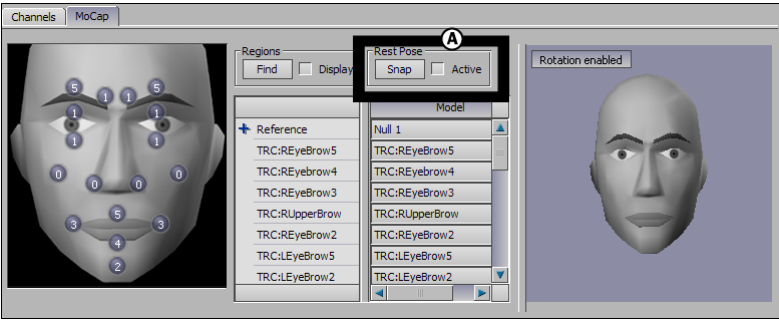
| | |
|---------------|---|
| Right Eye | Upper and lower right eye sensors (2) |
| Left Eye | Upper and lower left eye sensors (2) |
| Right Eyebrow | Inner and outer right eyebrow sensors (2) |
| Left Eyebrow | Inner and outer left eyebrow sensors (2) |
| Mouth | Right, left, upper, and lower mouth sensors (4) |

| | |
|---------------|----------------------|
| Right Cheek | Right cheek sensor |
| Left Cheek | Left cheek sensor |
| Right Nostril | Right nostril sensor |
| Left Nostril | Left nostril sensor |

NOTE Remember that both the size of your optical sensors and of the bounding boxes in the Viewer window are adjustable, so the bounding boxes might not match their corresponding optical sensors exactly.

Rest Pose area

The Rest Pose area consists of the Snap button and the Active option.



MoCap pane. A. Rest Pose area

| Option | Description |
|--------|---|
| Snap | Use the Snap button after creating the Marker set and setting the regions. Click Snap to compute slight positioning differences between the Marker set and the sensors the Marker set uses, and to set the starting point of the face. The Actor Face settings use the rest pose of the face as the default starting point. |

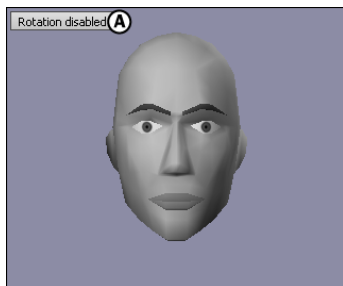
| Option | Description |
|--------|--|
| Active | Clicking Snap automatically enables the Active option and activates the mapping. When activated, the remaining options in the Rest Pose and Regions areas are disabled. To make any changes in the Mapping List, you must disable the Active option. |

■ [Actor Face Settings](#) on page 1431

Preview pane

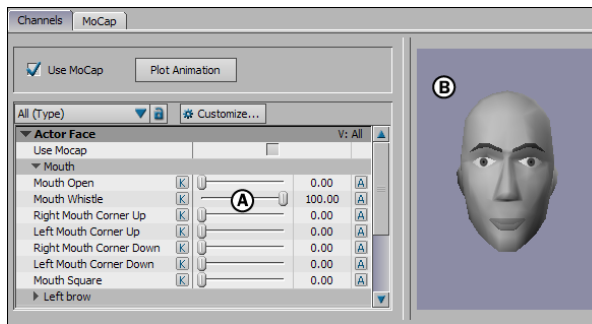
The Preview pane lets you view individual generic channels, as well as the effect of motion capture.

By default, the model in the Preview pane assumes the rest pose, in which the mouth is closed, the eyes are open, and the eyebrows are at mid-level.



Preview pane with model in the rest pose. A. Rotation disabled button appears in the Mocap Preview pane.

To view the effect of an individual channel on the model in the Channels pane, drag a channel slider fully to the right.



A. The channel slider for Mouth-Whistle is at 100%. B. The full value of the channel displays on the Preview model.

When you blend generic channels, you can see the composite effect on the Preview model. In the Channels pane, drag multiple sliders to see the effect on the Preview model. See [Channels List](#) on page 1433 for more on channels.

Shortcuts in the Preview Pane

You can use the following shortcuts in the Actor Face Preview pane:

| | |
|------------------------|--|
| Orbit around Face | Ctrl-Shift-drag in the Preview pane. |
| Zoom on Face | Ctrl-drag in the Preview pane. |
| Frame on Face | Click in the Preview pane and press F. |
| Hide the Preview Model | Double-click in the Preview pane to hide the model and increase the refresh rate. Double-click again in the Preview pane to display the model. |

■ [Channels List](#) on page 1433

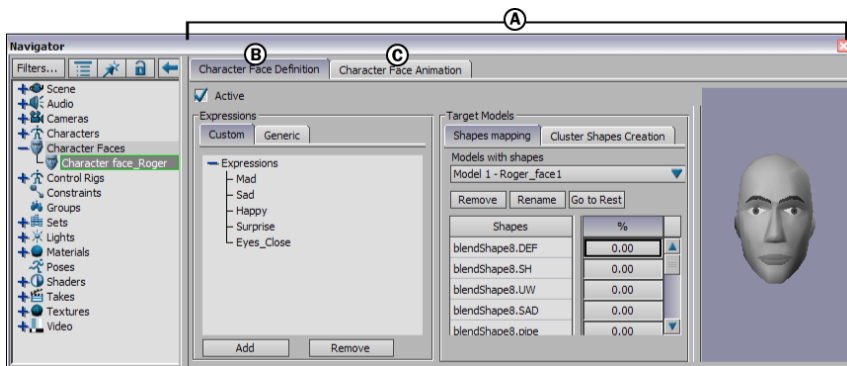
Character Face settings

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When you add a Character Face asset to the scene, the Character Face settings display in the Navigator window. These settings let you create facial expressions, rename shapes, and use the Voice device for real-time lip synchronization with facial animation.

The Character Face settings consist of the following main areas:

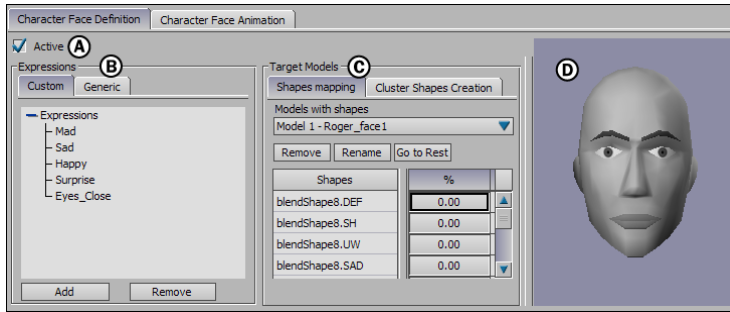
- [Character Face Definition pane](#) on page 1443
- [Character Face Animation pane](#) on page 1452



Navigator window A. Character Face settings B. Character Face Definition pane C. Character Face Animation pane

Character Face Definition pane

The Character Face Definition pane lets you create a set of facial expressions for your character by blending together shapes or clusters.



Character Face Definition pane A. Active option B. Expressions area C. Target Models area D. Preview pane

You can create your own custom expressions using the Custom pane, or use the Generic pane to define preset generic expressions for connecting to an Actor Face.

Regardless of which expressions you are defining, you must first Alt-drag models with shapes or clusters into the Target Models area. You cannot define expressions until a head model with shapes or clusters displays in the Target Models area.

Active option

Enable the Active option to activate and constrain the Character Face to its animation source.

When Active is enabled, you cannot define or preview expressions on the model in the Viewer window since the Character Face is constrained to its animation source.

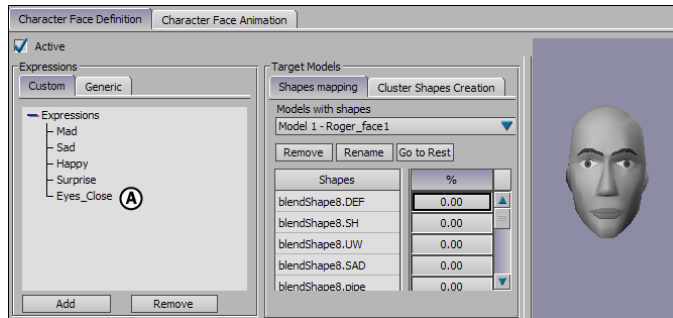
Expressions area

The Expressions area lets you define custom or generic expressions for your Character Face.

Once you define expressions, you animate them in the Character Face Animation pane using either an Actor Face asset, keyframe animation, or a Relations constraint connected to the Voice device.

Custom pane

Use the Custom pane in the Expressions area to define your own custom expressions. Custom expressions can be whatever facial expressions your project requires, including expressions that represent phonemes and are linked to the Voice device.

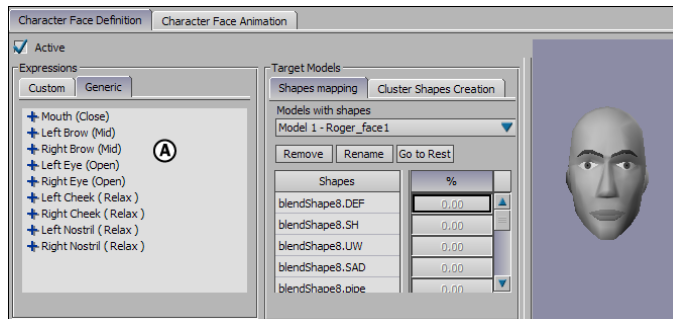


Character Face Settings A. Custom Expressions pane

For example, you can create a new expression, such as a surprised face, from a blend of shapes for the eyes, mouth, eyebrows, and other shapes.

Generic pane

The Generic pane in the Expressions area displays a basic set of facial expressions used to connect the Character Face with an Actor Face.



Character Face Settings A. Generic pane

An Actor Face lets you connect the Character Face to motion capture data from either a live source or imported file.

TIP If you are not using an Actor Face in conjunction with motion capture data, you can create facial animation using only a Character Face.

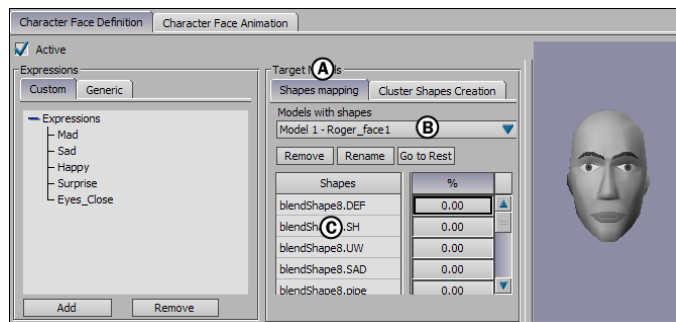
Target Models area

The Target Models area lists all the shapes for the model selected in the Models with Shapes menu. It consists of the following panes:

- [Shapes Mapping pane](#) on page 1446
- [Cluster Shapes Creation pane](#) on page 1449

Shapes Mapping pane

The Shapes Mapping pane lets you define the values for the shapes of your Character Face. It also lets you rename shapes and remove models from the Models with shapes menu.



Character Face Settings A. Shapes Mapping pane B. Models with shapes menu C. Shapes list

Models With Shapes menu

The Models With Shapes menu lets you select which shapes display in the Shapes list. By default, the Models With Shapes menu is empty. Before you can define your expressions, you must add at least one model with shapes.

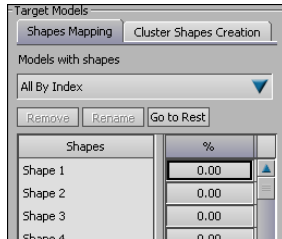
You can choose from the following views in the Models With Shapes menu:

Model Name

Displays individual model shapes. For example, in the previous figure, “Model 1 Roger_face1” is selected and displays all of its shapes in the Shapes list.

All by Index

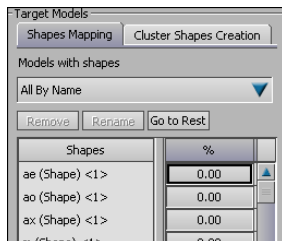
Displays all shapes numerically. Shape numbers are set when you originally create the shapes for your model in your 3D modelling software.



The All by Index display.

All by Name

Displays shapes by name and part number. Using All by Name affects shapes with the same name for all models in the Models With Shapes menu.



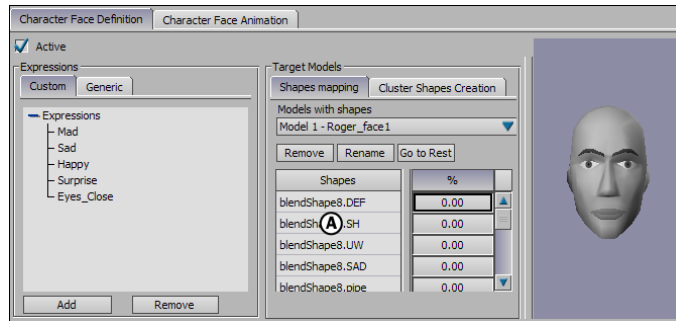
The All By Name display lists shapes by name and part number.

A number in brackets <x> next to the entry in the Shapes list indicates how many models in the Models With Shapes menu use the same shape name.

NOTE When adjustments are made to values of shape names with more than one occurrence, every shape with the same shape name in the scene is affected.

Shapes List

The Shapes list displays the shapes for the model(s) selected in the Model With Shapes menu.



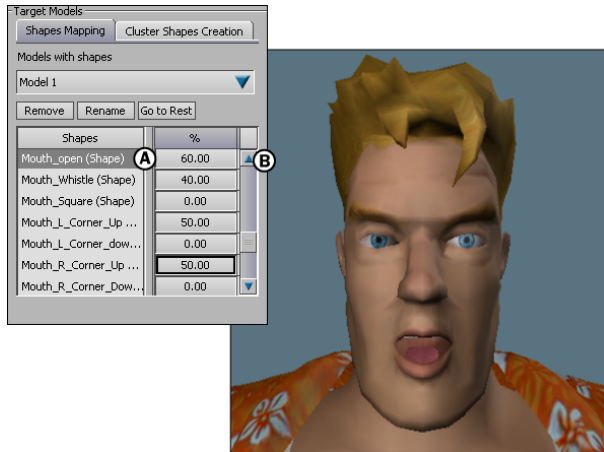
Character Face Settings A. Shapes list

You use the shapes listed in the Shapes list by associating them with Expressions in the Custom and Generic panes. By selecting a shape in the Shapes list and changing its percentage, you assign a percentage of that shape to help create the selected Expression.

Every expression has a memory, and retains the value you define for each shape in the Shapes list. By default, the value of all shapes is set to 0.

When you select an expression in the Expression pane and then select the corresponding shape in the Shapes list, you define the expression for model shapes or cluster shapes.

If you are associating shapes with a Generic Expression, you can view the configuration for Generic Expressions on the Preview model, and the results of changing the shape percentage on the model in the Viewer window.

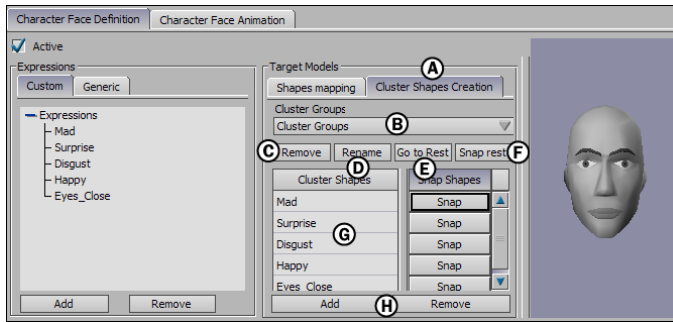


A. A shape is selected in the Shapes list. **B.** The selected shape displays on the model.

To match the shapes on your model to the generic expression more precisely, drag in the shape's value field until the head model in the Viewer window resembles that of the Preview model with the selected expression. You can change values in other fields in the Shapes list to create a blend for the expression you want.

Cluster Shapes Creation pane

The Cluster Shapes Creation pane lets you create shapes using clusters. You can then use these cluster shapes in the Shapes Mapping pane. For more information on creating cluster shapes, see [Creating cluster shapes](#) on page 1413.



Character Face Settings A. Cluster Shapes Creation pane B. Cluster Groups menu C. Remove button D. Rename button E. Go to Rest button F. Snap rest button G. Cluster Shapes list H. Add and Remove buttons

Cluster Groups Menu

Lets you select which shapes display in the Shapes list. You can select the model's shapes in different views, or you can select generic when defining custom expressions.

By default, the Cluster Groups menu is empty. Before you can select anything in the menu, you must drag groups of selected clusters into the Cluster Groups menu.

Remove

Deletes cluster groups from the Cluster Groups menu.

Rename

Lets you rename cluster groups.

Go to Rest

Displays the selected cluster group in its rest pose. By default, the rest pose is the position of selected clusters when you drag them into the Cluster Groups menu.

Snap Rest

Lets you redefine your model's rest pose. To change the default rest pose, move the clusters and click Snap Rest. A dialog box asks you to confirm changing the default rest pose.

Cluster Shapes list

Displays the new shapes of the selected cluster group and each shape's Snap button. The Cluster Shapes list lets you create new shapes using selected groups of clusters.

| Cluster Shapes | Snap Shapes |
|------------------|-------------|
| Mouth Open | Snap |
| Left Corner Up | Snap |
| Right Corner Up | Snap |
| Whistle | Snap |
| Cluster Shape 05 | Snap |

Cluster Shapes list A. Snap buttons

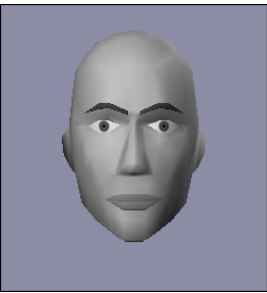
Add and Remove

Let you add and delete new shapes to the selected cluster groups.

Preview pane

The Preview pane lets you view individual generic and custom expressions, as well as the effect of motion capture.

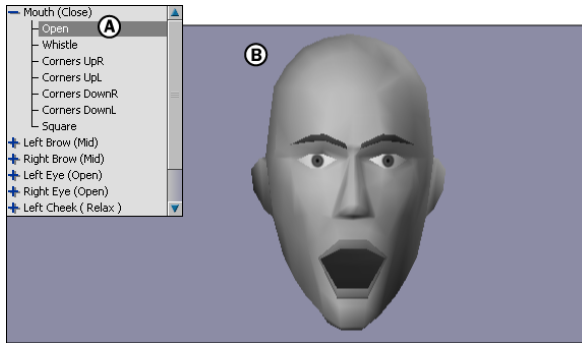
By default, the model in the Preview pane assumes the rest pose in which the mouth is closed, the eyes are open, and the eyebrows are at mid-level.



Preview pane with model in the rest pose.

To preview the effect of a generic expression in the Character Face settings, select the expression in the Source list.

For example, shows the expression “Open” selected in the Character Face settings, and the corresponding facial expression displays on the model.



A. Generic expression for Mouth-Open is selected. B. Expression displays on the Preview model.

You can use the following shortcuts in the Character Face settings Preview pane:

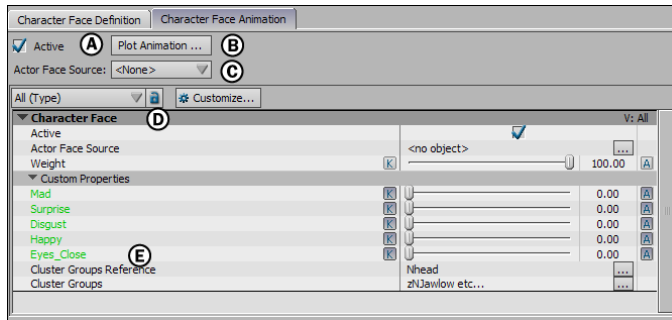
| | |
|------------------------|---|
| Orbit around Face | Ctrl-Shift-drag in the Preview pane. |
| Zoom on Face | Ctrl-drag in the Preview pane. |
| Frame on Face | Click in the Preview pane and press F. |
| Hide the Preview Model | Double-click in the Preview pane to hide the model and increase the refresh rate. Double-click again to display the model. |

■ [Character Face Animation pane](#) on page 1452

Character Face Animation pane

Use the Character Face Animation pane to animate the generic and custom expressions defined in the Character Face Definition pane.

The Character Face Animation pane lets you animate using keyframes, motion capture, and constraints.



Character Face Animation pane A. Active option B. Plot Animation button C. Actor Face Source D. Character Face Properties E. Actor Face Properties

The Character Face Animation pane consists of the following:

- [Active option](#) on page 1453
- [Plot Animation button](#) on page 1453
- [Actor Face Source menu](#) on page 1453
- [Character Face properties](#) on page 1454
- [Actor Face properties](#) on page 1454

Active option

To activate and constrain the Character Face to either an Actor Face or plotted animation, enable the Active option. You can also enable the Active option in the Character Face Definition pane.

When Active is enabled, you cannot preview facial expressions on the model in the Viewer window. You are also unable to define shapes.

Plot Animation button

The Plot Animation button lets you transfer the animation from the selected source to the shapes of the Character Face model. See [Plotting facial animation](#) on page 1663.

Actor Face Source menu

The Actor Face Source menu, lets you select an Actor Face as the animation source.

An Actor Face lets you use motion capture data as a source for your Character Face. The motion capture data can be from live sensors connected to a performer or an imported motion data file. See [Connecting an Actor Face to motion capture data](#) on page 1418.

View menu

The View menu gives two methods of viewing generic channels:

- Select which channels to display from the View menu. The All (Type) view displays both generic and Actor Face properties. The Generic Channels (Type) view displays only generic channels.
- Click the Customize button (fig 39-4, B) to create your own view. This is the same window accessible from the Properties window. See [View Editor pane](#) on page 595

Character Face properties

All custom expressions display as properties that you can keyframe and animate in the Character Face Properties area.

Once all the animation is plotted to the model, you can save your *.fbx* file and import it into other compatible 3D software, or reuse it in MotionBuilder. You can also see the function curves on the animation in the FCurves window.

Actor Face properties

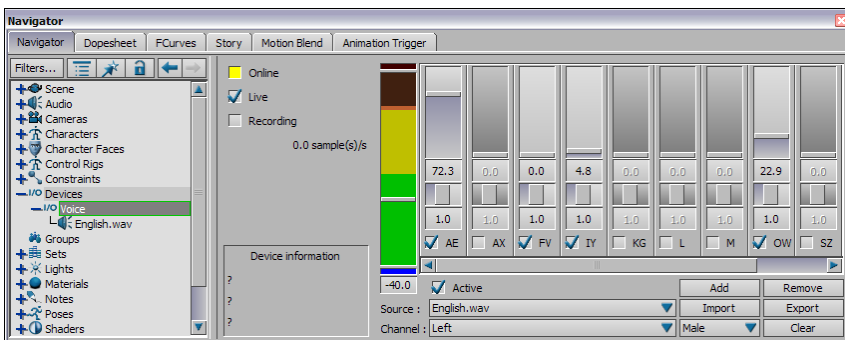
If the Character Face uses an Actor Face as its source, an additional folder with all the Generic channels appears.

Voice device

88

The Voice device provides voice recognition and sound analysis that let you synchronize the lip movements of up to two characters simultaneously in real time, using any language. You can also link audio files or live audio input to models, and extract various sound properties.

The Voice device identifies specific phonemes in the audio input so that when connected to a Character Face it can drive the shapes of your character's head model, making the character's mouth move with the audio.



Voice device settings in the Navigator window

NOTE Before you can use the Voice device to drive facial animation, you need to load a face model with either shapes or cluster shapes for the appropriate phonemes. See [Audio-driven facial animation workflow](#) on page 1396.

- [Adding a Voice device to a scene](#) on page 1456
- [Head models](#) on page 1401
- [Voice device settings](#) on page 1468

Adding a Voice device to a scene

To add a Voice device to a scene and view the Voice settings, do one of the following:

- Drag a Voice device asset from the Devices folder of the Asset browser into the scene.
- Drag an audio file directly onto a head model and select Attach Facial to automatically add a Voice device that is connected to the Character Face using a Relations constraint.
- [Linking a Character Face to a Voice device](#) on page 1456
- [Adding sound parameters](#) on page 1461
- [Activating all phonemes and instruments](#) on page 1468

Linking a Character Face to a Voice device

To link a Character Face to a Voice device:

- Drag an audio file onto a head model and select Attach Facial from the menu that appears.
- Drag an audio file onto a Character Face listed in the Scene browser, then select Attach Facial from the menu that appears.
- Drag a Voice device onto a Character Face listed in the Scene browser, then select Attach Facial from the menu that appears.
When you select Attach Facial, a Voice device is added and automatically connected to the Character Face through a Relations constraint.
- Character Face asset

Selecting live or recorded audio in the Voice device

You can use either live or recorded audio input to drive the Voice device.

To use recorded .wav files:

- 1 Use the Audio settings to select and adjust a .wav file before linking it to your head model.

NOTE The Voice device uses the audio file with the options you set in the Audio settings. See [Audio](#) on page 183.

By default, the name of your computer's sound card and "New Media" appear in the Source menu.

To use live audio input:

- 1 Select your computer's sound card in the Scene browser's Audio folder. See [Recording audio](#) on page 187 for more information on how to use the audio settings.
- 2 Configure your sound options using the Volume Control options provided by your operating system.

NOTE When using live audio input, use a professional quality microphone to avoid introducing noise that may occur if you use your computer's microphone.

- [Audio settings](#) on page 192
- [Setting an audio threshold](#) on page 1466
- [Adding a Voice device to a scene](#) on page 1456

Tracking two channels

To track two channels:

- 1 Set up two Voice devices.
- 2 Assign the first channel to Left and the second channel to Right.

NOTE Channel is disabled if your audio source has only one track (mono).

- [Voice device settings](#) on page 1468

- [Filtering noise in audio files](#) on page 1467

Specifying gender in the Voice device

To specify gender in the Voice device:

- 1 Select Male or Female in the Gender menu. This selection can help to precisely analyze spoken vowels.



Voice device settings A. Gender menu

While speech frequency varies from person to person, women generally have a higher speech frequency than men. Choosing the Female option may produce more accuracy for phoneme values.

NOTE You may also want to use the Female option for children’s voices.

- [Smoothing phoneme transitions](#) on page 1465
- [Filtering noise in audio files](#) on page 1467
- [Adding sound parameters](#) on page 1461

Refining a model’s face movements

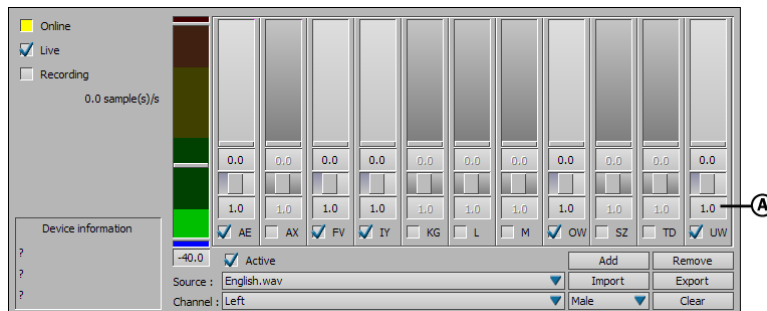
You can use the Sound parameter settings in the Voice device to refine the movements of your model’s face or mouth to produce a closer match between its lips and voice.

To refine a model's face movements:

- 1 Identify which phonemes you want to adjust, then adjust the Weighting value for that phoneme in the Sound parameter settings.

NOTE Before adjusting weighting, make sure you have set the Threshold level at an appropriate value. See [Setting an audio threshold](#) on page 1466.

For example, if a model does not pronounce the UW phoneme with enough emphasis, you can boost the shape by increasing the Weighting value for that phoneme. The number values range from one to ten, where ten produces the most emphasis.



Voice device settings A. Individual phoneme Weighting value

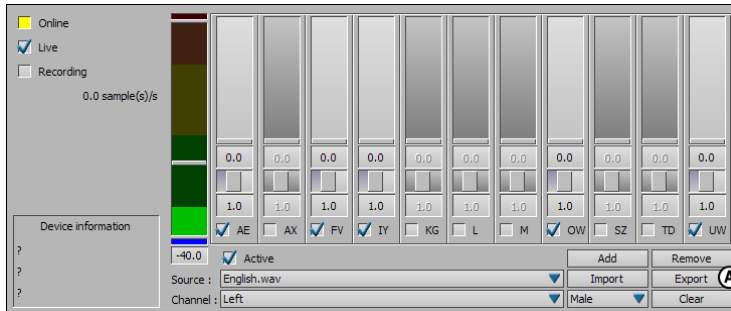
NOTE Typing a number in the value field while dragging the slider allows the motion to continue while you make adjustments.

- [Specifying gender in the Voice device](#) on page 1458
- [Smoothing phoneme transitions](#) on page 1465
- [Sound parameter settings](#) on page 1471

Saving a Voice device setup

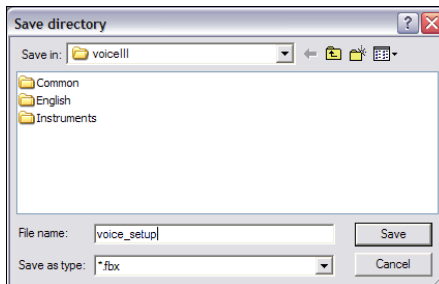
To save a Voice device setup:

- 1 Click the Export button in the Voice device settings.



Voice device settings A. Export button

The Save directory dialog box appears .



Save directory dialog box

- 2 Enter a file name, then click Save.

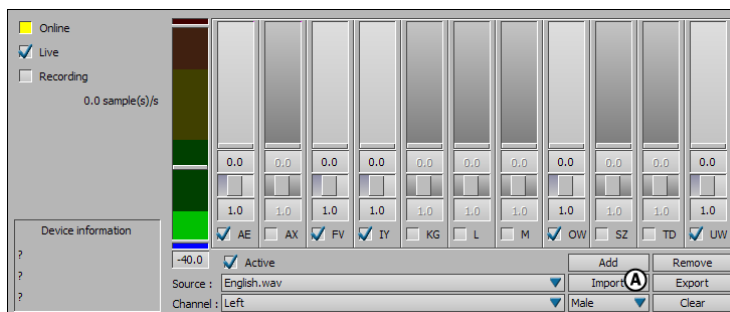
The Voice device setup is saved in the *.fbx* file format.

- [Loading a Voice device setup](#) on page 1460

Loading a Voice device setup

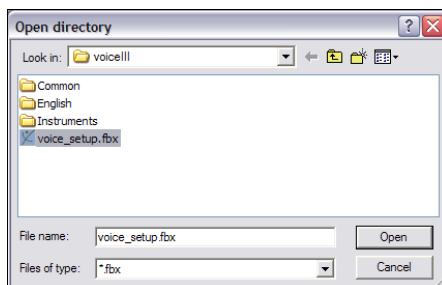
To load a previously saved Voice setup:

- 1 In the Voice device settings, click Import.



Voice device settings A. Import button

The Open Directory dialog box appears .



Open directory dialog box

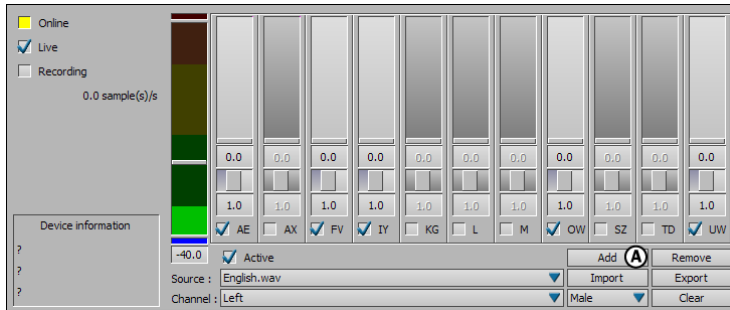
- 2 Select the *.fbx* file containing the voice setup you want to load into the Voice device and click Open.

- [Saving a Voice device setup](#) on page 1459

Adding sound parameters

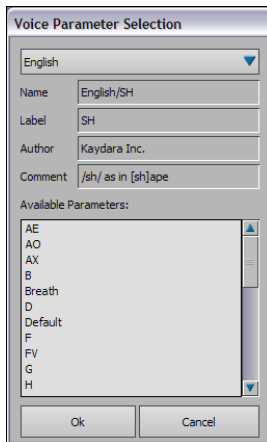
To add sound parameters:

- 1 In the Voice device settings, click Add to open the Voice Parameter Selection dialog box.



Voice device settings A. Add button

- 2 Choose a parameter type from the first menu . A list of phonemes or instruments appears in the Available Parameters area.



Voice Parameter Selection dialog box

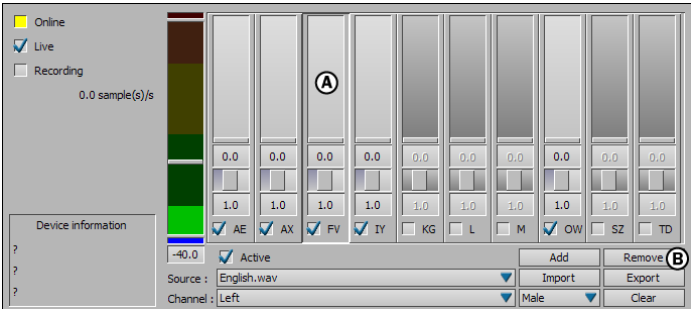
- 3 Select a phoneme or instrument, then click Ok to add the new parameter to your Voice device setup.

- [Sound parameter settings](#) on page 1471
- [Activating and disabling sound parameters](#) on page 1464
- [Removing sound parameters](#) on page 1463

Removing sound parameters

To remove sound parameters from the Voice device:

- 1 Select the sound parameter you want to remove.
- 2 Click Remove.



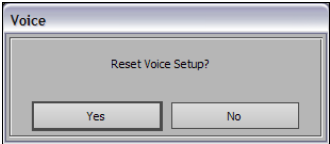
Voice device settings A. The FV sound parameter is selected. B. Remove button

- [Clearing all sound parameters in the Voice device](#) on page 1463

Clearing all sound parameters in the Voice device

To clear all sound parameters:

- 1 In the Voice device settings, click Clear.
- 2 In the Voice dialog box that appears, click Yes to confirm that you want to clear all the sound parameters.



Voice dialog box

- [Removing sound parameters](#) on page 1463

Activating and disabling sound parameters

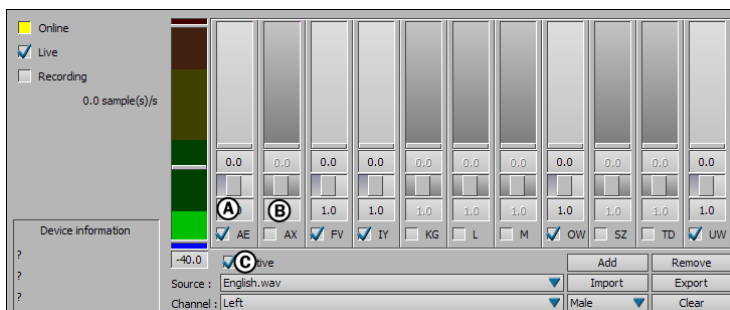
When you add a sound parameter to the Voice device, it is active by default. See [Adding sound parameters](#) on page 1461.

To disable a parameter:

- 1 Disable the Active option in the sound parameter.

To disable all parameters:

- 1 Disable the main Active option in the Voice device settings.



Voice device settings A. Activated sound parameter B. Disabled sound parameter C. Active option

NOTE When a sound parameter is disabled, you cannot change its settings.

- [Sound parameter settings](#) on page 1471
- [Adding sound parameters](#) on page 1461
- [Removing sound parameters](#) on page 1463

Default phoneme

When the Voice device does not detect any speech, the sound information is sent to the default field. The default field represents the neutral shape.

- [Choosing shapes to create](#) on page 1411

- [Threshold level](#) on page 1466
- [Adding a Voice device to a scene](#) on page 1456
- [Setting an audio threshold](#) on page 1466

Smoothing phoneme transitions

Use the filter slider for each sound parameter to smooth transitions between phonemes that have lip jittering and other unwanted movement.

When the filter effect is increased, the differences between the facial shapes for that phoneme and others is reduced.

To reduce the filtering effect:

- 1 Slide the filter to the left.

To increase the filtering effect:

- 1 Slide the filter to the right.



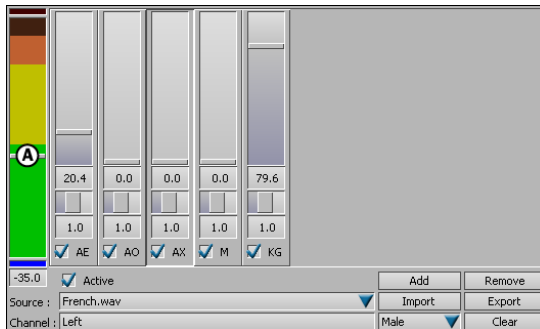
**Sound
parameter**
A. Filter
slider

- [Setting an audio threshold](#) on page 1466
- [Filtering noise in audio files](#) on page 1467

Threshold level

Both live input and pre-recorded audio files usually contain some level of ambient noise caused by background noise or other problems during recording. This noise can produce unwanted movement when the audio is used to drive a character's face, such as mouth jittering when there is no actual speech.

The Threshold slider in the Voice device settings lets you define a Threshold level to compensate for this ambient noise in your audio files, and eliminate that unwanted mouth movement.



A. Threshold slider

- [Setting an audio threshold](#) on page 1466
- [Audio-driven facial animation workflow](#) on page 1396

Setting an audio threshold

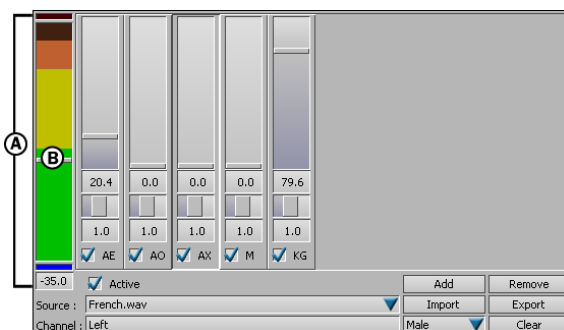
For the Voice device to recognize and register silence, you need to set the Threshold slider to the minimum sound level that is considered speech. This can also help to filter out any background noise affecting your live input or pre-recorded audio files.

To set a threshold:

- 1 Listen to the audio file or have the voice input begin speaking, and watch the Threshold meter in the Voice device settings.
During speech, the Threshold meter rises to a peak value and returns to a lower value when speech stops. It registers at zero when there is no sound. At zero, the model's mouth is closed.

- 2 Determine the minimum noise level during silent periods and drag the Threshold slider up to that level on the Threshold meter.

Generally, the higher the ambient noise level in your audio input, the higher you need to set the Threshold level. However setting the Threshold slider too high causes the Voice device to ignore all but the loudest speech.



A. Threshold meter B. Threshold slider

- 3 Play the audio again and observe the effect this Threshold slider placement has on your character's mouth movement. Continue adjusting the Threshold slider as necessary.

- [Smoothing phoneme transitions](#) on page 1465
- [Voice device settings](#) on page 1468

Filtering noise in audio files

To filter out ambient noise affecting live input or pre-recorded audio files, you can adjust the Threshold slider in the Voice device settings. See [Setting an audio threshold](#) on page 1466.

- [Smoothing phoneme transitions](#) on page 1465

Activating all phonemes and instruments

To activate phonemes and instruments:

- 1 Enable the Active option in the Voice device settings. This activates all phonemes and instruments added to your device.

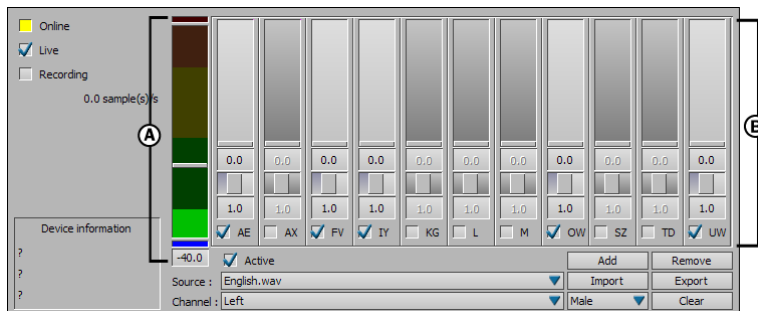
To activate or disable individual phonemes:

- 1 Activate or disable the Activate option for each sound parameter.

- [Voice device settings](#) on page 1468
- [Adding sound parameters](#) on page 1461
- [Removing sound parameters](#) on page 1463

Voice device settings

The Voice device settings contain controls to let you set thresholds, specify voice parameters, and set gender for your voice, as well as save and remove voice setups.

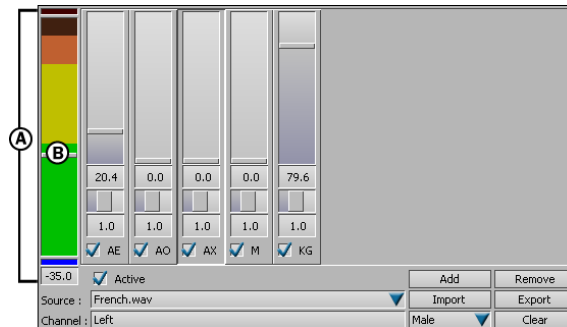


Voice device settings A. Threshold meter B. Sound parameter

Threshold meter and Threshold slider

The Threshold meter shows a graphical representation of the audio input in the Voice device. It rises as the audio input gets louder, and registers at zero when there is no sound.

The Threshold slider lets you set a Threshold level to compensate for noise in your audio. See [Setting an audio threshold](#) on page 1466.



A. Threshold meter B. Threshold slider

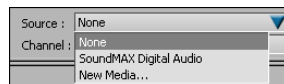
When the sound level falls lower than the Threshold slider, the Voice device does not consider the signal to be speech and sets all phoneme values to zero.

Active

When Active is enabled, all phonemes and instruments added to your device are active.

Source menu

Lets you specify your audio source . You can use the Voice device with live audio input and recorded .wav files.



Source menu

Channel menu

Lets you specify which channel to display when working with stereo files.

NOTE Channel is disabled if your audio source has only one track (mono).

Add button

Opens the Voice Parameter Selection dialog box, letting you add sound parameters to the Voice device. See [Voice Parameter Selection dialog box](#) on page 1472.

Remove button

Removes the selected sound parameter from the Voice device. See [Removing sound parameters](#) on page 1463.

Import button

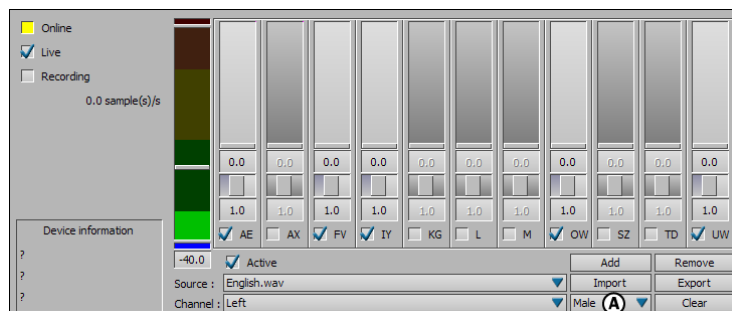
Click to open a previously saved Voice setup. See [Loading a Voice device setup](#) on page 1460.

Export button

Click to save the current Voice device setup in *.fbx* format. See [Saving a Voice device setup](#) on page 1459.

Gender menu

Use the Gender menu to precisely analyze spoken vowels. See [Specifying gender in the Voice device](#) on page 1458.



Voice device settings A. Gender menu

Clear button

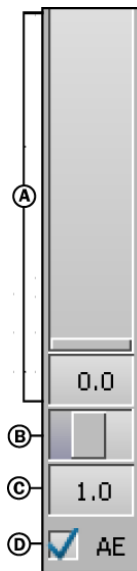
Click to remove all sound parameters from the Voice device settings. See [Clearing all sound parameters in the Voice device](#) on page 1463.

Sound parameter settings

The Voice device's sound parameters include phonemes and various instruments that measure sound properties .

Each sound parameter has a value representation, Filter slider, Weighting value, and Active button. By adjusting values in the sound parameters, you can do the following:

- Measure the value of various sound parameters
- Filter noise
- Control phoneme sensitivity by adjusting the phoneme's Weighting value
- Activate or disable individual sound parameters



Sound
parameter A.
Phoneme value
representationB.
Filter slider C.
Weighting value
D. Active option

Phoneme value

The phoneme values display in two forms on each sound parameter: as sliders, and as numerical values. Phoneme values display information taken from the audio input, so you cannot modify them in the Voice device.

Filter slider

Adjust the Filter sliders to smooth phoneme transitions. See [Smoothing phoneme transitions](#) on page 1465.

Weighting value

The Weighting value on each sound parameter dictates the amount of emphasis each phoneme reflects in the talking model. See [Refining a model's face movements](#) on page 1458.

Active

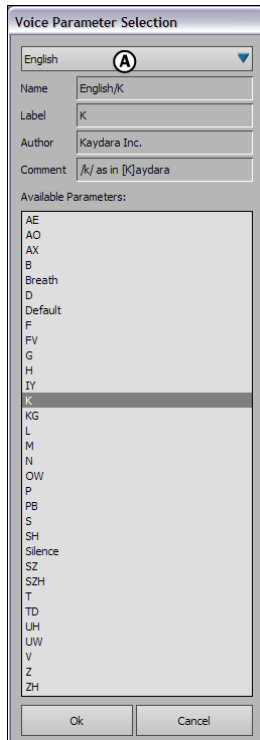
Activates the individual sound parameter.

NOTE When a sound parameter is disabled, you cannot change its settings.

■ [Adding sound parameters](#) on page 1461

Voice Parameter Selection dialog box

The Voice Parameter Selection dialog box lets you select the types of sound parameters you want to add to the Voice device, including phonemes and various instruments that measure sound properties.



Voice Parameter Selection dialog box A. Parameter type menu

The Parameter Type menu lets you select the following groups of sound parameters:

- [Instruments parameters](#) on page 1473
- [English parameters](#) on page 1475
- [Compatibility parameters](#) on page 1477
- [Common parameters](#) on page 1477

Instruments parameters

This group of parameters measure sound properties. You can use Instruments in your Voice-Facial Relations constraint to control elements in your scene.

You can use the Instruments parameters to connect with 3D light intensity in a Relations constraint, to control the lighting in a scene from a sound track. You could also make a model such as a cube oscillate as the audio level changes by linking the Level instrument to the cube's scaling. The value that displays in the instrument in Voice also drives the shape.

You could also add a Pitch instrument to track whether a sound is low or high, and connect it to the color of a light in a Relations constraint. The color change according to the current note, and the intensity of the light varies depending on whether the notes are loud or soft.

You can add the following instruments:

| Instrument | Description |
|------------|--|
| Level | Average sound level in linear scale (0 to 100%), where silence is 0%. |
| LeveldB | Average sound level in decibel scale, where 0 is the maximum sound level, and -60 is nearly mute. |
| Overload | Overload (clipping) indicates when the sound level is too high. Overload operates on a scale of 0 to 100, where 0 is an acceptable sound level, and 100 is too high.VER: Overload corresponds to the overload indicator of the Threshold level. This level displays as a red bar at the top of the Threshold level. When there is no audio, the bar is dark blue. When the bar at the bottom of the Threshold level is light blue, it indicates that there is audio input. |
| Peak | Sound peak level in linear scale (0 to 100%). |
| PeakdB | Sound peak level in decibel scale, where 0 is the maximum sound level, and -60 is nearly silent. At -60, the Threshold level is at its lowest level. |

| Instrument | Description |
|------------|---|
| Speech | Speech indicator, where 0 indicates no speech during that audio portion. At 100, the speech is very loud. |

English parameters

This group of parameters includes phonemes for the English language.

The International Phonetic Alphabet (IPA) is the standard method for representing phonemes. The ARPABET, which the Voice device uses, codes these phonemes as ASCII characters.

The following phonemes are currently available in the Voice device:

| Phoneme | Sounds like |
|--------------|-----------------------------|
| AE[a] | As in "bat" |
| AO[ou] | As in "bought" |
| AX[e] | As in "the" |
| B[b] | As in "baritone" or "bet" |
| D[d] | As in "dolcissimo" or "dog" |
| F[f] | As in "fortissimo" or "fit" |
| FV/F/ or /V/ | As in "average" |
| G[g] | As in "glissando" or "get" |
| H[h] | As in "hip-hop" or "hat" |
| IY[ea] | As in "beat" |
| K[k] | As in "cat" |

| Phoneme | Sounds like |
|-----------------|---------------------------|
| KG/K/ or /G/ | As in “coat” or “goat” |
| L[l] | As in “legato” or “let” |
| M[m] | As in “moderato” or “met” |
| N[n] | As in “neo” or “net” |
| OW[oa] | As in “ago” or “boat” |
| P[p] | As in “piano” or “pen” |
| PB/P/ or /B/ | As in “pat” or “bat” |
| S[s] | As in “soprano” or “sat” |
| SH[ch] | As in “shut” |
| SZ/S/ or /Z/ | As in “sip” or “zip” |
| SZH/SH/ or /ZH/ | As in “explosion” |
| T[t] | As in “tenor” or “ten” |
| TD/T/ or /D/ | As in “tip” or “dip” |
| UH[u] | As in “book” |
| UW[oo] | As in “boot” |
| V[v] | As in “vibrato” or “vat” |
| Z[z] | As in “mezzo” or “zoo” |
| ZH[j] | As in “measure” |

Compatibility parameters

This group of parameters emulate phonemes for use with the Voice device.

Common parameters

This group of parameters includes the phonemes that are common to most languages.

These phonemes also appear in the list when you select another language. For example, all the phonemes in the Common category relating to the English language also display in the English category.

- [Adding sound parameters](#) on page 1461
- [Voice device settings](#) on page 1468

Animating with Physical Properties

The Asset browser Physical Properties folder contains solvers that you can use to simulate complex interactions between 3D objects and their environment. The Physics solver lets you create collision and rigid interaction effects that are difficult to obtain with keyframing and motion capture techniques.

The two physical descriptions, Rigid Body and Ragdoll, provide a description of the objects in the scene to the Physics Solver; the Rigid body physical description which you can use to prevent interpenetration of characters, objects and other scene elements, and the Ragdoll physical description lets you animate the character's Control rig for increased realism to produce a character that waves his arms as he falls.

Ragdoll physical property

The Ragdoll physical property lets you simulate complex interactions between a character and its environment.

The Ragdoll physical property lets you simulate and record collisions and collapses on characters with Control rigs.

If you use the Physics solver to write animation data to an object, it writes the data into the Translation and Rotation channels of the object. For a Character it writes the data on the Control rig effectors.

If you do not want this to happen, store the animation you want to use in the solve in another Take. Then, use this take as an input and record onto yet another Take. (You can also copy the take and record over it.)

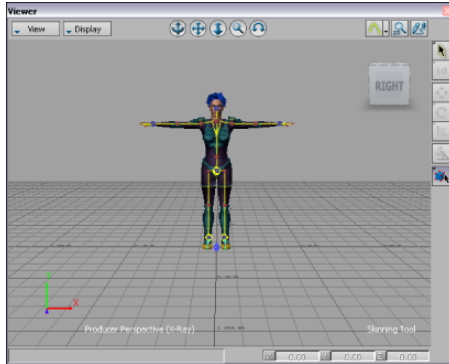
The overwrite occurs when you plot or record, and a dialog box appears to ask if you want to overwrite the current take. If you choose yes, and you are on the same track, your animation data is overwritten.

Ragdoll workflow

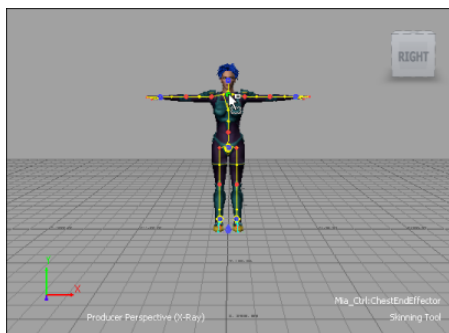
You can add Ragdoll behavior to any character with a Control rig.

To create Ragdoll collision effects on a character:

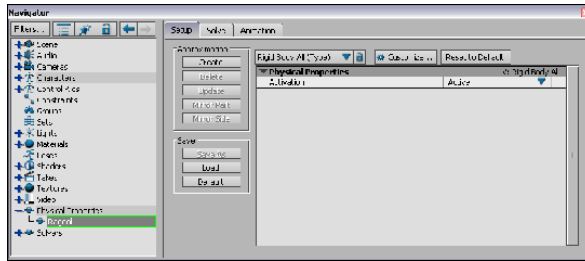
- 1 Load a character or skeleton with a Control rig into your scene. See [Creating a Control rig](#) on page 1245.
- 2 Press Ctrl-A until you are in X-Ray mode.



- 3 From the Asset browser Solvers folder, drag a Physics solver into the Viewport window.
- 4 From the Asset browser Physical Properties folder, drag the Ragdoll asset onto any part of a Control rig to connect the ragdoll data to the Character solver.

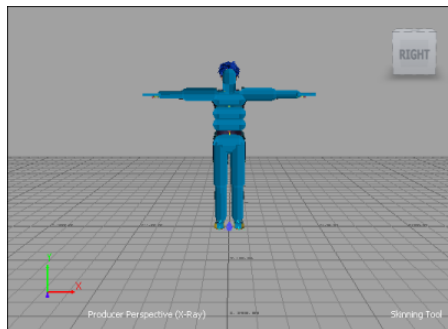


- 5 In the Navigator window Scene browser, expand the Physical Properties folder and double-click the Ragdoll physical property.

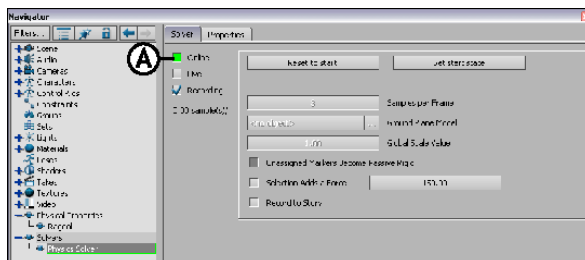


- 6 In the Approximation area, click Create. A proxy body is created on top of the Control rig.

NOTE To hide the proxy, press Ctrl-A three times.



- 7 Expand the Physical Properties and define specific properties for the object, as well as in the Solve, and Animation panes.
You can modify settings for individual body parts in the Properties area.
- 8 Switch to the Navigator window Solver > Physics Solver setup pane, and click Online. Or you can also click the Active option in the Physics Solver properties in the Properties window.



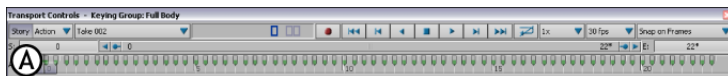
Solver Setup pane A. Click Online.

The Ragdoll solving is now active and you can test and tweak your scene. See [Ragdoll settings](#) on page 1482 for information on the different settings.

- 9 To test your scene, click Live. The Ragdoll solving occurs. To reset your scene after a test, click Reset to Start.



- 10 When you are ready to start recording the Ragdoll action so you can convert it to keyframes, disable the Live option.
- 11 Click Reset to Start to set the Control rig in the pre-collapse position.
- 12 Press Record in the Transport controls. A dialog box appears asking if you want to overwrite the existing take or create a new take. Select an option.
- 13 Press Play in the Transport controls and Stop when the animation is over. The character collapses.
- 14 In the Physics Properties Setup pane, deactivate Online.
- 15 To view the recorded keyframes, select one of the animated objects. Keyframes appear in the Transport controls, and the FCurve window.



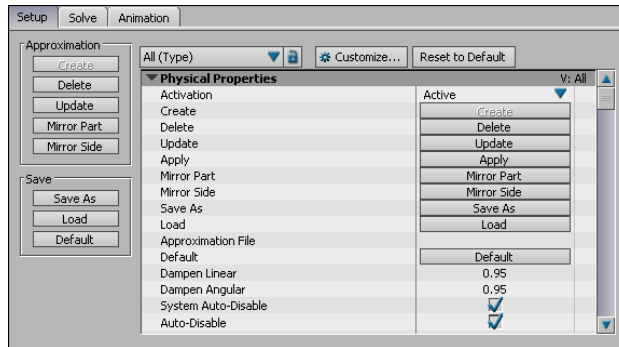
You can also press Ctrl-Home and then Play to replay your animation.

Ragdoll settings

The following settings are for the Ragdoll asset.

Setup pane

The Ragdoll Setup pane is where you configure options that are generic settings, or system overrides.



Approximation area

The Approximation area lets you create a proxy or a “Dummy” for your character.

| Option | Function |
|-------------|---|
| Create | Generates a proxy model. |
| Delete | Deletes the proxy model. |
| Update | Resets the existing proxy model. |
| Apply | Applies the proxy model. |
| Mirror Part | Mirrors a body part to the other side, or mirror the entire side. |
| Mirror Side | Mirrors a side of the character's body to other side. |

Ragdoll properties area

The Ragdoll properties area is where you can configure the settings for the solve.

Customize button

The Customize button opens the Properties Editor. See [Property Editor](#) on page 595

Reset to Default button

Click Reset to Default to restore the Ragdoll properties to their original settings.

Activation menu

Use this menu to set when the collision reaction starts for the object. For example, you can create objects that only react when they are struck.

| Option | Function |
|---------------------|---|
| Active | Ragdoll solving begins when the session is set to Live. |
| Active at collision | Ragdoll solving reacts only when a collision occurs. |
| Passive | The object is not affected but still interacts with other objects in the scene. |

Create/Delete/Update/Apply/Mirror part/Mirror side options

These are the same settings in the Approximation area. See [Approximation area](#) on page 1483 for descriptions of each of these options.

Save/Save as/Load/Default options

These are the same setting as in the Save area. See [Save area](#) on page 1488 for descriptions of each of these options.

Approximation file field

The Approximation file field lets you view the path of the current Approximation file.

Dampen linear/angular settings

Use the Dampen settings to define the clamp value applied to the linear and angular velocity when calculating the rolling friction. Because the physical property does not model rolling friction, it uses dampening clamps behavior so that objects can come to rest. For example, without a dampening setting, a rolling sphere will roll forever. It is done by scaling linear velocities at each simulation step by dampening factor for all colliding objects.

A value of 1 retains actual velocity. Any value below 1 decreases velocity, while any value greater increases it.

| Value | Description |
|---------|--|
| Linear | Change the Linear Velocity to modify the linear movement of the object |
| Angular | Change Angular velocity setting to modify the rotational movement of the object. |

System Autodisable options

Activate the System Autodisable option so that the animation is cut off below a threshold, otherwise system resources are absorbed processing vibrations so minute that they are no longer visible.

| Option | Description |
|--------------------|--|
| Enable Autodisable | This option is active when you disable Use System Autodisable. |
| Linear Threshold | Sets a linear cutoff limit for motion. |
| Angular Threshold | Sets a angle-based cutoff limit for motion. |

| Option | Description |
|--------|---|
| Steps | Lets you specify the number of steps that the physical property must process before it falls below the threshold. |

Weight Linear velocity/Weight angular velocity fields

When a collision occurs with a body, velocities are used to calculate the force of the collision.

Weight is the “weight transfer” or energy transfer between two objects. When two objects collide, you can control the apparent transfer of energy from one to the other.

If the values are left to 1 the solvers uses the normal calculations to predict how far an object will travel when hit. If you set this value over 1, the apparent transfer of energy increases, while if set run it below 1, it decreases this transfer.

Modify the Linear and Angular Velocity settings to override the default force of the collision, for example, to assign more or less collision force to an object than what is already specified in the physical property.

NOTE You must have both colliding objects enabled for velocity settings to work.

Global Muscle settings

These settings let you specify overall joint resistance for your solved control rig. Activate Global Muscle to expose the overall directional resistance settings, and Lower Muscle to expose the local muscle settings.



Muscle stiffness: A. Disabled B. Activated

| Global Muscle Field | Value |
|---------------------|-----------------------------------|
| Strength | Sets the amount of resistance. |
| Stiffness | Sets the amount of inflexibility. |

These values set the ability to lower the Muscle Strength and Stiffness settings over time.

| Lower Muscle Field | Value |
|--------------------|--|
| Strength % | Sets the amount of resistance. |
| Stiffness % | Sets the amount of inflexibility. |
| Time | Sets the amount of time (in seconds) that the settings take to change. |

Source list

Opens an asset list where you can specify source objects in your scene.

Pose match menu

Lets you match your solve start or end to a pose.

Pose match bone

Lets you specify which bone you want the solve's action to refer to when matching poses.

Pose match Strength/Elasticity

Lets you enter a value to specify how flexible or rigid you want the solve to match your pose.

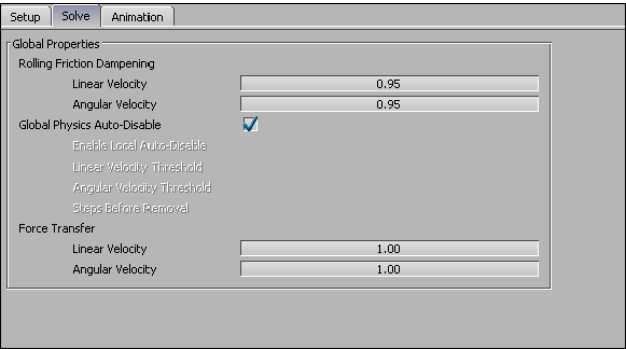
Save area

Use these options to create a text file that contains any modifications made to this solve.

| Option | Function |
|---------|--|
| Save as | Save the current modifications as a text file. |
| Load | Lets you open a previously saved set of solve modifications. |
| Default | Restores the default solve settings. |

Solve pane

The Ragdoll Solve pane contains the attributes related to the physical solve of the body such as weighting, and threshold.



Rolling friction dampening settings

Use the Dampen settings to define the clamp value applied to the linear and angular velocity when calculating the rolling friction. Because the physical property does not model rolling friction, it uses dampening clamps behavior so that objects can come to rest. For example, without a dampening setting, a rolling sphere will roll forever. It is done by scaling linear velocities at each simulation step by dampening factor for all colliding objects.

A value of 1 retains actual velocity. Any value below 1 decreases velocity, while any value greater increases it.

| Value | Description |
|---------|--|
| Linear | Change the Linear Velocity to modify the linear movement of the object |
| Angular | Change Angular velocity setting to modify the rotational movement of the object. |

Global Physics auto-disable.

See [System Autodisable options](#) on page 1485.

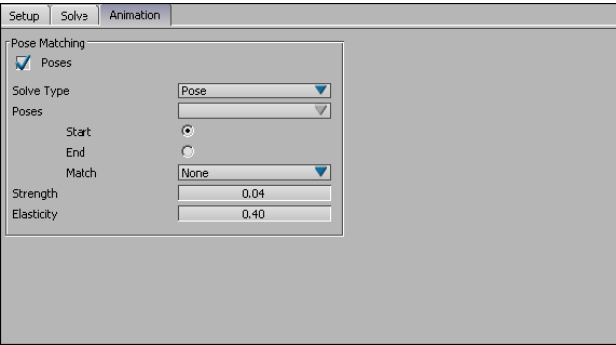
Force transfer

These values let you specify how forces is transferred to the solve objects.

| Value | Description |
|------------------|---|
| Linear velocity | Change the Linear Velocity to specify how linear movement is transferred to your object. |
| Angular velocity | Change Angular velocity setting to specify how rotational movement is transferred to your object. |

Animation pane

The Animation pane is where you find information related to pose matching. Activate the Pose option to use the Animation settings.



Solve type menu

Select a Solve type from the menu. There are two types of Solve you can perform:

| Solve type | Description |
|---------------|---|
| Pose | Forces the solve to reproduce the pose exactly. |
| Match to Pose | Blends the solve to best approximate the pose. |

Poses menu

Use this menu to select the pose you want to use for the solve, then set the following options:

| Option | Description |
|--------|---|
| Start | Matches the pose to the beginning of the solve. |
| End | Matches the pose to the end of the solve. |

| Option | Description |
|--------|--|
| Match | Lets you specify a center of mass from which the solve matches the pose. |

Strength/Elasticity

Lets you enter a value to specify how flexible or rigid you want the solve to match your pose.

Rigid Body physical property

Use the Rigid Body physical property to create real-time collisions that you can use to prevent interpenetration of characters, objects and other scene elements.

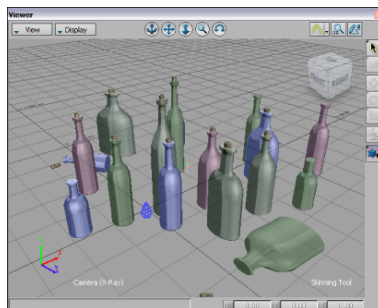
This is useful if you want to edit 3D animations involving characters interacting with objects.

Creating collision effects

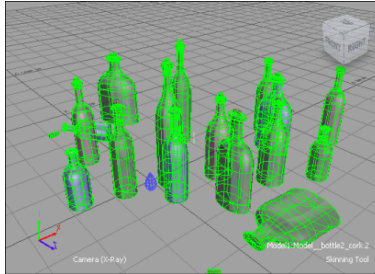
The Rigid Body physical property lets you create collision effects in your scene that you can record as keyframe animation.

To create collision effects:

- 1 Load an existing scene or build a scene with primitives from the Asset browser Elements folder.



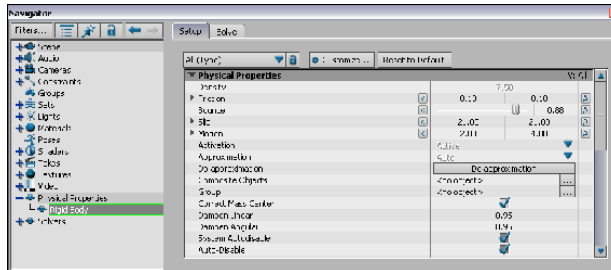
- 2 From the Asset browser Solvers folder, drag a Physics solver asset into the Viewer window.
- 3 Select the item(s) to which you want to apply the Rigid Body collision settings.



- 4 From the Asset browser Physical Properties folder, drag the Rigid Body physical property on top of your selected objects.

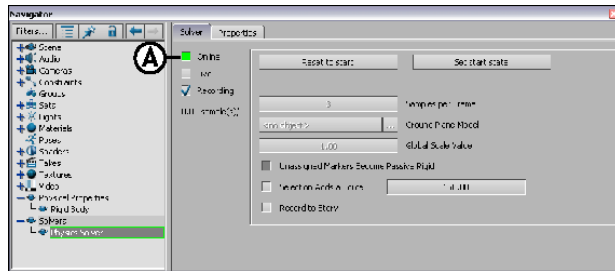
NOTE If you apply a Rigid Body physical property to a group of selected objects, all the objects are controlled by the same Rigid Body definitions. If you want to define specific settings for different objects, apply a separate Rigid Body physical property to each object. You can also group objects and apply a physical property to the group.

The Rigid Body properties display in the Navigator and Properties windows.



- 5 In the Navigator window Scene browser, expand the Physical Properties folder and double-click the Rigid Body physical property.
- 6 Adjust the properties in the Rigid Body Setup pane (for example, Density, Friction, and so on).

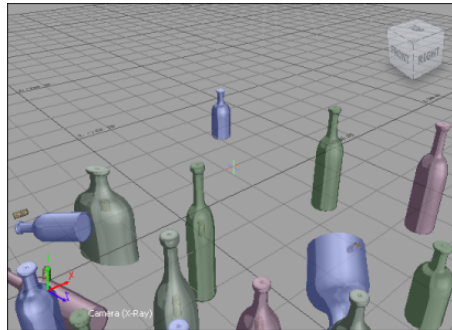
- 7 Switch to the Navigator window > Solvers > Physics Solver Solver pane, and click Online. Or you can also click the Active option in the Physics Solver properties in the Properties window.



Physics solver Setup pane A. Click Online.

The collision solving is now active and you can test and tweak your scene. See [Rigid Body settings](#) on page 1496 for information on the different settings.

- 8 To test your scene, click Live. The rigid body solving occurs. To reset your scene after a test, click Reset to Start.



- 9 When you are ready to start recording the collision action so you can convert it to keyframes, disable the Live option.

NOTE If you modify properties in the Solver or the Rigid Body, you must take the Solver offline, and switch back online to have your changes recognized.

- 10 Click Reset to set the objects up in the pre-collision position.

- 11 Press Record in the Transport controls. A dialog box appears asking if you want to overwrite the existing take or create a new take. Select an option.
- 12 Press Play in the Transport controls and Stop when the animation is over.
- 13 In the Physics Properties Setup pane, deactivate Online.
- 14 To view the recorded keyframes, select one of the animated objects. Keyframes appear in the Transport controls, and the FCurve window. Your object receives key-frame data corresponding to the Physical solve.



Transport controls A. Keys display along the timeline.

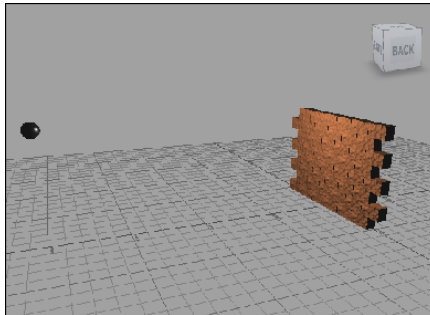
You can also press Ctrl-Home and then Play to replay your animation.

- 15 Save the take.

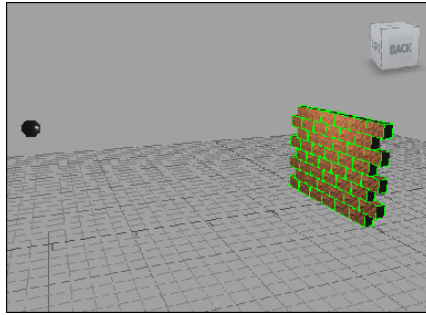
Creating multiple object collisions

Sometimes you might want to animate collisions between more than one object. In this example, a cannonball is animated destroying a brick wall.

- 1 Open a file with elements you want to animate.

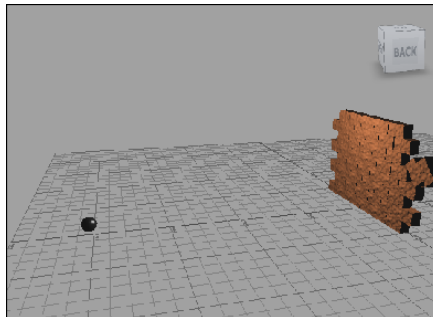


- 2 Create the animation you want to create the collision effect. In this example, the cannonball is keyframed to pass through the wall.
- 3 Select all the objects you want to be affected by the collision.



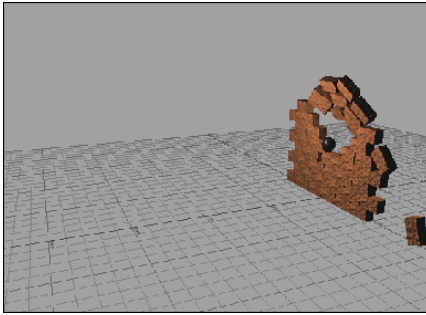
- 4 In the Asset browser, expand Physical Properties and drag a Rigid Body Physical property onto the wall.
- 5 Drop another Rigid Body Physical property onto the cannonball.
- 6 In the Rigid Body Physical property setup pane for both the Rigid Body assets, set Activate Physics Solve to Collision.

This ensures that the behavior of both objects changes only at the moment a collision occurs. Otherwise, the cannonball would fall to the ground and the wall would collapse under its own weight.



If the objects are not set to collision, the collision effect occurs before the actual collision.

- 7 Drag the Physics solver asset from the Navigator window Solvers folder anywhere into the Viewer window.
- 8 In the Navigator window Solvers > Physical Properties settings, click Online and Live to activate the solving.



- 9 Press Play in the Transport controls to view your results. Make any adjustments to both objects Rigid Body settings. See [Rigid Body settings](#) on page 1496.

NOTE Make changes to the Rigid Body settings when the Physical Properties solver is not online.

- 10 When you are satisfied with your result, press Record, followed by Play in the Transport controls. A dialog box appears asking if you want to overwrite the existing take or create a new take. Select an option.
- 11 Press Record in the Transport controls.
- 12 Press Play in the Transport controls and Stop when the animation is over.
- 13 In the Physics Properties Setup pane, deactivate Online.
- 14 To view the recorded keyframes, select one of the animated objects. Keyframes appear in the Transport controls, and the FCurve window. Your object receives key-frame data corresponding to the Physical solve.



Transport controls A. Keys display along the timeline.

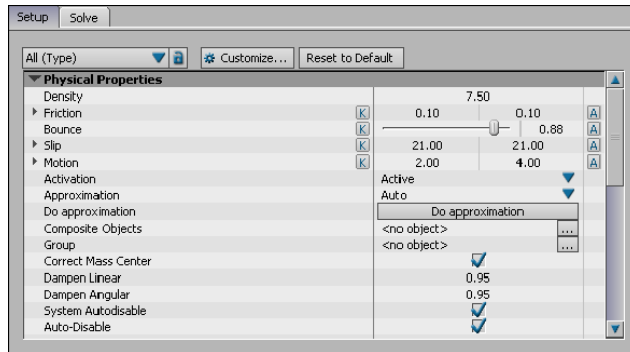
You can also press Ctrl-Home and then Play to replay your animation.

Rigid Body settings

Use the Rigid body settings to adjust your collision effects.

Setup pane

The Rigid Body Setup pane is where you can find generic Physical properties and basic setup information.



Customize button

The Customize button opens the Properties Editor. See [Property Editor](#) on page 595

Reset to Default button

Click Reset to Default to restore the Ragdoll properties to their original settings.

Density field

Use this field to set the thickness and mass of an object.

Friction (Mu) field

Use the Friction settings to set the surface resistance of an object. For example, use a setting of 0.1 for a smooth object and a setting of 10.00 for a rough object.

Bounce slider

Use the Bounce slider to set the amount the object bounces when struck.

Slip field

Enter values in the Slip field to set how far an object will stray from the position of its collision, whether it will tip over or roll onto an edge.

Motion field

Enter values in the Motion field to determine how far the object moves when a collision occurs.

Activation menu

Use this menu to set when the collision reaction starts for the object. For example, you can create objects that only react when they are struck.

| Option | Function |
|---------------------|---|
| Active | Collision reaction for the affected object(s) begins when the session is set to Live or when recorded. |
| Active at collision | The affected object reacts only when something collides with it. |
| Passive | The object is not affected by objects colliding with it, but still collides with other objects, it is a passive rigid body. |

Approximation menu

Approximation lets you specify the type of object, or the mesh that to use to approximate the solve. Select Auto, Sphere, Capsule, Cube, or Mesh.

Do Approximation button

Click the Do approximation button to apply the approximation object specified in the Approximation menu.

Composite Objects

Composite objects let you specify the mesh that you want to use to approximate the solve.

Group menu

This menu provides a list of the available groups from which you can choose an approximation object.

Correct mass center option

Activate this option to offset the “Center” or “Center of Gravity” of an object to a given point to represent the center of gravity for an object.

Dampen linear/angular

Use the Dampen linear/angular settings to define the clamp value applied to the linear and angular velocity when calculating rolling friction. Because the physical property does not model rolling friction, it uses a dampening system so that objects can come to rest.

For example, without a dampening setting, a rolling sphere will roll forever. It is done by scaling linear velocities at each simulation step by dampening factor for all colliding objects.

A value of 1 retains actual velocity. Any value below 1 decreases velocity, while any value greater increases it.

| Value | Description |
|---------|--|
| Linear | Change the Linear Velocity to modify the linear movement of the object |
| Angular | Change Angular velocity setting to modify the rotational movement of the object. |

System Autodisable option

System Autodisable clamps the calculation of collisions below a specified threshold. By default, MotionBuilder uses the same Auto-disable settings as in the Physics Solver.

Activate the System Autodisable option so that the animation is cut off below a threshold, otherwise system resources are absorbed processing vibrations so minute that they are no longer visible.

But on a per-property list basis, you override the default Autodisable settings. Disable the System Autodisable option to override these settings for every objects the Property list is applied to.

Auto-disable

Linear/angular threshold fields

Use these fields to specify a speed for the solve process.

| Option | Description |
|-------------------|--|
| Linear Threshold | The linear velocity that controls the linear rate of speed. |
| Angular Threshold | The angular velocity that controls the rotational speed. |
| Steps | The Step Value setting lets you specify the number of steps that an object must process before it falls below the threshold. |

Weight linear/angular velocity fields

When a collision occurs with an object, velocities are used to calculate the force of the collision.

Modify the Linear and Angular Velocity settings to override the default transfer of energy that occurs in a collision, for example, to assign more or less collision force to an object than what is already specified in the physical property.

NOTE You must have both colliding objects enabled for velocity settings to work.

Custom properties

Expand Custom properties to you add your own properties to selected objects. You can modify and animate the properties you create just as you would other properties.

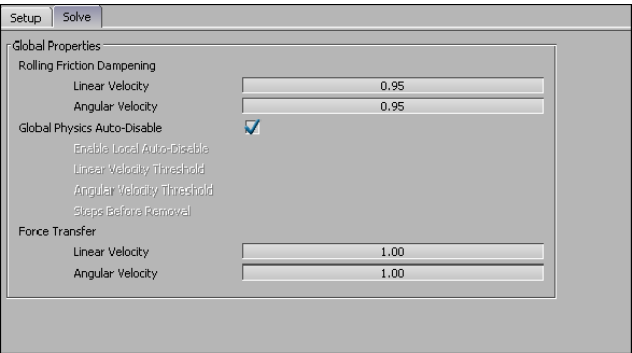
For example, you can add check boxes, sliders, and value fields to trigger specific actions, create a custom animation interface, or simply store information you need to export to other software packages. See Custom Properties pane for more information.

See [Custom Properties pane](#) on page 598 for more information on how to set custom properties.

Solve pane

Solve pane

The Rigid Body Solve pane contains the attributes related to the physical solve of the object such as density, friction, and bounce.



Rolling friction dampening settings

Use the Dampen settings to define the clamp value applied to the linear and angular velocity when calculating the rolling friction. Because the physical property does not model rolling friction, it uses dampening clamps behavior so that objects can come to rest. For example, without a dampening setting, a rolling sphere will roll forever. It is done by scaling linear velocities at each simulation step by dampening factor for all colliding objects.

A value of 1 retains actual velocity. Any value below 1 decreases velocity, while any value greater increases it.

| Value | Description |
|--------|--|
| Linear | Change the Linear Velocity to modify the linear movement of the object |

| Value | Description |
|---------|--|
| Angular | Change Angular velocity setting to modify the rotational movement of the object. |

Global Physics auto-disable.

See [System Autodisable options](#) on page 1485.

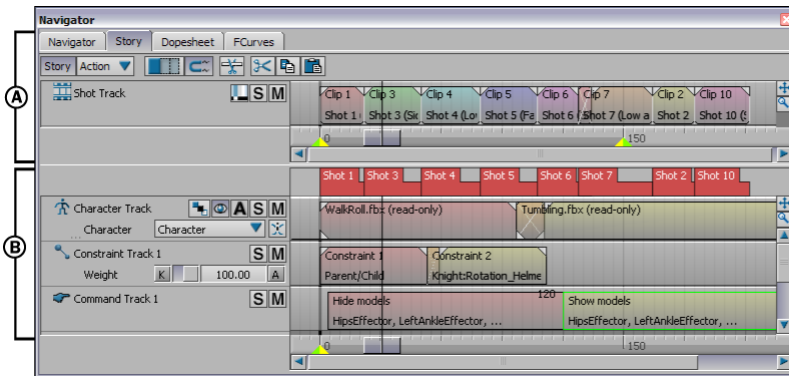
Force transfer

These values let you specify how forces is transferred to the solve objects.

| Value | Description |
|------------------|---|
| Linear velocity | Change the Linear Velocity to specify how linear movement is transferred to your object. |
| Angular velocity | Change Angular velocity setting to specify how rotational movement is transferred to your object. |

Animating with the Story Window

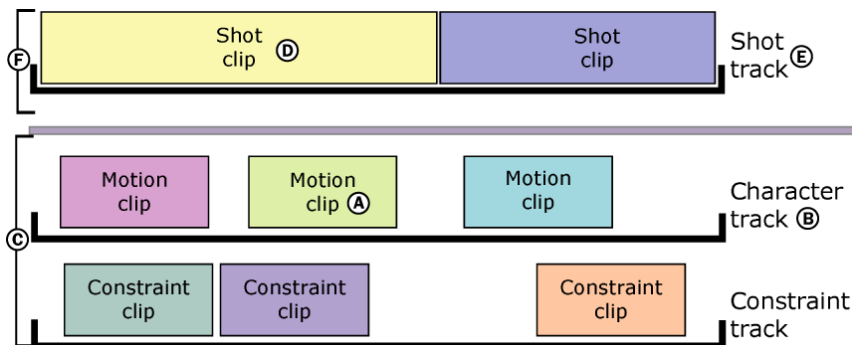
A story is defined as a series of events. Similarly, the Story window lets you assemble scenes by combining and manipulating elements such as characters, lights, cameras, audio, and animation along a timeline, much like a non-linear editor.



A. Edit timeline B. Action timeline

The Story window is made up of two timelines that look similar but are used for different purposes. You can switch between these two timelines using the Story Mode button at the top left corner of the Story window.

- Action timeline: This is where you build the scene using tracks and clips.
- Edit timeline: Once you have arranged your scene along the Action timeline, this is where you can then rearrange the order of shot clips to create camera switches or editing effects.



Story window illustration: Clips (A) are arranged along tracks (B) on the Action timeline (C). Shot clips (D) are along the Shot track (E) on the Edit timeline (F).

To use the Story window, you need to create clips of data (A and D) that represent objects or actions in your scene and arrange them on tracks placed in the Action and Edit timelines (C and F). Which timeline you use determines what you can do with the clips on tracks.

NOTE No matter how you arrange clips and shots on tracks, you do not alter the current take.

Once you have assembled the story's actions in the Story window, you can edit and rearrange them without losing your original action.

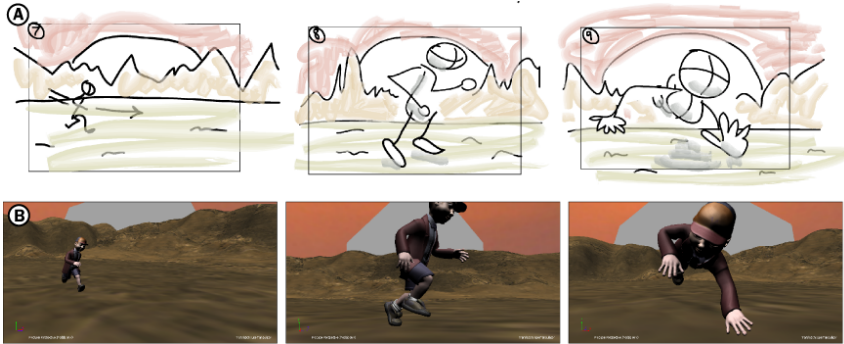
To access the Story window, select **Window > Story** from the menu bar. The Story window also appears in the Story layout. To select the Story layout, select **Layout > Story** from the menu bar.

Story window animation can be edited in the FCurves and Dopesheet windows, as well as the Transport Controls. For more information, see [Editing Story data in the FCurves and Dopesheet windows](#) on page 1522.

- [Story Controls](#) on page 1511
- [Edit Track list](#) on page 1627
- [Action Track list](#) on page 1528
- [Contextual menu for selected clips](#) on page 1561
- [Contextual menu for selected tracks](#) on page 1545
- [Types of clips](#) on page 1549

Storyboarding

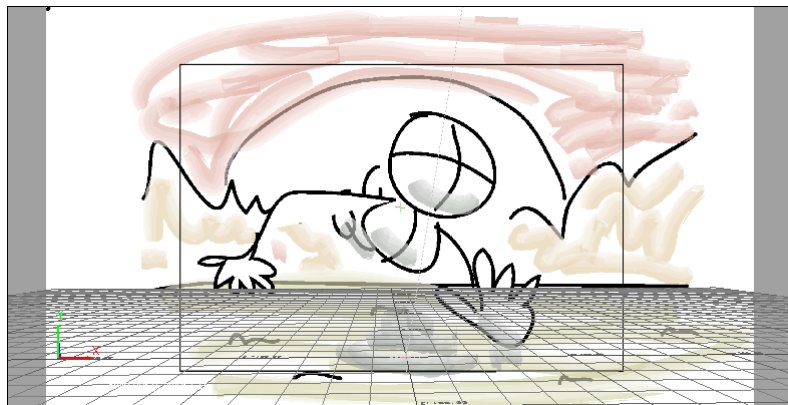
Storyboarding is a way of planning a scene before you build it to give you an idea of the way your scene will finally look. You can base models, sets, and animation on what is contained in a Storyboard.



A. Example of a traditional hand-drawn storyboard B. The finished 3D scene in MotionBuilder.

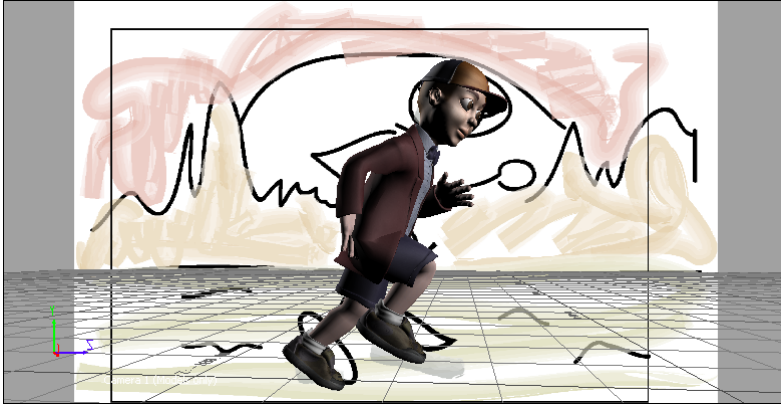
Traditional storyboards are a series of images that show the sequence of events in a story, much like a comic book. Each storyboard panel lets you plan the camera shot, the action, and the character's position in a scene.

With the Story window, you can project images of a storyboard on the background of camera shots, then schedule each image and camera shot to show the sequence of events. This creates a kind of slide show.



A camera shot with a back plate storyboard image.

You can also rough out your scene using pre-existing models and animation. Or you can use storyboards as guides when you set up your scene and animate. For example, you can use a static storyboard image as a guide when you set up your scene and animate your characters.



Place your models with the help of static storyboard panels.

This way, you can experiment with camera angles and timing before you have the characters and props you need. Use this technique to create scenes that are just the way you planned them.

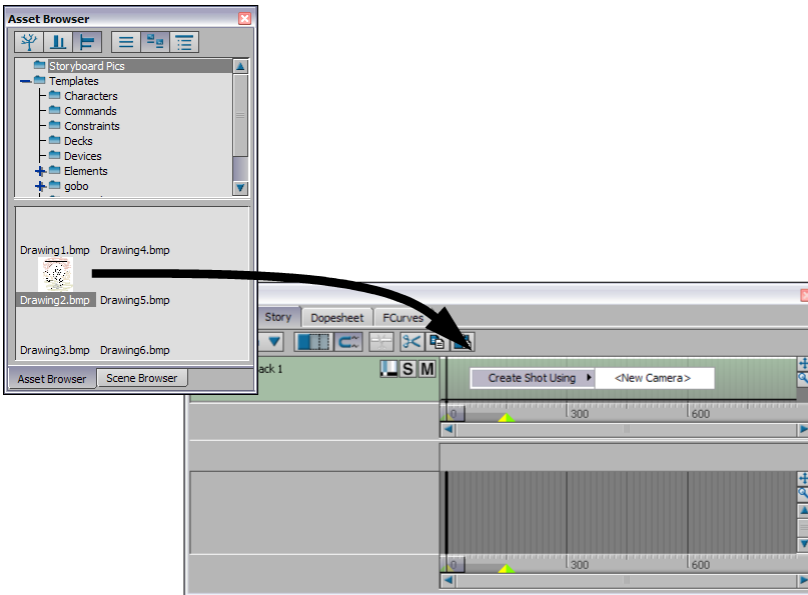
■ [Creating a storyboard](#) on page 1506

Creating a storyboard

You can use the Story window to create a storyboard that lets you plan your action before you start animating.

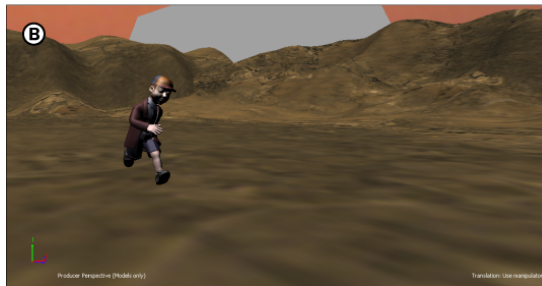
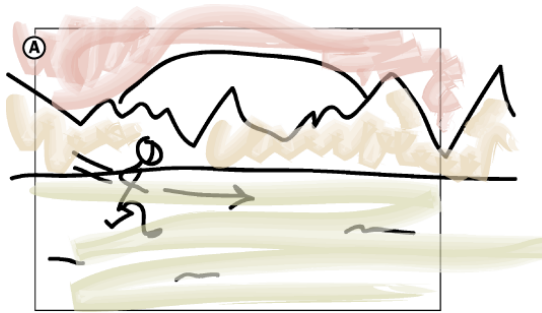
To create a storyboard using storyboard images:

- 1 Drag an image to use for a storyboard from the Scene or Asset browser into the Story window Edit track.
- 2 Select New Camera from the Create Shot Using menu that appears. If you want to assign the image to a camera that is already in the scene, select it from the menu.



Drag a storyboard image into the Story window Edit track and select New Camera from the menu that appears.

- 3** Right-click the resulting shot clip and select Make Camera Switcher Current from the contextual menu.
- 4** Resize and schedule each camera shot to show the sequence of events, creating a slide show with which you can time the length of action as well as set up camera angles.



A. Storyboard image B. Shot with models and set.

- 5 If you want to use cross-dissolve effects between camera shots, switch to Edit mode and overlap the camera shots on the Edit track.

You can also create a storyboard using pre-existing models and animation so you can rough out your scene before you create the characters and props you need without the use of traditional storyboard images.

To do this, set up as much of your scene in the Story window as possible and then use any characterized model to “stand in” for your yet-to-be-created character. Position cameras and tweak the scene until you are satisfied with the animation.



A. Quickly build a storyboard using models and animation you already have. B. The final scene created using the storyboard.

When you have the correct character, drag it into the scene and select it from the Character menu of the Action track. Doing this lets you arrange and set up elements can be reused when you create the final scene. For example, you can reuse any camera shots or poses you create while building your storyboard.

- [Storyboarding](#) on page 1505

Framing Story window clips

You can frame takes in the Story window using the Frame Start/End option. This makes the first clip on the track become the starting time of the take, with the end value of the last clip being the end time of the take.

To frame a take in the Story window:

- 1 Right click in the Action or Edit track list.
- 2 Select Frame Start/End to set the Start and End values of the take.
When you use Frame Start/End, the Start value of the take becomes the start time of the earliest clip and the End value of the take becomes the end time of the last clip.

- [Zooming in on Story window clips](#) on page 1509

Zooming in on Story window clips

To zoom in on part of a take in Story window:

- 1 Right-click in the Action or Edit Track list.
- 2 Select Frame Zoom Bar from the contextual menu.
The Start value becomes the start time of the earliest clip and the End value becomes the end time of the latest clip.

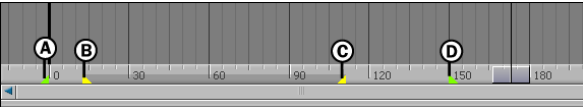
NOTE To zoom in on a single clip only, right-click it and frame it using the command in the contextual menu.

- 3 Press A to center the clips in the Story window.

- [Framing Story window clips](#) on page 1509

Story window time range

In the Story window, the length of the take is referred to as the *time range*. A timeline displays at the bottom of each track list. The time range displays along the timeline as green and yellow markers. The time range displays along the timeline as green and yellow markers.



A. Start of take B. Start of zoom bar C. End of zoom bar D. End of take

| Marker color | Indicate |
|--------------|--|
| Green | The start and end of the take (A and D). |
| Yellow | A selected segment of that take (B and C). |

NOTE These markers correspond with the Start and End fields and the Zoom bar in the Transport Controls window. See [Transport Controls contextual menu](#) on page 625” for more information.

- [Changing the length of a Story take](#) on page 1510

Changing the length of a Story take

To change the length of a take in the Story window:

- 1 In the Story window, drag the green markers at the bottom of the Action Track list.

The green markers indicate the start and end of the take and correspond with the Start and End fields in the Transport Controls window.

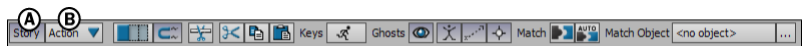
- To select a different segment of the take, drag the yellow markers.
- You can also scroll the zoomed area without changing its length by dragging the gray bar between the yellow markers. Double-click this bar to expand it to the length of the take.

Disabling the Story window

When there is animation in your scene other than that in the Story window, you can mute the Story window so you can see it instead of the Story window's action.

To disable the Story window:

- 1 Click the Story Mode option in the Story controls to disable the Story window. Only the take selected in the Transport Controls window plays.



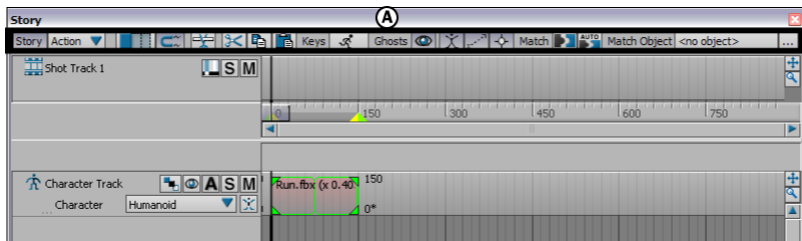
A. Story Mode option B. Story Mode menu

- 2 To activate the Story window, click the Story Mode option again. The animation in the Story window overrides or blends with the take selected in the Transport Controls window.

For more on the Story Mode option, see [Story Mode option](#) on page 1512.

Story Controls

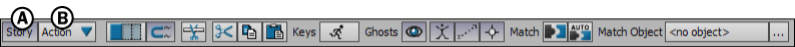
The Story Controls, arranged along the top of the Story window, let you manipulate tracks, clips, and animation. The Story Controls displayed change depending on what is currently selected. For example, the Clips and Edit options are always shown, but the Keys and Ghosts options appear only if a Animation, Camera Animation, or Character track is selected.



This section covers the Story Controls that appear when any clip is selected. Story controls that are specific to particular types of tracks are covered with the track information.

Story Mode option

The Story Mode option lets you activate and disable the Story window. The Story Mode menu lets you select between Action and Edit modes. This option is also in the Transport Controls window.



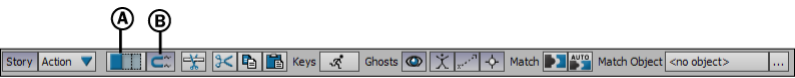
Story Controls A. Story Mode option B. Story Mode menu

Disable Story Mode so that only the take selected in the Transport Controls window plays. If Story Mode is active, the animation in the Story window can override or blend with the take selected in the Transport Controls window.

When Story window animation is active, the Story Mode menu is also active. This menu lets you select between the Story window Action and Edit modes. See [Disabling the Story window](#) on page 1511 for more information.

Manipulation options

The Manipulation options let you manipulate clips:

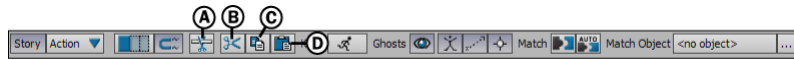


Manipulation options A. Loop/Scale B. Snap

| Manipulation option | Behavior |
|---------------------|--|
| Loop/Scale | Lets you loop and trim clips, or scale clips. Looping is the default clip manipulation mode. See Looping clips on page 1575. |
| Snap | Lets you snap the clip to frames, clips, shots, or to the current time, when you drag a clip along a track, depending which option is active in the Snap contextual menu. See Snap menu options on page 1521 for descriptions of the different Snap options. |

Edit buttons

The Edit buttons let you slice, cut, copy and paste clips.



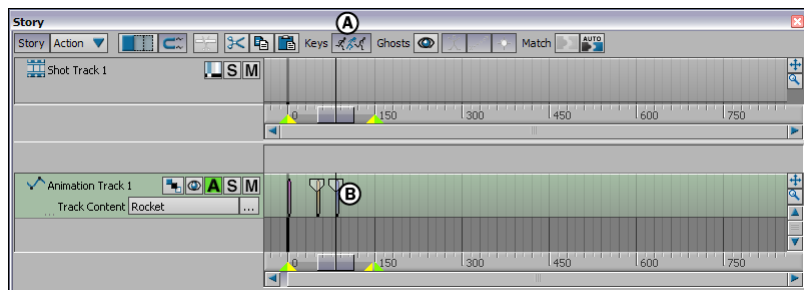
Edit buttons A. Razor B. Cut C. Copy D. Paste

| Button | Function |
|--------|---|
| Razor | Lets you slice selected clips in two. |
| Cut | Removes selected clips and stores them in memory. You can also use the keyboard short-cut Ctrl-X to cut selected clips. |
| Copy | The Copy button copies selected clips. You can also use the keyboard short-cut Ctrl-C to copy selected clips. |
| Paste | Inserts a copied or cut selection into another location. |

Multiple Clips option

The Multiple Clips option displays when an Animation, Camera Animation, or Character track is selected.

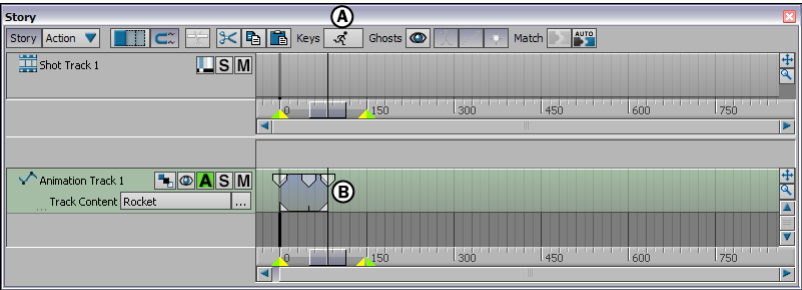
When the Multiple Clips option is active, clips are automatically created along the track as you move the Timeline indicator and transform selected assets. A separate clip is created for each keyframe.



A. Multiple Clips option (set to Multiple clip) B. Individual clips created for keyframes at Frame 0, 49, and 81.

NOTE The color of the clips on the track represent the keyframes they represent.

When the Multiple Clips option is disabled, only one clip is created when you transform selected assets. When the option is disabled, an existing clip stretches to include the keyframes you set.



A. Multiple Clips option (set to Single clip) B. Created clip encompassing keyframes at Frame 0, 49, and 81.

You can change the contents of a keyless clip by placing the Timeline indicator over it and transforming the selected assets again.

Ghosts options

The Ghosts options let you hide and show various ghosts. These options display only when Animation, Camera Animation, and Character tracks or clips are selected.

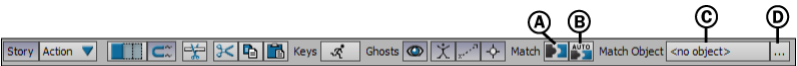
The Ghosts options consist of the following:

| Option | Behavior |
|-----------------------------|---|
| Ghost option | Hides or shows all ghosts of selected tracks or clips. For more information, see Ghost option on page 1599 |
| Model option | Hides or shows a model's ghost. |
| Clip Vector/Travelling Node | Hides or shows either clip vector ghosts or travelling nodes, depending on whether tracks or clips are selected. For more inform- |

| Option | Behavior |
|--------------------|--|
| | ation, see Clip Vector/Travelling Node on page 1600. |
| Ghost Match Object | Hides or shows the match object ghosts of tracks and clips. Ghosts of match objects look like crosses in the Viewer window. See Matching clips on page 1582 for more information on match objects. |
| Travelling Node(s) | Lets you define a different travelling node for an Animation, Character, or Camera Animation track. For more information, see Travelling node on page 1596. |

Match Controls

The Match Controls let you blend animation between clips and tracks smoothly. You can match a selected clip to the clip that comes before or after it. You can also match more than one clip at once by selecting all but the first clip.



A. Match Options button B. Auto Match option C. Match Object field D. Match Object button

The Match Controls are active only when an animation, camera animation, or character clip is selected. See [Matching clips](#) on page 1582 for more information.

Story contextual menu

This section describes the options found in the Story window’s contextual menu that are available regardless of what you right-click in the Story window. See [Contextual menu for selected tracks](#) on page 1545, [Contextual menu for selected clips](#) on page 1561, and [Edit track contextual menus](#) on page 1631 for information on additional menu options.

The following contextual menu items appear regardless of what is selected in the Story window:

- [Insert](#) on page 1516
- [Make Camera Switcher Current](#) on page 1518
- [Plot Shot Track To](#) on page 1518
- [Plot Whole Scene To Current Take](#) on page 1518
- [Razor](#) on page 1518
- [Cut](#) on page 1518
- [Copy](#) on page 1518
- [Copy Time Range](#) on page 1519
- [Paste](#) on page 1519
- [Key At Time](#) on page 1519
- [Delete](#) on page 1519
- [Select Clips](#) on page 1519
- [Frame Start/End](#) on page 1520
- [Frame Zoom Bar](#) on page 1520
- [Step by All Fades](#) on page 1520
- [Snap menu options](#) on page 1521
- [Time Discontinuity](#) on page 1521
- [Sync Action and Edit Views](#) on page 1521

Insert

The Insert menu lets you add folders and tracks to the Track lists.

Tracks let you use specific kinds of clips along a timeline. For example, a Command track lets you use commands and application launches, whereas an Animation track lets you manipulate animation clips. See [Story clips](#) on page 1549 for information on the clips you can create for each type of track.

The types of track the menu lets you insert depend on where you right-click. For example, you can insert Shot tracks, Audio tracks, and Video tracks in the

Edit Track list. In the Action Track list, there are three different types of animation tracks, as well as Audio, Video, Constraint, and Command tracks.

| Track Type | Purpose |
|---------------------|---|
| Folder | Lets you insert folders, which you can use to organize your tracks. You can create hierarchies of tracks by dragging one track onto another or into a folder. To remove a track from a folder, drag it to an empty place in the track list. |
| Shot | Lets you create a series of camera switches using camera shots. |
| Generic Animation | Lets you create keyframe animation for translation, rotation, and scaling for assets such as lights and cubes. |
| Character Animation | Lets you animate characters with keyframes and motion data. |
| Camera Animation | Lets you animate cameras with keyframes. |
| Video | Lets you loop video clips and schedule when they play. |
| Audio | Lets you set audio cues at specific times in a take, as well as loop and play audio clips. |
| Command | Lets you show and hide models at specific frames in your track. You can also use the Command track to launch an external application. |
| Constraint | Lets you select, blend, and fade constraints. |

Make Camera Switcher Current

The Make Camera Switcher Current option sets the Camera Switcher as the current camera in the Viewer window, which lets you see the results of the shots and camera switches in the Edit Track list.

NOTE This option is active when you right-click in the Edit Track list.

Plot Shot Track To

The Plot Shot Track To menu lets you plot camera switches from the Edit Track list to a take. This lets you use the camera switches in the Camera Switcher settings. See [Camera switcher](#) on page 335.

NOTE This option is active when you right-click in the Edit Track list.

Plot Whole Scene To Current Take

The Plot Whole Scene To Current Take options combines all the animation in a scene with the take selected in the Transport Controls window.

NOTE This plotting includes the animation of the take selected in the Transport Controls window as well as the animation in the Story window.

See [Plotting Animation](#) on page 1659 for more information on plotting.

Razor

The Razor option lets you slice selected clips in two at the Timeline indicator. You can also use the keyboard shortcut Alt-R to razor selected clips. See [Razoring clips](#) on page 1579.

Cut

The Cut option removes selected clips and store them in memory for pasting into another location. See [Cutting, copying, and pasting clips](#) on page 1568.

Copy

The Copy option lets you copy selected clips and store them in memory for pasting into another location. See [Cutting, copying, and pasting clips](#) on page 1568.

Copy Time Range

The Copy Time Range option lets you copy all the clips in the selected time range. You can then paste these copied clips. See [Story window time range](#) on page 1510.

Paste

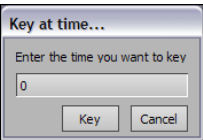
The Paste option lets you insert a copied or cut selection in another location. See [Cutting, copying, and pasting clips](#) on page 1568.

Key At Time

The Key At Time option opens a Key at Time dialog box which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can also access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing Ctrl-Shift-K.

See [Setting many keyframes at once](#) on page 646.



Key at time dialog box

Delete

The Delete option lets you delete a selected track or clip. You must select a track or clip to delete it.

NOTE Deleting a parent track also deletes its sub-tracks.

Select Clips

The Select Clips option lets you select clips with All, Clear, Inverse, and Time-based options. Which track list you right-click determines which clips and shots are affected.

| Option | Function |
|--------|--|
| All | Lets you select all the clips in a track list. |

| Option | Function |
|------------|---|
| Clear | Lets you deselect all clips and shots. Clicking in either Clip area also deselects everything. |
| Inverse | Lets you select all the clips and shots that are not selected, and deselects all selected clips and shots. |
| Time Based | The Time Based menu lets you select clips depending on the location of the Timeline indicator. See Time based menu options for details on what options are available. |

Frame Zoom Bar

Use the Frame Zoom Bar option to set the Zoom bar start and end values. See [Zooming in on Story window clips](#) on page 1509.

Frame Start/End

Use Frame Start/End to set the Start and End values of the take. When you use Frame Start/End, the Start value of the take becomes the start time of the earliest clip and the End value of the take becomes the end time of the last clip. See [Story window time range](#) on page 1510.

Step by All Fades

You can press Shift-Left arrow and Shift-Right arrow to step the Timeline indicator between the points of clips in the Story window.

When the Step by All Fades option is disabled, the shortcuts move the Timeline indicator between clip In and Out points.



Points of a clip A. In point B. Out point

When the Step by All Fades option is active, the shortcuts move the Timeline indicator between clip Fade In and Out points, Still In and Out points, as well as In and Out points.



Points of a clip A. Still In point B. In point C. Fade In point D. Out point E. Fade Out point F. Still Out point

You can step through the clips in only one track list at a time. Hover the mouse over either the Edit Track list or the Action Track list to step through the clips.

Also, when no clip or track is selected, you can step through all clips on all tracks within a track list.

Snap menu options

The Snap menu let you snap the clips you move to the nearest frame, clip, or shot, or to the Timeline indicator. All options are selected by default.

The following table describes the options in the Snap menu:

| | |
|----------------|---|
| Active | Turns snap options on or off. |
| On Time Cursor | Snaps to the Timeline indicator. |
| On Clips | Snaps to the exact frame of the start or end of another clip. |
| On Frames | Snaps dragged clips to exact frames. |

Time Discontinuity

The Time Discontinuity option affects how you can manipulate shot clips.

See [Edit Track list](#) on page 1627 for more information.

Sync Action and Edit Views

The Sync Action and Edit Views option affects the way you manipulate the view in the Action Track list and the Edit Track list.

You can manipulate the view in either track list by Shift-dragging to scroll and Ctrl-dragging to zoom. When the Sync Action and Edit Views option is active, manipulating the view affects both track lists at once. For example, zooming in the Action Track list also zooms in the Edit Track list.

Time based menu options

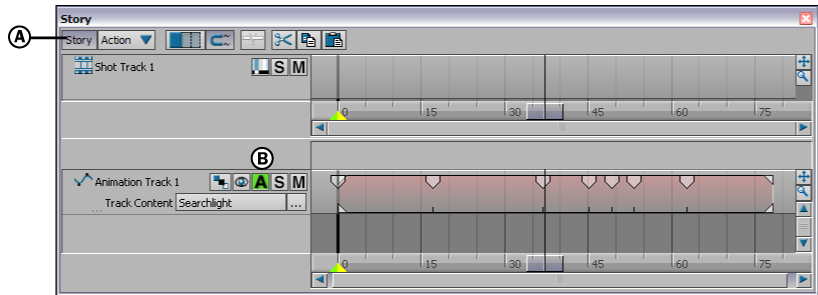
The Time based menu options let you select clips depending on the location of the Timeline indicator.

| Option | Function |
|---------------------------|---|
| Before Time Cursor | Selects all the clips before the Timeline indicator, but does not select clips at the Timeline indicator. |
| Before And At Time Cursor | Selects all the clips before the Timeline indicator, including those at the Timeline indicator. |
| After Time Cursor | Selects all the clips after the Timeline indicator, but does not select clips at the Timeline indicator. |
| After And At Time Cursor | Selects all the clips after the Timeline indicator, including those at the Timeline indicator. |

Editing Story data in the FCurves and Dopesheet windows

You can view and edit Story window animation in the FCurves and Dopesheet windows, as well as the Transport Controls.

- 1 Activate the Story Mode option.
- 2 Select the asset that has the animation you want to view or edit in the Scene browser or the Viewer window. You can view any keyframes placed on the animation clip, but they cannot be edited.
- 3 If the clip is read-only, activate the animation track's Animate option, right-click the clip and select "Make Track Writable".
- 4 Open the FCurves or Dopesheet window and view or edit the animation's keyframes. You can also view and edit the animations keys in the Transport Controls.



A. Make sure that Story Mode is activated B. Activate the Animate option for the track.

NOTE If you make a Camera animation clip Writeable and save your scene, the saved scene crashes on reload. You can work around this limitation if you make sure all clips in Camera Animation tracks are Read-Only before you save.

■ [Transport Controls](#) on page 619

Story tracks

89

In the Story window, a track is a path along which you can move and edit clips along a timeline. There are three different track types, based on what the track contains:

- [Animation tracks](#) on page 1525
- [Character Animation tracks](#) on page 1525
- [Camera Animation tracks](#) on page 1526

The type of track that you create depends on what asset you drop into the Action Track list from the Viewer window, Asset or Scene browser.

There can be many clips on a single track, and each track has various settings that affect the clips it contains. See [Action Track controls](#) on page 1530 for detailed information on track settings. Each of these tracks can also have subtracks.

Animation tracks

Animation tracks to animate models and assets. to create animation clips let you animate the properties of all models and elements with keyframes and *.fbx* files.

Character Animation tracks

A Character Animation track appears whenever you drag an *.fbx* file from the Asset browser to the Asset Track list. The *.fbx* file must contain motion data or keyframe animation plotted to any characterized skeleton.

NOTE Unlike other tracks, a Character Animation track also has a Track Contents menu, which lets you use props with characters.

Camera Animation tracks

A Camera Animation track appears whenever you drag a camera from the Viewer window into the Action Track list. You could also add a Camera Animation track to the Action Track list and select a custom camera from the Track Content menu.

Shot tracks

A Shot track appears whenever you drag a camera from the Viewer window or Scene browser into the Shot Track list. Shot tracks are unique to the Edit Timeline. See [Edit Track list](#) on page 1627 for more information.

Track priority

Clips placed on the same track blend horizontally. In cases where there are multiple tracks of the same type, the top tracks have priority. These tracks are read vertically, blending from top to bottom. The top-most “track” is in fact the Transport Controls window.

You can change how multiple animation tracks are read by using track options like Additive, Override, and Passthrough.

When you have many clips on one track, you can merge or “flatten” them into a single clip by processing the track. You can also do this to multiple tracks and subtracks, provided they are all the same track type. The new clip created from the merged tracks appears as a new track.

You can merge clips of tracks and subtracks into a single clip to save the result of the animation clips in your scene without altering the original animation clips.

Creating Story tracks

All tracks are created when you drag an object, or element into an empty space in the Action Track list from the Viewer window, Asset or Scene browser. The type of track created depends on what you drag.

To create an animation track:

- 1 Drag a model, camera, or other asset such as a light, into an empty space in the Action Track list from the Viewer window, Asset or Scene browser.

A new Animation track appears, and the object is automatically selected in the track's Track Contents menu.

To create a character animation track:

- 1 Drag a characterized model into an empty space in the Action Track list from the Viewer window, Asset or Scene browser.

A new Character Animation track appears, and the character is selected in the track's Character menu.

To create a Camera Animation track:

- 1 Drag a camera into an empty space in the Action Track list from the Viewer window, Asset or Scene browser.

A new Camera Animation track appears, and the camera is automatically selected in the track's Track Content menu.

NOTE You can also drag objects onto a pre-existing track. If the track already contains one or multiple objects, you can then choose to either replace or add to them.

Selecting track content

Select a track's content to determine the models, cameras, or assets it affects.

A track's contents are selected in the track's Track Contents menu whenever you drag a model, camera, or other asset such as a light, into an empty space in the Action Track list. If you drag in a characterized model, the character is selected in the track's Character menu.

NOTE You can also drag objects onto a pre-existing track. If the track already contains one or multiple objects, you can then choose to either replace or add to them.

To manually select Track Content for Animation or Camera Animation tracks:

- 1 Add a camera, or a cube or light, to your scene.
- 2 Insert an Animation or Camera Animation track in the Action Track list.
- 3 In the new track, click the Track Content button and select the camera or other asset from the Asset list.

To manually select a character for Character tracks:

- 1 Add a characterized character to your scene.
- 2 Insert a Character track in the Action Track list.
- 3 Select the character from the track's Character menu.

To select individual body parts:

- 1 In a Character track, make sure a character is selected in the Character menu.
- 2 Click the Body Parts button, and deselect the body parts you do not want the track to affect. All body parts are selected by default.

- [Story tracks](#) on page 1525

Renaming tracks

To rename a track:

- 1 Right-click the Track Name field.
- 2 Select Rename from the contextual menu and type in a new name.

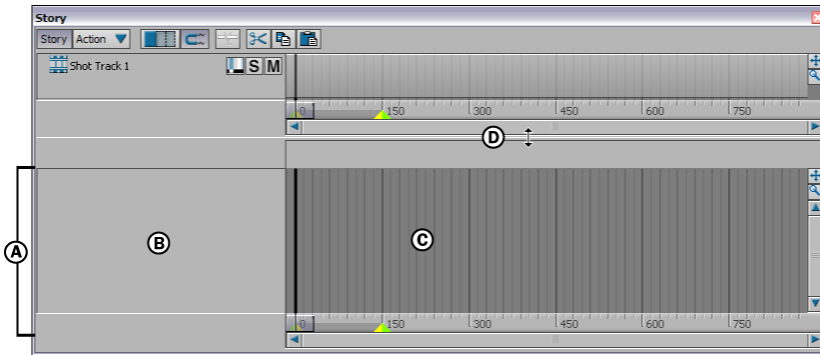
NOTE You can also rename tracks by typing in the Character Track field of the Asset Settings window.

- [Creating Story tracks](#) on page 1526

Action Track list

The Action Track list is found in the bottom half of the Story window, below the Edit Track list. This is where you can build animation along the timeline using tracks and clips.

The animation in the Action Track list overrides or blends with the take selected in the Transport Controls, depending on the settings in the Action Track controls.



Story window A. Action Track list B. Action Track controls area C. Action Clip area D. Resizing bar

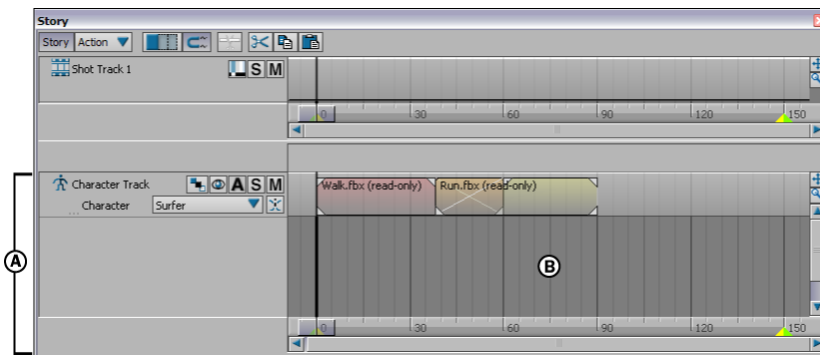
To display the results of the Action Track list, you must select Action from the Story Mode menu (see [Story Mode option](#) on page 1512).

The Action Track list consists of the following:

- [Action Clip area](#) on page 1529
- [Action Track controls](#) on page 1530

Action Clip area

The Action Clip area displays the timeline, as well as the tracks and clips you insert. It lets you add, schedule, and blend clips along the timeline.



Story window A. Action Track list B. Action Clip area

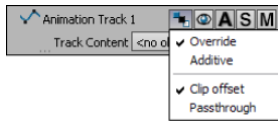
To navigate in the Clip area, Ctrl-drag to zoom and Shift-drag to scroll. You can also click in the Clip area and press A to frame all clips or press F to frame

a selection. See [Story window time range](#) on page 1510 for information on changing the time range.

Action Track controls

In the Story window, every time you insert a track, track controls appear in the Action Track list.

These Action Track controls let you move, stretch, expand, and collapse tracks. They also let you select animation options, hide or show ghosts, and activate or disable tracks.



Track Controls for different types of tracks.

The controls change depending on what track you have. For example, all tracks have Solo and Mute buttons, but only a Character track has a Character menu.

Track controls include the following:

- [Collapse and Expand](#) on page 1531
- [Track Name](#) on page 1531
- [Track Options](#) on page 1532
- [Ghost Visibility option](#) on page 1534
- [Animate option](#) on page 1534
- [Solo and Mute options](#) on page 1535
- [Character menu](#) on page 1535
- [Body Parts menu](#) on page 1535
- [Track Content list](#) on page 1536
- [Weight](#) on page 1537
- [Destination](#) on page 1537

- [Volume](#) on page 1538

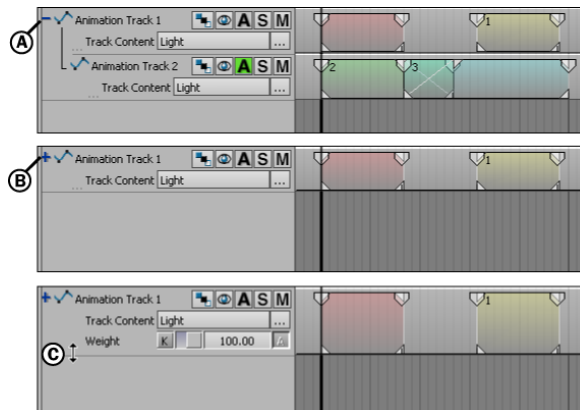
NOTE You can also find these settings in the Asset Settings window when the appropriate track is selected.

Collapse and Expand

You can expand and collapse folders and tracks when you have a hierarchy of folders, tracks, or subtracks.

To hide or show the selected track's subtracks, click the Collapse/Expand (-/+) button (A and B) located at the upper left of the Track controls. Collapse and expand tracks when you use multiple hierarchies of tracks, or do not want to view all tracks simultaneously. See [Insert Subtrack](#) on page 1545 for more information on creating track hierarchies.

You can also resize tracks vertically if you want to display additional options or a better view of a track's audio waveform. To resize the track, drag the bottom of its Track Controls up or down.



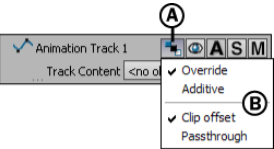
Tracks A. Collapse symbol B. Expand symbol C. Stretched track

Track Name

The Track Name indicates the track type. Double-click the Track Name to display additional track settings in the Asset Settings and in the Properties windows.

Track Options

The Track Options button displays a menu, where you can select options that set how Animation, Character, and Camera Animation tracks interact with each other.



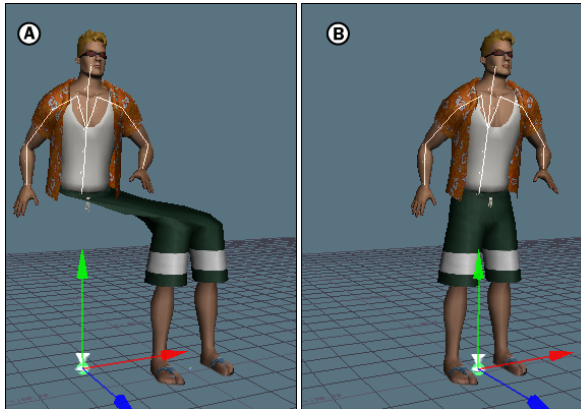
Track Controls A. Track Options button B.Track Options menu for Animation, Character Animation, and Camera Animation tracks

When you select a Animation, Character, or Camera Animation track, these options also display in the Asset Settings window. You can find the Override and Additive options in the Compo Mode menu.

The Track Options menu includes the following options:

| Option | Function |
|----------|---|
| Override | When you set a track to Override, you give the current track priority over any the tracks above it that have the same track content. The animation of any tracks above is disabled. For example, if the first track contains animation of a cube moving back and forth, and the track beneath contains animation of the same cube moving up and down, the first track’s animation does not play if you set the second track to Override. Note: The track also overrides the current take selected in the Transport Controls window. |
| Additive | When you set a track to Additive, the track influences animation on other tracks. For example, if the first track contains animation of a cube moving back and forth, and the track beneath it contains animation of |

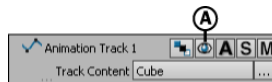
| Option | Function |
|-------------|---|
| | the same cube moving up and down, the animation in both tracks blend together. |
| Clip Offset | <p>When you disable Clip Offset, the clip trajectories are locked in their original location. If you activate Clip Offset, you can translate and rotate clip trajectories in the Viewer window. Clip Offset is useful when you need to keep part of a model in its original location. For example, when only a character's upper body is selected in a track, translating the track's clips stretches the character's body apart unnaturally. The character's upper body is translated but the lower body is left behind. To keep this from happening, disable the Clip Offset option. If you want to use the Clip Offset option but freeze the clip vector in a new location, you can move the clip vector, save the clip, then enable Clip Offset. The Clip Offset option displays in the Track Options of Animation, Character, and Camera Animation tracks, as well as the Asset Settings window.</p> |
| Passthrough | <p>When you select Passthrough for a Animation, Character, and Camera Animation track, the animation on tracks beneath the selected track plays when there is no clip on the selected track. When there is only one track in the Story window, and that track has no clips, the animation of the take selected in the Transport Controls window plays.</p> |



Using Clip offset **A**. When Clip offset is active, translating clips can create unwanted results **B**. When Clip offset is disabled, clips remain in their original position and cannot be translated or rotated.

Ghost Visibility option

Activate the Ghost Visibility option to hide and show all a track's ghosts. Ghosts are hidden by default.



Track Controls **A**. Ghost Visibility option

See [Ghosts options](#) on page 1598 for more information on hiding all ghosts or only certain types of ghosts.

Animate option

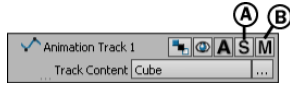
When a track's Animate option is active, you can set keyframes on the track. You can see and edit these keyframes in the FCurves, Transport Controls, Dynamic Editor, and Dopesheet windows.

The Animate option is always disabled by default.

See [Keyframe \(K\) and Animate \(A\) buttons](#) on page 642 for information on Animate options elsewhere in MotionBuilder.

Solo and Mute options

Use the Solo (S) and Mute (M) options (A and B) to activate or disable tracks. When a track's Solo option is active, only that track plays and when a track's Mute option is active, that track does not play. This means that all animation, video, audio, command, or constraint clip on a muted track is disabled.

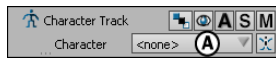


Track Controls A. Solo option
B. Mute option

NOTE You can also find the Solo and Mute options in the Asset Settings window when you double-click a track.

Character menu

Use a Character track's a Character menu to select the character you want to animate. Only characterized characters can be selected in Character tracks.

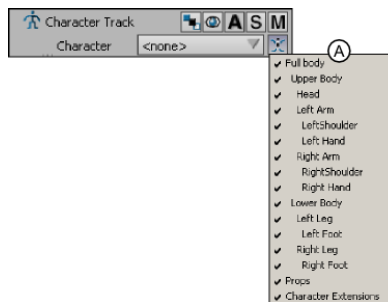


Track Controls A. Character menu

Body Parts menu

Use the Body Parts menu to select the parts of the character that are to be used in the animation. Use the menu to also select or deselect any character extensions or props included as track content.

Only the body parts selected in the Body Parts menu can be animated.



Track Controls A. Body Parts menu

For example, when only Right Arm and Right Hand are selected in the menu, you can only transform and animate the character's right arm and hand. No other body part moves from its original location.

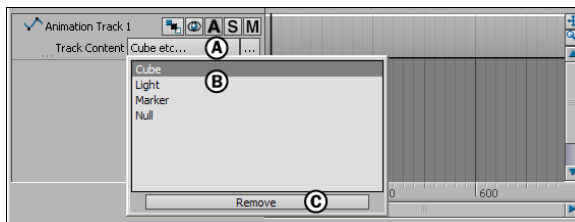
Selecting only a few parts of a character's body also lets you create local blends. A local blend consists of replacing the motion in one track with motion from another track on only part of a hierarchy. For example, blending the lower body of a running character with the upper body of a waving character to create animation of a character running and waving at the same time.

NOTE Character shoulders are considered as a subset of the arm in a Story window Character track or subtrack. However, previous versions of MotionBuilder (version 7.5 ext. 2 and earlier) will show shoulders included as part of the Character chest (without the rest of the arms). This difference preserves shoulder animation created in earlier versions of the software.

Track Content list

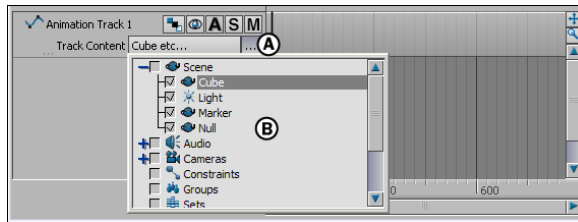
The Track Content list displays the name of the asset that you drag onto an Animation, Character, or Camera Animation track. A track's clips affect the asset selected in the Track Content list. These selected assets are often referred to as the track content.

Clicking the Track Content list displays the entire list of assets you have dragged into the track. The Remove button lets you remove objects from the list.



A. Track Content list B. Click on the list to see what you dragged into the track. C. Remove button

The Track Content button displays the Asset list. This Asset list lets you select assets and create local blends.



A. Track Content button B. Asset list

You can also find the Track Content list in the Asset Settings window when you double-click an Animation, Character, or Camera Animation track.

Weight

The Weight field appears in Animation, Character, Camera Animation, and Constraint tracks. It also displays in the Asset Settings window when you double-click on one of these tracks.



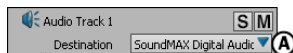
Weight field A. Animation track B. Constraint track

The Weight field lets you determine and animate to what percentage a track's clips are in effect, with 100% meaning fully animated and 0% meaning disabled.

For example, a Constraint track's Weight field lets you define how much a track's constraints are in effect. If you set the Weight value for a Constraint track containing a Position constraint at 50%, the position of the constrained object is halfway between its original position and the position of its source object.

Destination

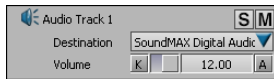
The Destination menu in Audio tracks lets you select the audio card on which the audio track plays. When <none> is selected in the Destination menu, the track's audio does not play.



Audio track A. Audio Destination menu

Volume

The Volume settings in Audio tracks let you modify and animate the volume of the audio clips on Audio tracks.

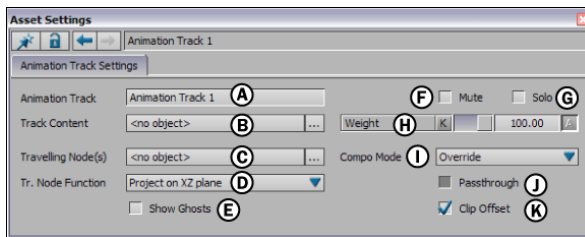


Audio track A. Volume settings

- [Ghosts options](#) on page 1598

Track settings

When different types of tracks are selected in the Story window, different settings that display in the Asset Settings window. These settings are generally the same as what is found on the track's Action Track list area and the settings change depending on what type of track is selected.



Animation track settings A. Track Name field for an Animation track B. Track Content field C. Travelling Node(s) field D. Tr. Node Function menu E. Show Ghosts option F. Mute option G. Solo option H. Weight settings I. Compo Mode menu J. Passthrough option K. Clip Offset option.

NOTE To see the Asset Settings window and the Story window at the same time, select Layout > Story from the menu bar.

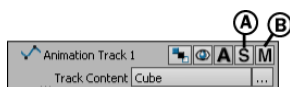
Track Name

The Track Name indicates the track type. Double-click the Track Name to display additional track settings in the Asset Settings and in the Properties windows.

NOTE This setting is available for all track types.

Solo and Mute options

Use the Solo (S) and Mute (M) options (A and B) to activate or disable tracks. When a track's Solo option is active, only that track plays and when a track's Mute option is active, that track does not play. This means that all animation, video, audio, command, or constraint clip on a muted track is disabled.



Track Controls A. Solo option
B. Mute option

For more information about tracks, see [Edit Track list](#) on page 1627 and [Action Track list](#) on page 1528.

NOTE This setting is available for all track types.

Weight

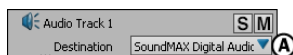
The Weight field lets you determine and animate what percentage a track's clips are in effect, with 100% meaning fully animated and 0% meaning disabled.

For example, a Constraint track's Weight field lets you define how much a track's constraints are in effect. If you set the Weight value for a Constraint track containing a Position constraint at 50%, the position of the constrained object is halfway between its original position and the position of its source object.

NOTE This setting is available for Animation, Character, Camera Animation, and Constraint tracks.

Destination

The Destination menu in Audio tracks lets you select the audio card on which the audio track plays. When <none> is selected in the Destination menu, the track's audio does not play.



Audio track A. Audio
Destination menu

NOTE This setting is available only for Audio tracks.

Show Back Plates

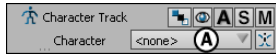
The Back Plate option lets you set a background image or video clip to be displayed on a camera's background plane.

The background plane is a separate plane used only for projecting images or video clips. The size of the background plane matches the camera's viewing area and remains a part of the camera's view, even with the 2D magnifier, and the Turn Table options. For more information, see [Back Plate pane](#) on page 291.

NOTE This setting is available only for Camera tracks.

Character menu

Use a Character track's Character menu to select the character you want to animate. Only characterized characters can be selected in Character tracks.



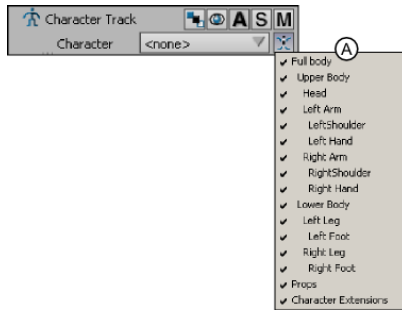
Track Controls A. Character menu

NOTE This setting is available only for Character tracks.

Body Parts menu

Use the Body Parts menu to select the parts of the character that are to be used in the animation. Use the menu to also select or deselect any character extensions or props included as track content.

Only the body parts selected in the Body Parts menu can be animated.



Track Controls A. Body Parts menu

For example, when only Right Arm and Right Hand are selected in the menu, you can only transform and animate the character's right arm and hand. No other body part moves from its original location.

Selecting only a few parts of a character's body also lets you create local blends. A local blend consists of replacing the motion in one track with motion from another track on only part of a hierarchy. For example, blending the lower body of a running character with the upper body of a waving character to create animation of a character running and waving at the same time.

NOTE Character shoulders are considered as a subset of the arm in a Story window Character track or subtrack. However, previous versions of MotionBuilder (version 7.5 ext. 2 and earlier) will show shoulders included as part of the Character chest (without the rest of the arms). This difference preserves shoulder animation created in earlier versions of the software.

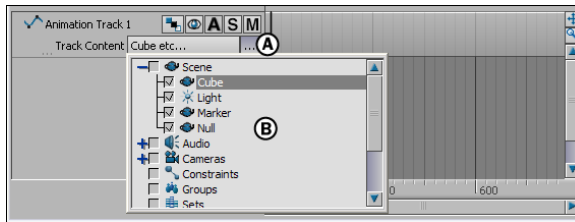
NOTE This setting is available only for Character tracks.

Track Content list

The Track Content list displays the name of the asset that you drag onto an Animation, Character, or Camera Animation track. A track's clips affect the asset selected in the Track Content list. These selected assets are often referred to as the track content.

Clicking the Track Content list displays the entire list of assets you have dragged into the track. The Remove button lets you remove objects from the list.

The Track Content button displays the Asset list. This Asset list lets you select assets and create local blends.



A. Track Content button B. Asset list

You can also find the Track Content list in the Asset Settings window when you double-click an Animation, Character, or Camera Animation track.

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Travelling Node(s)

Double-click a character track in the Story window to access the Travelling Node(s) field in the Asset Settings window.

The Travelling Node(s) field lets you define a different travelling node. You can change where the travelling node displays by changing the option in the Travelling Node function menu (see [Tr. Node Function](#) on page 1542).

NOTE This setting is available only for Character tracks.

Tr. Node Function

The Travelling Node Function menu lets you determine where the travelling node displays. See [Tr. Node Function](#) on page 1615 for more information on travelling nodes.

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Show Ghosts option

The Show Ghost option lets you show or hide the ghosts of a selected clip. Ghosts are hidden by default. This option displays when an animation, camera animation, or character clip is selected.

The ghosts affected by the Show Ghost option include a selected clip’s model, clip vector, and match object ghosts. The Show Ghost option controls the visibility of these ghosts as a group.

Also, clip ghosts can display only if the ghost visibility options of the clip’s track is active. See [Ghosts options](#) on page 1598 for more information on track ghosts.

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Compo Mode menu

The Compo Mode menu lets you prioritize your track order and includes the following options:

| Option | Track behavior |
|----------|---|
| Override | When you set a track to Override, you give the current track priority over any the tracks above it that have the same track content. The animation of any tracks above is disabled.For example, if the first track contains animation of a cube moving back and forth, and the track beneath contains animation of the same cube moving up and down, the first track’s animation does not play if you set the second track to Override.The track also overrides the current take selected in the Transport Controls window. |
| Additive | When you set a track to Additive, the track influences animation on other tracks.For example, if the first track contains animation of a cube moving back and forth, and the track beneath it contains animation of the same cube moving up and down, the animation in both tracks blend together. |

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Passthrough option

When you activate the Passthrough option, the animation on tracks beneath the selected track plays when there is no clip on the selected track.

When there is only one track in the Story window, and that track has no clips, the animation of the take selected in the Transport Controls window plays.

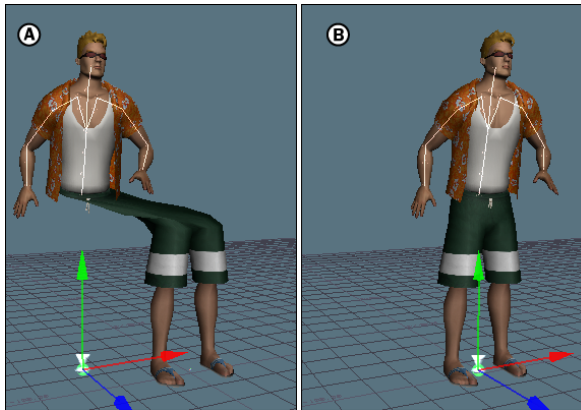
NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Clip Offset

When you disable Clip Offset, the clip trajectories are locked in their original location. If you activate Clip Offset, you can translate and rotate clip trajectories in the Viewer window.

Clip Offset is useful when you need to keep part of a model in its original location. For example, when only a character's upper body is selected in a track, translating the track's clips stretches the character's body apart unnaturally.

The character's upper body is translated but the lower body is left behind. To keep this from happening, disable the Clip Offset option.



Using Clip offset *A*. When Clip offset is active, translating clips can create unwanted results *B*. When Clip offset is disabled, clips remain in their original position and cannot be translated or rotated.

If you want to use the Clip Offset option but freeze the clip vector in a new location, you can move the clip vector, save the clip, then enable Clip Offset.

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Contextual menu for selected tracks

This section describes the options found in the Story window's contextual menu that are available when you right-click a track. See [Story contextual menu](#) on page 1515 and [Contextual menu for selected clips](#) on page 1561 for information on additional menu options.

You can also access some of these options from the Story Controls. See [Story Controls](#) on page 1511.

Depending on where you right-click and what is selected, the options in the contextual menu may change. For example, right-clicking in the Edit Track list shows different options than right-clicking in the Action Track list. The options that appear also change depending on which tracks or clips are selected and apply to the selection.

Insert Subtrack

Inserts a subtrack onto the track.

You can also create subtracks by dragging a track onto another track. Character tracks can only be dragged onto other Character tracks. Animation tracks can only be dragged onto Camera Animation tracks, Character tracks, and other Animation tracks.

NOTE The Insert Subtrack option appears when any track is selected.

To unparent subtracks, drag them to an empty space in the track list.

| Option | Behavior |
|--------------------|--|
| Animation Override | Inserts an Animation subtrack which is set to Override by default. |
| Animation Additive | Inserts an Animation subtrack which is set to Additive by default. |
| Character Override | Inserts a Character subtrack which is set to Override by default. This subtrack can only |

| Option | Behavior |
|--------------------|---|
| | be the child of a Character track. The same character is automatically selected in the subtrack's Character field. |
| Character Additive | Inserts a Character subtrack which is set to Additive by default. This subtrack can only be the child of a Character track. The same character is automatically selected in the subtrack's Character field. |

■ [Track Options](#) on page 1532

Insert Animation/Audio/Video File

Load files as clips using the Insert <x> File option, where <x> is either Animation, Audio, or Video.

| | |
|-----------------------|--|
| Insert Animation File | Displays an Open File dialog box, which lets you load .fbx files as clips for Animation, Character, and Camera Animation tracks. |
| Insert Audio File | Displays an Open File dialog box, which lets you load audio files for Audio tracks. |
| Insert Video File | Displays an Open File dialog box, which lets you load video files for Video tracks. |

NOTE The Insert Animation/Audio/Video File options offered depend on what type of track is selected.

Insert Current Take

Insert Current Take lets you paste keyframe animation from the take selected in the Transport Controls window to a track in the Action Track list.

You can also insert a take into the Story window by dragging it from the Scene browser. You must drag the take onto an Animation, Character, or Camera

Animation track whose Animate button is active and whose track content is defined.

NOTE The Insert Current Take option appears when any track is selected.

Process Track/Subtracks to New Clip

The Process Track/Subtracks To New Clip option combines the animation of a track and its subtracks into one clip. The animation that is merged involves the selected track, all of the selected track's subtracks, and all tracks above the selected track that have the same track content as the selected track. However, the animation of muted tracks is not merged.

NOTE The Process Track/Subtracks To New Clip option appears when any track is selected.

Import Camera Switcher From

Camera switches created with the Camera Switcher appear as keyframes in the Transport Controls window. The Import Camera Switcher From menu lets you move these camera switches from the takes in the Transport Controls window to the Story window, where they appear as camera shots on a selected Shot track in the Edit Track list.

NOTE The Import Camera Switcher From option appears only when a Shot track is selected.

Export to Camera Switcher

When a Shot track is selected, the Export to Camera Switcher menu lets you plot camera switches from a single Shot track to a take. This lets you use the camera switches in the Camera Switcher settings.

NOTE The Export to Camera Switcher From option appears only when you select a Shot track.

Rename

The Rename option lets you rename a selected track in the Story window. You can also rename selected tracks and clips in the Asset Settings window.

NOTE The Rename option appears when you select any track.

Story clips

90

Scenes are assembled in the Story window with clips. Nothing happens in the Story window until you create at least a clip or two.

In the Story window, a clip is an individual instance of a camera shot, a command, a constraint, animation, audio, or video. The steps you take to create clips depend on the type of track you use.

Clips display on tracks, along which they can be manipulated. There is a different kind of track for every type of clip. See [Story tracks](#) on page 1525 for more information.

In and Out points

The values that display near the top left and right corners of a selected clip (A and B) are Global In and Global Out points, which refer to the start and end of the clip along the Action timeline or Edit timeline.



A clip in the Story window A. Global In point B. Global Out point C. Local In point D. Local Out point.

The values that display near the bottom left and right corners of a selected clip (C and D) are Local In and Local Out points, which refer to the start and end of the clip when it was first created and exported, and display near the bottom of selected clips.

Types of clips

There are eight different types of clip:

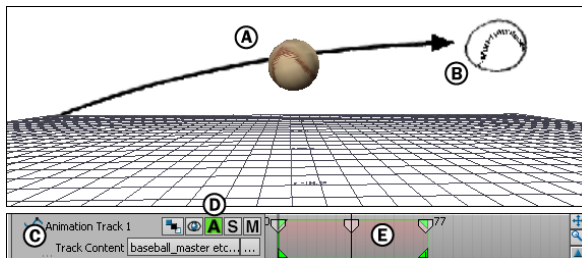
- [Animation clips](#) on page 1550

- [Character clips](#) on page 1551
- [Camera animation clips](#) on page 1551
- [Command clips](#) on page 1551
- [Constraints clips](#) on page 1553
- [Audio clips](#) on page 1553
- [Video clips](#) on page 1554
- [Shot clips](#) on page 1555

Animation clips

Animation clips are clips of keyframe animation you can create, save, and reuse. You create animation clips on Animation tracks to animate models and assets.

For example, when a character throws a baseball, the baseball model arcing through the air alone can be one animation clip.



Keyframe animation A. Baseball model in the Viewer window. B. A static storyboard panel used as a template. C. Animation track for a baseball. D. The track's Animate button is active. E. Animation clip which consists of keyframes.

The animation in the Story window can be also edited in the FCurves, Transport Controls, and Dopesheet windows when the Story window is active and when an animation track's Animate option is active.

While you can animate almost anything with animation clips, you should use character animation clips and camera clips on Character tracks and Camera tracks to animate characters and cameras. See [Character clips](#) on page 1551 and [Camera animation clips](#) on page 1551.

- [Creating animation clips](#) on page 1555

Character clips

Character animation involves a series of actions which flow into one another. Final character animation is composed of many bits of motion, or character clips which you can blend and edit to create a part of a scene.

For example, to create a scene that builds on the storyboard (see [Storyboarding](#) on page 1505), you could use character clips of Surfer walking around, of Surfer throwing a ball, and of Surfer standing and looking at Rufus run. You can also retarget Character animation to any character, meaning that one character clip can be used to animate many types of characterized characters.

- [Creating character clips](#) on page 1556

Camera animation clips

Custom cameras in your scene can be static, or you can animate them in the Story window to create more interesting shots. For example, in the next figure, an animated custom camera captures Rufus as he runs after the ball and catches it.



A camera follows Rufus as he tries to catch the baseball.

- [Creating camera animation clips](#) on page 1556

Command clips

Three kinds of command clips let you show and hide selected models, or launch an application at any time in your story. You drag these command clips from the Asset browser.

With three types of Command clips, you can make objects appear and disappear at specific points in time using command clips. You can also use command clips to launch external applications.



A command clip makes Rufus disappear at a specific point in time.

Command assets

In the Asset browser, the Commands folder contains Command assets. Drag any one of the Command assets into the Story window to insert Command clips with which you can build animation in the Story window.

You can apply more than one model to the same command clip by Ctrl-clicking a group of them in the Viewer window and dragging them into the command clip or Clip content field.

There are three commands available in the Asset browser:

| Command | Description |
|--------------------|--|
| Application Launch | The Application Launch command clip lets you launch an external application when the clip plays. |
| Hide Models | The Hide Models command clip lets you hide models assigned to the clip. |
| Show Models | The Show Models command clip lets you show models assigned to the clip. |

Constraints clips

You create constraints clips to schedule a constraint, turning on and off at specific points in time. For example, a baseball can be constrained to Surfer and Rufus in turn, at different points in time, because of a series of constraint clips. The baseball is not constrained to Surfer's hand until he touches it, and the ball follows his hand until he throws it.



The baseball is constrained to Surfer's hand for a specific moment in time. When Surfer throws the ball, the constraint is turned off and the ball is no longer constrained to his hand.

■ [Creating constraints clips](#) on page 1560

Audio clips

An audio clip is an audio file you can schedule in the Story window. For example, you can schedule an audio clip so that Surfer says “Good boy, Rufus” at a specific point in time, such as when he pats the dog.



An audio clip determines when Surfer says “Good boy, Rufus” when he pats his dog.

- [Creating audio clips](#) on page 1560

Video clips

A video clip is a video file you can schedule in the Story window. Using a video file as a video clip forces it to start and stop playing at specific times. For example, the clock in a scene can be a model to which a video texture of moving hands is applied.



The clock’s video texture is a video clip scheduled in the Story window.

- [Creating video clips](#) on page 1561

Shot clips

A shot clip, also called a camera shot, is a section of time captured with a single camera.

- [Creating shot clips](#) on page 1618

Creating animation clips

Used with Animation tracks, animation clips let you animate the properties of all models and elements with keyframes and *.fbx* files.

Before you can create an animation clip, you need to drag models or elements from the Viewer window or Scene browser into the Action Track list. You can also select them from the Track Content button's Asset list.

To animate characters or cameras using specialized tracks, see [Character clips](#) on page 1551 or [Camera animation clips](#) on page 1551.

To create the animation clip:

- 1 Right-click in the Action Track list and select Insert > Generic Animation Track from the contextual menu.
- 2 Activate the track's Animate option.
- 3 Select the track's asset in the Animation track's Track Content menu.
- 4 Make sure the track's asset is selected in the Viewer window.
- 5 Press K to set a keyframe.
- 6 Move the Timeline indicator, transform the asset, and press K again.

NOTE The animation in the Story window can be also edited in the FCurves, Transport Controls, and Dopesheet windows when the Story window is active and when an animation track's Animate option is active.

To animate an asset, you can also drag an *.fbx* file from the Asset browser into the Animation track. The *.fbx* file must contain animation plotted to an asset with the same name as the one selected in the track. You can also insert an animation file as a clip using the Insert Animation File option in the contextual menu. See [Insert Animation/Audio/Video File](#) on page 1546 for more information.

- [Animation clips](#) on page 1550

Creating character clips

Used with Character tracks, character clips let you animate characters with keyframes and *.fbx* files.

Before you can create a character clip, you must open a file containing a characterized character.

To create a character clip:

- 1 From the Asset browser, drag an *.fbx* file containing motion data or keyframe animation plotted to any characterized skeleton onto the Asset Track list.

A Character Track appears and a clip is created from the *.fbx* file.

You can also use keyframes to create a character clip. Your character must be characterized.

To create the clip using keyframes:

- 1 Activate the Character track's Animate option.
- 2 Select and transform either the character's skeleton or the effectors of the character's Control rig
- 3 Press K to set a keyframe.
- 4 Move the Timeline indicator, transform the bones or effectors, and press K again.

■ [Character clips](#) on page 1551

Creating camera animation clips

Used with Camera Animation tracks, camera animation clips let you animate cameras with keyframes and *.fbx* files.

Before you can create a camera clip, there must be at least one camera in your scene.

To create a camera animation clip:

- 1 Drag a camera from the Viewer window into the Action Track list.

NOTE If you drop the camera accidentally into the Edit Track list instead of the Action Track list, you can delete the created Shot track or shot clip by selecting it and pressing Delete.

A Camera Animation track and clip appear. The dropped camera is automatically selected in the Track Content menu of the new track.

You could also add a Camera Animation track to the Action Track list and select a custom camera from the Track Content menu.

- 2 Make sure the track's camera is selected in the Viewer window, and press K to set a keyframe.
- 3 Move the Timeline indicator, transform the camera, and press K again.

You can transform the camera using two different methods:

- Select and transform it in the Viewer window as you would other assets.
- Transform it with the Current Camera keying mode in the Key Controls window. When you select this keying mode, you can transform and set keyframes for the current custom camera. This method is useful when you are animating multiple cameras.

To animate the camera, you can also drag an *.fbx* file from the Asset browser into the Animation track. The *.fbx* file must contain animation plotted to any custom camera. You can also insert an animation file as a clip using the Insert Animation File option in the contextual menu. See [Insert Animation/Audio/Video File](#) on page 1546 for more information.

- [Reusing camera clips](#) on page 1632

Creating command clips

The following steps use the Story Layout.

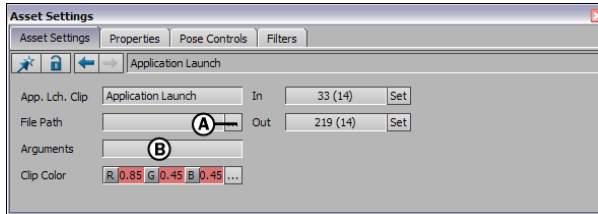
To create a command clip in the Story window:

- 1 In the Asset browser, open Templates > Commands
- 2 There are three types of Command asset in the Commands folder. Drag one of these into the Story window.
- 3 A command clip appears on a Command track.

NOTE You can add several types of commands to the same Command track.

To create an Application Launch command clip:

- 1 Double-click the Application Launch clip to select it.
The clip's settings display in the Asset Settings window.
- 2 Click the browse button of the File Path setting, select the application you want to launch.



Asset Settings window A. Browse button of the File Path settings. B. Arguments field.

- 3 Type arguments in the Arguments field, if necessary.
For example, to open Internet Explorer you can type the following path in the File Path field:

```
C:\Program Files\Internet Explorer\IEXPLORE.EXE
```

When the Application Launch clip plays, the Web browser opens.

Add arguments by typing in the Arguments field. For example, to open the Autodesk Web site when an Application Launch command clip opens Internet Explorer, enter the following in the Arguments field:

```
www.Autodesk.com
```

When the Application Launch clip plays, Internet Explorer opens to the Autodesk web site.

The arguments you type in the Arguments field depend on the application you launch.

Use spaces to separate arguments. For example, the following are separate arguments:

```
argumentOne argumentTwo
```

If there are spaces in an argument, place quotation marks ("") before and after each argument, as follows:

```
"This is one argument" "Followed by a second argument"
```

You can also place a back slash (\) before each space. A back slash indicates that the next character is *escaped*, meaning it is only a character. For example:

```
This\ is\ one\ argument
```

If an argument contains a back slash or quotation marks, place another back slash before it, as follows:

```
"He said: \"I love animation.\""
```

- 4 Press Ctrl-Spacebar. The application you selected launches.

To create a Hide Models Command clip:

- 1 Drag an object, such as a light or a model, from the Viewer window and drop it on the Hide Models Command clip.

The name of the object displays at the bottom of the clip.

TIP You can also drag objects from the Scene browser into the Command clip.

- 2 Press Ctrl-Spacebar. The object disappears when the Timeline indicator passes over the clip. The object does not reappear, unless you add a Show Models Command clip.

TIP You can apply more than one model to the same command clip by Ctrl-clicking a group of them in the Viewer window and dragging them into the command clip or Clip content field.

To create the Show Models Command clip:

- 1 Drag an object, such as a light or a model, from the Viewer window and drop it on the Hide Models Command clip.

The name of the object displays at the bottom of the clip.

TIP You can also drag an object from the Scene browser.

- 2 Press Ctrl-Spacebar. The object displays when the Timeline indicator passes over the clip. The object does not disappear again, unless you add a Hide Models Command clip.

TIP You can apply more than one model to the same command clip by Ctrl-clicking a group of them in the Viewer window and dragging them into the command clip or Clip content field.

- [Command clips](#) on page 1551

Creating constraints clips

Used with Constraint tracks, constraint clips let you animate the use of constraints.

To create constraint clips:

- 1 Drag constraints from the Asset browser or Scene browser to the Action Track list.

Use constraint clips to make constraints active for only a segment of a take. For example, you can use a Parent-Child constraint between a cup and a character's hand. You can create a constraint clip with the Parent-Child constraint to make the constraint active only when the clip plays, so that you can give the impression that the character is actually picking up the cup halfway through the animation.

- [Constraints clips](#) on page 1553
- [Animating with Constraints](#) on page 819

Creating audio clips

Used with Audio tracks, audio clips let you animate the use of audio files.

NOTE You can create Audio tracks in both the Action and Edit timelines.

To insert an audio clip:

- 1 Right-click the Action Track list and select Insert > Audio Track from the contextual menu.
- 2 Right-click the new Audio track and select Insert Audio File from the contextual menu.

- 3 Use the Open File dialog box that opens to browse to the audio file of your choice and click Open. The audio file appears as a clip on the Audio track.

NOTE If you are creating an Audio track on the Edit timeline, you may need to expand the timeline to see anything other than the first Shot track.

- [Audio clips](#) on page 1553

Creating video clips

Used with Video tracks, video clips let you animate the use of video files.

NOTE You can create Video tracks in both the Action and Edit timelines.

To create a video clip:

- 1 Drag a video file from the Asset browser or Scene browser into the Action Track list.
- 2 Drag the Video track containing the video clip into the Viewer window. You can use the video as a background or video plane if you drag the track into empty space, or you can drop it on a model to use it as a video texture.

NOTE If you are creating an Video track on the Edit timeline, you may need to expand the timeline to see anything other than the first Shot track.

Contextual menu for selected clips

This section describes the options found in the Story window's contextual menu that are available when you right-click one or more selected clips. See [Story contextual menu](#) on page 1515 and [Contextual menu for selected tracks](#) on page 1545 for information on additional menu options.

You can also access some of these options from the Story Controls. See [Story Controls](#) on page 1511.

Depending on where you right-click and what is selected, the options in the contextual menu may change. For example, right-clicking in the Edit Track list shows different options than right-clicking in the Action Track list. The options that appear also change depending on which tracks or clips are selected and apply to the selection.

The options described in the rest of this topic are listed according to the order in which they appear in the contextual menu. The options that are listed appear regardless of which Track list you right-click, unless otherwise indicated.

The following contextual menu items may appear when one or more clips are selected in the Story window:

- [Select Camera](#) on page 1562
- [Make Camera Current](#) on page 1562
- [Change Media File](#) on page 1562
- [Change Take](#) on page 1563
- [Make Clip Writable](#) on page 1563
- [Make Clip Read-Only](#) on page 1564
- [Export Clip](#) on page 1564
- [Clear Values Without Keys](#) on page 1564
- [Assign Sources To Destinations](#) on page 1565

Select Camera

Select Camera lets you select a shot clip's camera. This option appears when a shot is selected in the Edit Track list.

Make Camera Current

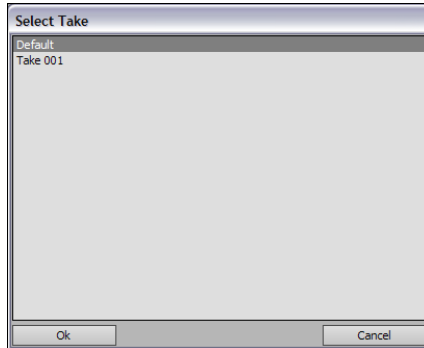
Make Camera Current switches the camera view in the Viewer window to a camera that can be used by a camera shot. The Make Camera Current option is available when a shot is selected in the Edit Track list.

Change Media File

Active when an audio, video, or character clip is selected, the Change Media File option lets you select a different media file for the clip.

Change Take

The *.fbx* files you use as animation, character and camera animation clips can contain more than one take. The clip uses only one of the takes by default. The Change Take option opens a dialog box, which lets you select a different take for the clip.



Select Take dialog box

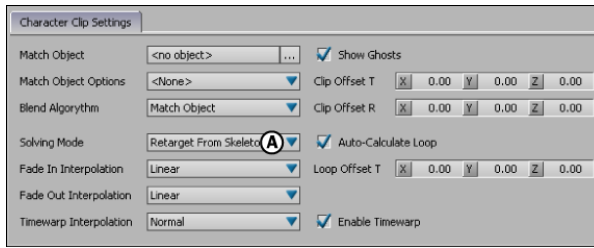
Make Clip Writable

The Make Clip Writable option lets you make read-only clips writable. When a clip is writable, its keyframes display, letting you edit them and set new keyframes. A writable clip's keyframes display and can be edited only when the clip's track content is selected and the track's Animate option is active.

The Make Clip Writable option appears when you right-click a read-only animation clip, camera animation clip, or character clip. However, this option does not appear if the clip's animation is retargeted.

For example, a character clip's animation is automatically retargeted when the skeleton it was plotted to is different than the skeleton of the character selected in the track's Character field.

The Solving Mode menu, which displays in the Asset Settings window, lets you see which solving mode a character clip is using. If Retarget From Skeleton is selected, the clip can only be made writable if you plot the animation to the current skeleton. When Skeleton or Control Rig is selected in the menu, the clip can be made read-only.



Asset Settings window A. Solving Mode menu

Make Clip Read-Only

The Make Clip Read-Only option appears when you right-click a writable animation clip, character clip, or camera animation clip. This option lets you save the contents of a clip and make them read-only.

The clip is saved as an *.fbx* file the you can reuse by dragging it from the Asset browser to the Story window. See [Creating animation clips](#) on page 1555, [Creating animation clips](#) on page 1555, or [Creating camera animation clips](#) on page 1556 for more information.

When a clip is read-only, its keyframes do not display and you cannot set keyframes on it.

Export Clip

The Export Clip option appears when you right-click on a writable animation clip, character clip, or camera animation clip.

The Export Clip option lets you save a clip as an *.fbx* file without making it read-only as well. You can reuse the *.fbx* file by dragging it from the Asset browser to the Story window.

Clear Values Without Keys

A clip can exist without keyframes. A clip without keyframes is created when a track's Animate button is active and you translate, rotate, or scale the track's selected asset. Such a clip displays the letter "c" in parentheses.

This clip contains certain initial values, even though it does not have keyframes. These values are the transform values of the track's selected asset.

For example, if you rotate an object 90 degrees, the clip that is created contains that value and the object remains rotated 90 degrees. If you create a second

similar clip, where you rotate the object again, the object rotates between the two clips.

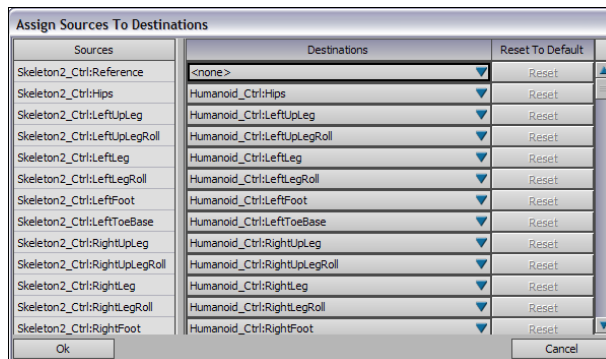
You can change the values of a clip by placing the Timeline indicator on the clip and transforming the object again.

The Clear Values Without Keys option lets you erase the transform values of a selected clip. When a clip is empty, it contains no values and does not animate the object in any way. The “c” in parentheses does not display on an empty clip.

Assign Sources To Destinations

The selected assets in a track and the track’s clips are linked automatically. The Assign Sources To Destinations option opens a dialog box which lets you view and change these links.

The Assign Sources To Destinations option is active when you right-click animation, camera animation, and character clips.



Assign Sources To Destinations dialog box

Saving animation clips

You can save animation clips to use with new objects. This can be useful when you want to reuse a complex animation.

To save an animation clip:

- 1 In the Story window, Alt-drag an animated object into the Action Track area.

An empty track appears and the name of the animated object displays in the Track content field.

- 2 Right-click the empty track and select Process Track/Subtracks to New Clip to create a clip from the object's animation.
- 3 The Process Tracks and Subtracks dialog box appears. Set the frame rate and activate any filtering from the Process Tracks and Subtracks dialog box options. Click Ok.
- 4 A Save Clip window appears. Name and save your clip.
A new animation track appears with your clip on it.

Reusing animation clips

You can use animation clips with other objects if you reassign the objects used in them.

To reuse an animation track:

- 1 In the Story window, right-click an empty Action track and select Insert Generic Animation track from the contextual menu.
A new Animation track is added.
- 2 Right-click the new track and select Insert Animation file from the contextual menu.
Select the animation clip you want to use from the Open File dialog box.
The animation clip is added to the track.
- 3 Rename the object you want to use the animation clip so it has the same name as the object that used the original animation.
- 4 In the Track Content asset list, assign a new object as the object to be used by the Animation clip.

Manipulating clips

91

Once you have created a clip (see [Story clips](#) on page 1549), you can manipulate it to edit the animation, video, and audio in your scene.

This section includes the following topics:

- [Selecting clips](#) on page 1567
- [Cutting, copying, and pasting clips](#) on page 1568
- [Moving clips](#) on page 1569
- [Cross-blending Story clips](#) on page 1572
- [Fading clip animation](#) on page 1573
- [Holding clip animation](#) on page 1574
- [Looping clips](#) on page 1575
- [Reversing clips](#) on page 1576
- [Scaling clips](#) on page 1578
- [Razoring clips](#) on page 1579
- [Trimming clips](#) on page 1580
- [Matching clips](#) on page 1582
- [Changing the color of a clip in the Story window](#) on page 1591

Selecting clips

Select clips to rearrange them on their tracks. In some cases, you can only access some contextual menu items or perform actions if a track has been selected.

To select a clip, do one of the following:

- Select a clip by clicking on it once. You can select multiple clips by Ctrl-clicking, Shift-clicking, or by Spacebar-dragging around them.
- You can also select clips using the Select contextual menu option (see [Select Clips](#) on page 1519).
- You can also select a clip from the Viewer window by double-clicking its clip vector ghost.

NOTE If you have a clip selected when you change panels, they become deselected. This is to protect you from accidentally razoring, cutting or deleting clips that are not visible or active.

Cutting, copying, and pasting clips

The following steps show you how to cut, copy, and paste clips in the Story window.

To cut clips:

- 1 Select a clip or many clips.
- 2 Click the Cut button. The selected clip is removed and stored in memory. You can also use the keyboard shortcut Ctrl-X to cut selected clips.

NOTE You can also cut a clip and paste it onto another track by dragging it from one track to another.

To copy clips:

- 1 Select a clip or many clips.
- 2 Click the Copy button to copy selected clips and store them in memory for insertion into another location. You can also use the keyboard shortcut Ctrl-C to copy selected clips.

To paste clips:

- 1 Select a clip or many clips.

- 2 Click the Paste button to insert a copied or cut selection into another location. You can also use the keyboard shortcut Ctrl-V to paste the copied or cut selection.
- 3 The selection is pasted onto a selected track at the current timecode or to the right of all the clips if there is no room.

NOTE You can also cut a clip and paste it onto another track by dragging it from one track to another.

- [Story clips](#) on page 1549
- [Manipulating clips](#) on page 1567

Moving clips

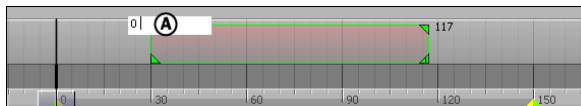
You can move a clip in time and in space. Moving a clip along a track in the Story window alters the time at which its animation plays. Moving a clip in the Viewer window alters where and in which direction its assets move.

To move a clip:

- 1 Select a clip or many clips.
- 2 Drag the clip(s) left and right on the track.
To move more than one clip at once, you can Ctrl-click each one to select them, then drag them. You can slash (/)-drag one clip to make all the clips to the right retain their distance from each other on the track.

To move a clip using its Clip In timecode:

- 1 Select a clip.
- 2 Double-click the clip.
- 3 Enter a new value in the Clip In timecode, and press Enter.



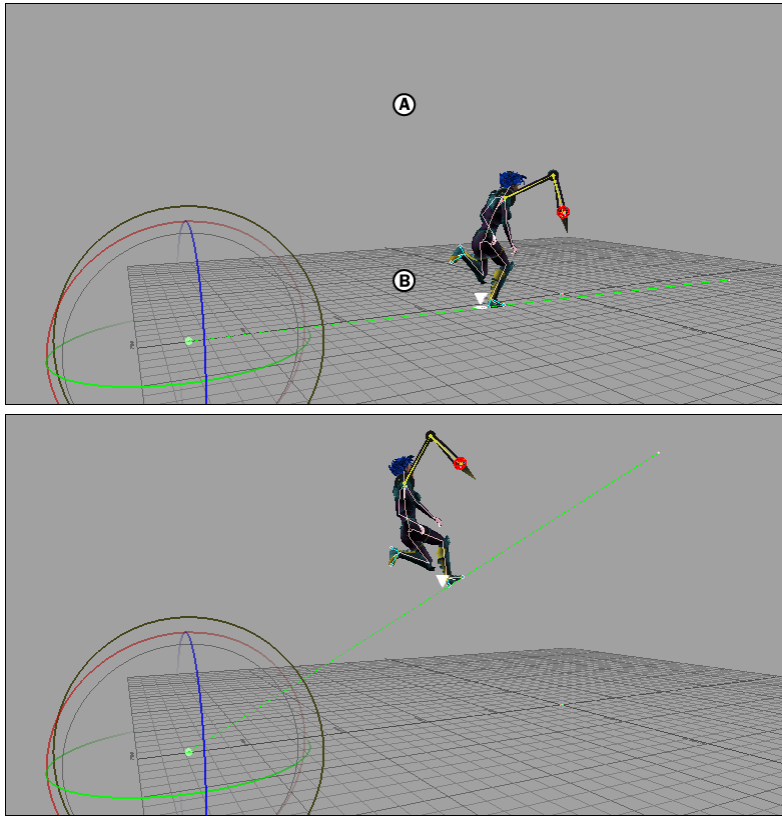
A. Change the value of a Clip In timecode to move the clip.

NOTE Do not change the Clip Out timecode of a clip unless you want to trim the clip.

To change a clip's trajectory in the Viewer window:

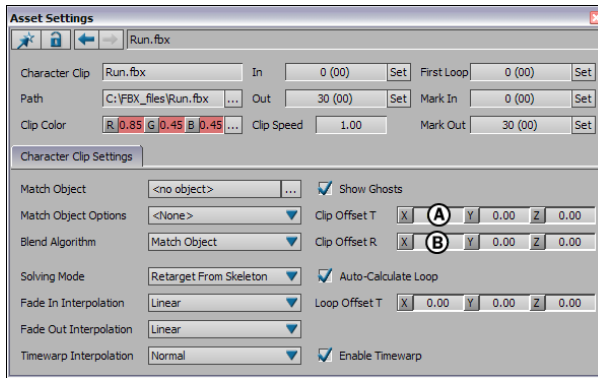
- 1 Select a clip in the Story window.
- 2 Translate and rotate it the Viewer window by manipulating its ghosts.
Translating and rotating a clip's ghost changes where the animation plays and in what direction. The ghost you select is the pivot point of the clip when you rotate it.

For example, in the next image, the start of the clip's ghost clip vector is selected. The clip pivots around the selection. If part of the model ghost is selected instead, the clip rotates around that part.



Moving a clip in the Viewer window A. The start of a clip's clip vector ghost is selected. B. The clip vector is rotated around the selection.

You can also translate and rotate a clip in the Viewer window by changing the values in the Clip Offset T and Clip Offset R fields (A and B) that display in the Asset Settings window and Properties window. These settings display in the Asset Settings window and Properties window when you double-click a clip.



Asset Settings window A. Clip Offset T settings B. Clip Offset R settings

■ [Story ghosts](#) on page 1593

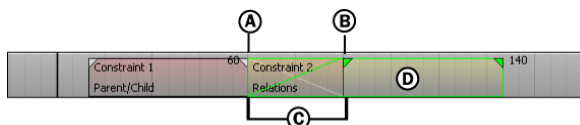
Cross-blending Story clips

When two animation, character, or camera animation clips on the same track do not overlap, the animation is blended by interpolation. When two clips overlap, the blend is called a cross-blend.

You can cross-blend animation, character, camera animation, and constraint clips. Cross-blending animation clips can create smoother animation. For example, blending constraints clips is useful when you want to create the impression that a model is under the influence of many actions.

To cross-blend two clips:

- 1 Select a clip in the Story window.
- 2 Drag one clip over another.



Constraints cross-blend A. First clip's Fade Out handle B. Selected clip's Fade In handle C. Blend area D. Selected clip

When an Animation, Character, or Camera Animation track's Animate option is active, the beginning and end of cross-blends on these tracks are represented in the FCurves window by small vertical lines.

Fine-tune the blend by dragging the clip's Fade and Still handles.

To create a cross-blend for camera shots, see [Creating a cross-fade effect with camera shots](#) on page 1620.

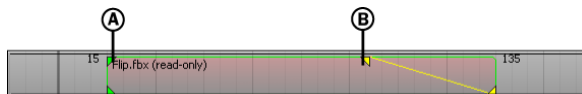
- [Story clips](#) on page 1549
- [Fading clip animation](#) on page 1573
- [Holding clip animation](#) on page 1574

Fading clip animation

You can fade the animation of character clips, animation clips, camera animation clips, and constraints clips.

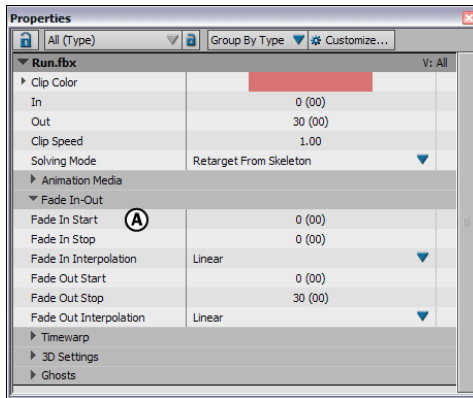
To fade clip animation:

- 1 Select a clip in the Story window.
- 2 Drag a clip's Fade In and Fade Out handles inward (A and B).
This changes where the clip starts and ends without scaling it or moving the clip.



Character clip A. Fade In handle B. Fade Out handle

You can also change the values of a selected clip's Fade In and Fade Out points in the Properties window.



Properties window A. Fade In-Out properties

- [Story clips](#) on page 1549
- [Manipulating clips](#) on page 1567

Holding clip animation

You can put a hold on the animation of character clips, animation clips, camera animation clips, and constraint clips.

To hold a clip's animation:

- 1 Select a clip in the Story window.
- 2 Dragging the Still In or Still Out handles outward (A and B) to hold the first or last state of a clip's animation.
When you drag these handles out, you can maintain the first or last frame of the animation for any number of frames without scaling or moving the clip.
- 3 You can also change the values of a selected clip's Still In and Still Out points in the Properties window (A and B).

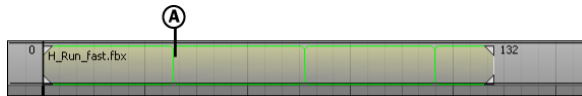


Character clip A. Still In handle B. Still Out handle

- [Story clips](#) on page 1549
- [Manipulating clips](#) on page 1567

Looping clips

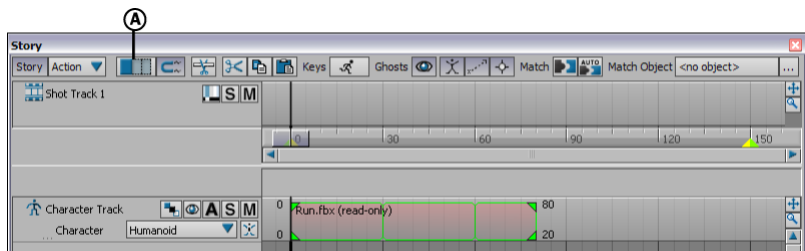
Looping clips lets you quickly duplicate animation so that it repeats. When a clip is looped, you can see the seams where it starts over again.



Looping character clip A. Seam

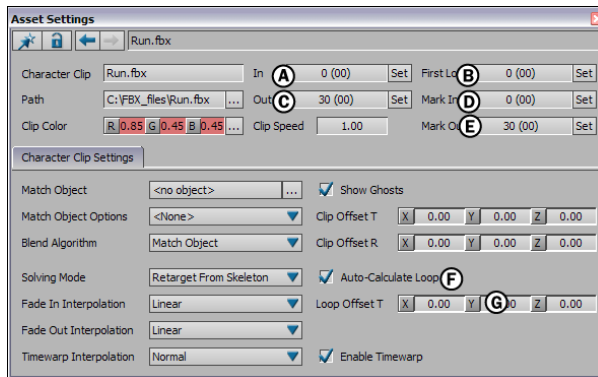
To loop a clip:

- 1 Select a clip in the Story window.
- 2 Make sure that Loop is selected in the Story Controls.
- 3 Drag the start or end of the clip outwards. You can also double-click the frame number at the start and end of a selected clip and enter a new frame number.



Story window A. Loop is active, letting you loop and trim clips.

- 4 If you want to trim the last loop of the clip, select the clip and use the Last Loop field in the Properties window to set an ending time for the loop. For example, if you have a clip that loops three times, you can set the end of the third loop so that it is shorter than the previous loop.
- 5 The Auto-Calculate Loop option in the Clip's Asset settings window lets you turn the automatic calculation of the loop offset on or off.
- 6 Use the Asset settings Loop Offset T values to change the loop's translation offset.



Asset Settings window A. In field B. First Loop field C. Out field D. Mark In field E. Mark Out field F. Auto-Calculate Loop option G. Loop Offset T settings

- [Story clips](#) on page 1549
- [Manipulating clips](#) on page 1567

Reversing clips

There are two different ways to make clips play backward, depending on whether or not the clip has been edited first.

To make an unedited clip play in reverse, follow the instructions for reversing an uncut clip. If you want to reverse only a segment of a whole clip, follow the instructions for reversing an edited clip.

To reverse an uncut clip:

- 1 Double-click the clip you want to reverse so that the clip's Asset settings display.
- 2 In the Clip settings area, activate the Enable Timewarp option.
- 3 Select the appropriate option from the Timewarp Interpolation menu.
The clip is reversed on the track so that it starts with the ending.

See [Timewarp Interpolation menu](#) on page 1612 for a description of the Timewarp Interpolation menu options.

To reverse an edited clip:

- 1 In the Story window, right-click on the character track (or clip) you want to reverse and select Plot Whole Scene to Current Take.
- 2 The Plot All Properties dialog box appears. Click Plot.
This plots everything the character is doing currently into the scene as one take.
- 3 Delete the selected clip.
- 4 Right-click the empty track and select Insert Current Take from the contextual menu.
The clip now becomes a keyframe animation clip on the track.
- 5 Select the clip and trim it using the Razor button.
- 6 Once you have made your edits, double-click the clip so that the Character Clip settings appear.
- 7 In the Character Clip settings, activate the Enable Timewarp option.
- 8 Select the appropriate option from the Timewarp Interpolation menu.
The clip is reversed on the track.

See [Timewarp Interpolation menu](#) on page 1612 for a description of the Timewarp Interpolation menu options.

- [Story clips](#) on page 1549
- [Manipulating clips](#) on page 1567

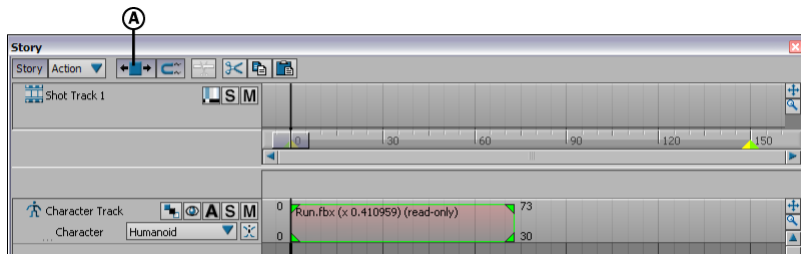
Scaling clips

Scaling clips lets you alter the length and speed of animation, character, camera animation, and video clips.

To scale a clip:

- 1 Select a clip in the Story window.
- 2 Select Scale in the Story Controls.
- 3 Drag the start or end of the clip left or right until it is resized.

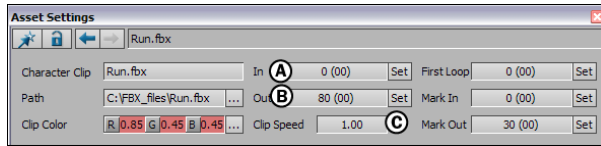
Scale more than one clip at a time by selecting multiple clips and dragging the start or end of one of them. You can also double-click the frame number at the start or end of a selected clip and enter a new frame number.



Story options A. Scaling is active.

When you double-click a clip in the Story window, the clip's settings display in the Asset Settings window. Some of these settings also let you scale a selected clip.

Changing the values in the In and Out fields (A and B) lets you scale a clip when Scaling is active. Changing the value in the Clip Speed field lets you scale a clip with a precise value.



Asset Settings window A. In field B. Out field C. Clip Speed field

- [Story clips](#) on page 1549
- [Manipulating clips](#) on page 1567

Razoring clips

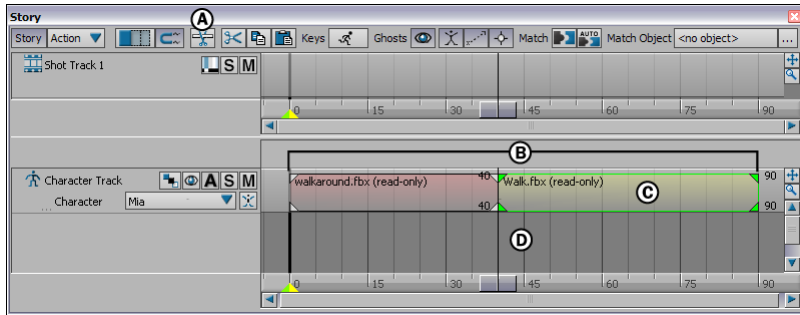
Use the Razor button to permanently delete segments of a clip. If you want to change the starting and ending points of a clip without cutting any part of the clip, trim your clips instead. (See [Trimming clips](#) on page 1580 for more information.)

Razoring a clip can be useful when, for example, you want to add a right turn to a walk cycle. With the Razor button, you can cut a walk-cycle clip in half and then rotate one of the clip vectors in the Viewer window to create the turn.

To razor a clip:

- 1 Select a clip.
- 2 Place the Timeline indicator where you want to razor the clip.
- 3 Click the Razor button.

The clip is split into two separate clips at the Timeline indicator's position.



Story window A. Razor button. B. Length of the original clip. C. The new clip D. The clip was razored at the current time.

- 4 Delete any parts of the clip you do not need by selecting and pressing Delete.

NOTE Deleting razored portions of clips is permanent. If you want to alter the clip so it starts or ends later, without cutting the clip see [Trimming clips](#) on page 1580.

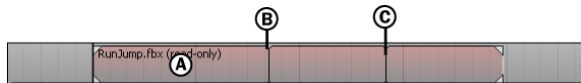
You can slice more than one clip at a time as long as the Timeline indicator is placed over them and the clips are selected. Clips that are not selected are not sliced.

- [Story clips](#) on page 1549
- [Manipulating clips](#) on page 1567

Trimming clips

Trim a clip when you want to alter the In and Out points for a specified length of time without affecting the clip. When you Trim a clip, you select only a segment of the original animation, audio or video, which you can then loop or scale.

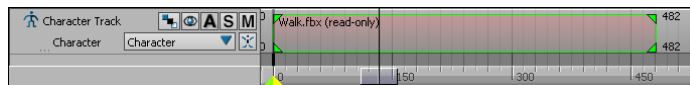
NOTE To edit a clip so that parts are deleted from it, use the Razor tool. see [Razoring clips](#) on page 1579.



Looping clip A. First loop B. Mark In C. Mark Out

To trim an animation, video, or audio clip:

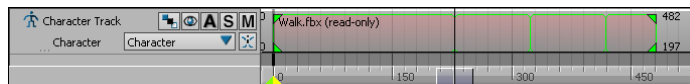
- 1 Double-click the clip to display its settings in the Asset Settings window.
- 2 Move the Timeline indicator to the point in the clip where you want it to start and click the Mark In field's Set button.



Move the indicator to where you want to trim the start of the clip.

- 3 Now, move the timeline indicator to where you want the clip to end and click the Mark Out field's set button.

The entire original clip is shown with the marked segment of the clip added to the end. The marked segment is shown looped until the end time of the original take.



Move the indicator to where you want to trim the start of the clip.

- 4 To trim the beginning part of the take, enter a value in the First Loop field, above the Mark In and Out fields. The First Loop field lets you trim the clip's first loop. This way, the first loop can be of a different length than the loops in the rest of the clip.

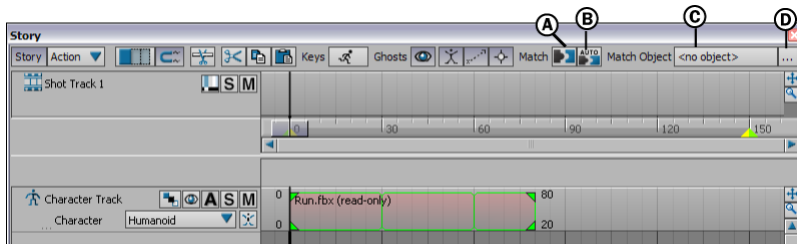
NOTE These values use the local time of the selected clip.

- [First Loop field](#) on page 1606
- [Story clips](#) on page 1549
- [Manipulating clips](#) on page 1567

Matching clips

When you blend animation in the Story window, it is important to match the animation between each clip. You can match a selected clip to the clip that comes before or after it along a track.

You can also match more than one clip at once by selecting all but the first clip.



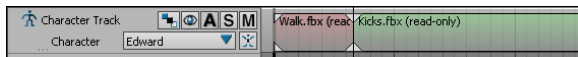
Match Controls in the Story window A. Match Options button B. Auto Match option C. Match Object field D. Match Object button

To match a clip:

- 1 Select the character to which you want to match clips in the Character track's Character menu.

NOTE The Match Controls are active only when an animation, camera animation, or character clip is selected.

- 2 If you have not done so, add two motion clips to the Character track and push them together so that there is no gap between them.



Character track with two motion clips added.

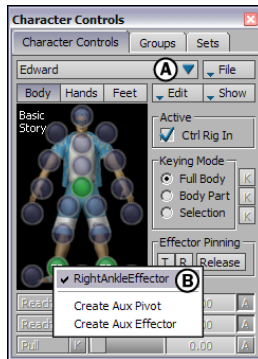
NOTE It is a good idea to use two motion clips that you have edited to facilitate matching. If the end of the first clip is similar to the beginning of the second clip, for example, the Character's left foot is flat on the ground, the match is smoother, and you will have less fine-tuning to make.

- 3 Click the Animate (A) button in the Character track controls so you can create animation.



Character track A. --Animate button.

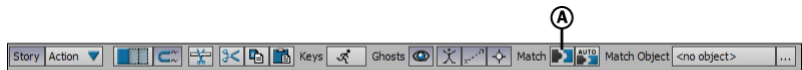
- 4 Select the second clip on the Character track.
- 5 In the Character Controls, select the character from the Character menu, and right-click a character effector to select it to be the Matching object, for example, the character's right foot.



Character Controls window. A. Select your Character in the Character menu B. Right-click an effector to select it.

NOTE You can also select the matching object from the Viewer window or the Schematic view.

- 6 Click the Match Options button in the Story controls.



Story controls A. Match Options button.

- 7 The Match Options dialog box displays with the name of the selected node appearing in the Match Object menu.

8 Activate the appropriate matching options for the match you are trying to create. For a description of options in the Match Options dialog box, see [Match Options dialog box](#) on page 1584.

9 Click Ok.

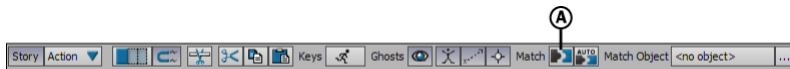
The clips match using the new match object.

- [Story clips](#) on page 1549
- [Manipulating clips](#) on page 1567

Match Options dialog box

Use the Match Options button in the Story window to open the Match Options dialog box, which lets you match clips to each other.

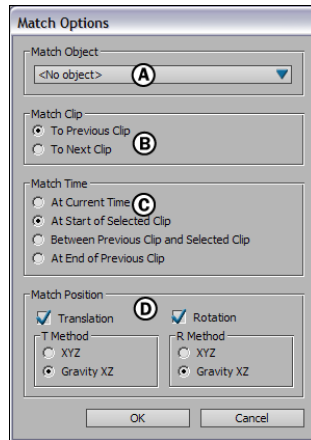
When you match two clips, the match object of a clip is matched with the match object of the clip before or after it on the track. When you do not select a match object, the travelling node is used by default to match clips.



Story Controls A. Match Options button

The Match Options dialog box consists of the following areas:

- [Match Object menu](#) on page 1585, A
- [Match Clip options](#) on page 1586, B
- [Match Time options](#) on page 1586, C
- [Match Position options](#) on page 1589, D



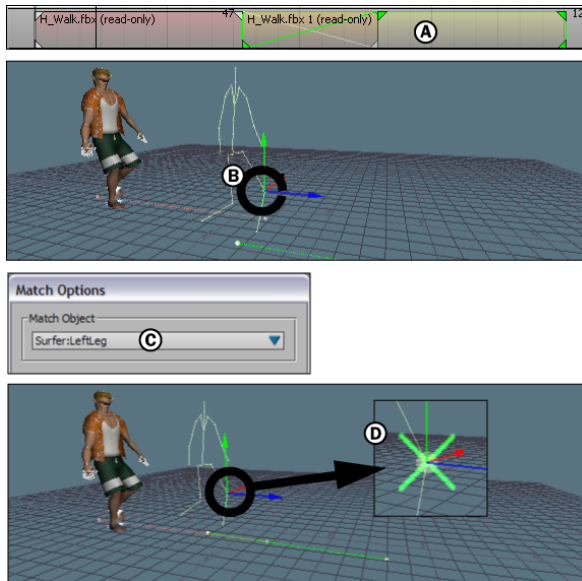
Match Options dialog box A. Match Object menu B. Match Clip options C. Match Time options D. Match Position options

Match Object menu

Use the Match Object menu to select which part of the track content used to match clips.

You can also disable the match object so that the blend does not take it into account when you match clips. See [Blend Algorithm menu](#) on page 1610 for more information.

You can also select a match object using the Match Object field and button. See [Match Object field](#) on page 1589 for more information.



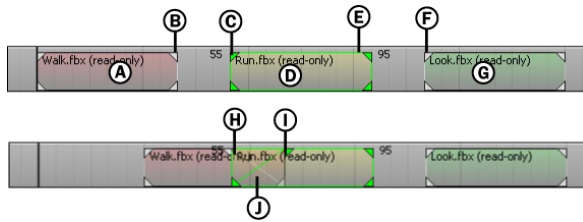
Choosing a new match object *A*. Select the clip *B*. Select the new match object *C*. The name of the new match object appears in the Match Object menu. *D*. The match object is used when you click Match.

Match Clip options

The Match Clip options in the Match Options dialog box let you select which clip you are matching. There are two choices: To Previous Clip, where the selected clip is matched to the clip before it on the track, or To Next Clip, which matches the selected clip the clip after it on the track.

Match Time options

The Match Time options let you select at which point of a cross-blend the selected clip is matched.



Cross-blend A. Previous clip B. Previous clip's Out point C. Selected clip's In point D. Selected clip E. Selected clip's Out point F. Next clip's In point G. Next clip H. Blend start I. Blend stop J. Mid-blend

The Match Time options change depending on which Match option is selected.

NOTE When matching clips, it is always the selected clip that plays in the Viewer window.

To Previous Clip

When To Previous Clip is selected in the Match Time area, the Match Time menu contains the following options:

| Option | Function |
|---|---|
| At Current Time | Matches the start of the selected clip to the previous clip at the current time. |
| At Start of Select Clip | Matches the start of the selected clip to the start of the blend with the previous clip. When there is no cross-blend between clips, the start of the selected clip is matched to the end of the previous clip. |
| Between Previous Clip and Selected Clip | Matches the selected clip and the previous clip at the middle of the blend. When there is no cross-blend between clips, the start of the selected clip is matched to the end of the previous clip. |
| At End of Previous Clip | Matches the end of the blend with the selected clip to the end of the previous clip. When there is no cross-blend between |

| Option | Function |
|--------|---|
| | clips, the start of the selected clip is matched to the end of the previous clip. |

To Next Clip

When To Next Clip is selected in the Match Time area, the Match Time menu contains the following options:

| Option | Function |
|-------------------------------------|---|
| At Current Time | Lets you match the start of the selected clip to the next clip at the current time. |
| At Start of Next Clip | Matches the start of the blend with the selected clip to the start of the next clip. When there is no cross-blend between clips, the end of the selected clip is matched to the start of the next clip. |
| Between Selected Clip and Next Clip | Matches the selected clip and the next clip at the middle of the blend. When there is no cross-blend between clips, the end of the selected clip is matched to the start of the next clip. |
| At End of Selected Clip | Matches the end of the selected clip to the end of the blend with the previous clip. When there is no cross-blend between clips, the start of the selected clip is matched to the end of the previous clip. |

Match Position options

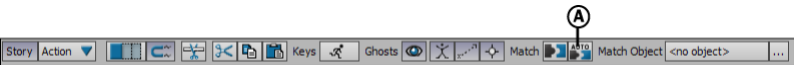
The Match Position options (C and D) let you determine if and how a clip's match object is translated and rotated to match another clip's animation, by selecting XYZ or Gravity XZ. The Match Position menu items are as follows:

| | |
|------------|--|
| XYZ | Translates or rotates a selected clip's match object to the same location or orientation as the previous clip's match object. |
| Gravity XZ | With the Translate (T) option, translates a selected clip's match object along the global X and Z axes. With the Rotation (R) option, rotates a selected clip's match object around the global Y axis. |

Auto Match option

The Auto Match option lets you match clips automatically as you add or paste clips. A clip you add or paste is matched to the clip on its left.

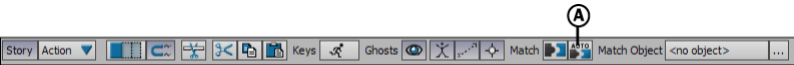
Matching with the Auto Match option involves the options selected in the Match Options dialog box. See [Match Options dialog box](#) on page 1584 for more information.



Story Controls A. Auto Match option

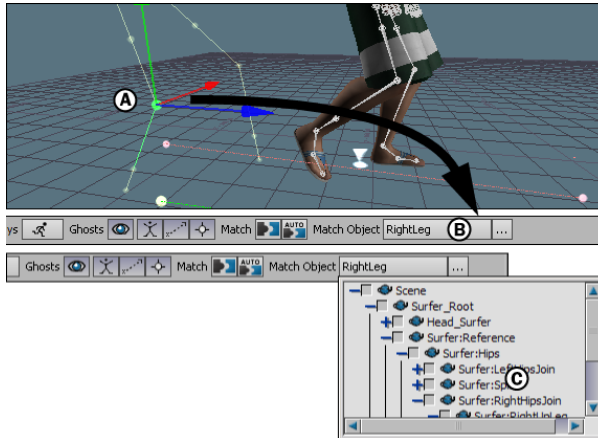
Match Object field

The Match Object field (A and B) lets you select a match object for each animation, character, or camera animation clip. The match object you select affects how clips match. By default, a clip has no match object and the travelling node is used to match clips.



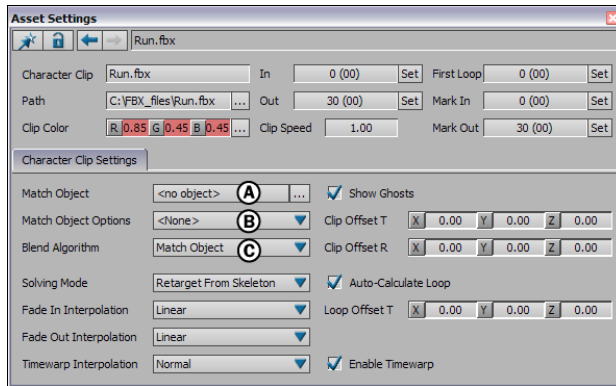
Story Controls A. Match Object field

To select a match object, Alt-drag a selection into the Match Object field (A and B). You can also click the Match Object button, which lets you select a match object from the Asset list. The Asset list displays the entire contents of a scene, but you should only select a match object that is selected in the track.



Selecting a match object A. Drag a selected node into the Match Object field **B**. The name of the custom match object appears in the Match Object field **C**. Asset list.

When you double-click on animation, camera animation, or character clip, its settings display in the Asset Settings window. These settings include the Match Object Options menu and the Blend Algorithm menu, as well as the Match Object field and button. What you select in the Match Object Options menu and in the Blend Algorithm menu affects the match object selected in the Match Object field. See [Match Options dialog box](#) on page 1584 and [Blend Algorithm menu](#) on page 1610 for more information.



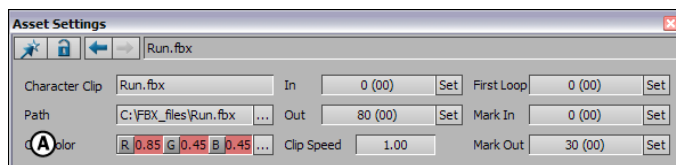
Character Clip settings in the Asset Settings window A. Match Object field B. Match Object Options menu C. Blend Algorithm menu

Changing the color of a clip in the Story window

The Clip Color settings let you change the color of a selected clip. This can be useful if you need to quickly identify a group of clips.

To change the color of a clip:

- 1 Double-click a clip on a track in the Story window. The Asset settings appear.
- 2 Change the values in the R, G, and B, fields of the Clip Color field, or click the Color Window (...) button to open the Color window.



Asset Settings window A. Clip Color settings

For more on the Color window, see [Using the Color window](#) on page 9.

Story ghosts

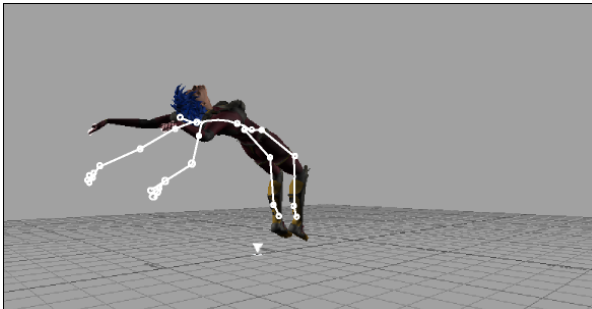
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Story ghosts are wireframe skeletons that display in the Viewer window to let you see and manipulate the location and duration of animation in selected clips and tracks.

Ghosts represents a track's or clip's content and change depending on what is selected. For example, when a character is selected in the Character field of a Character track, the character's ghost resembles the character's skeleton. When a cube is selected in a Track Content field, the cube's model ghost is a circle.

There are three kinds of Ghosts in the Story window:

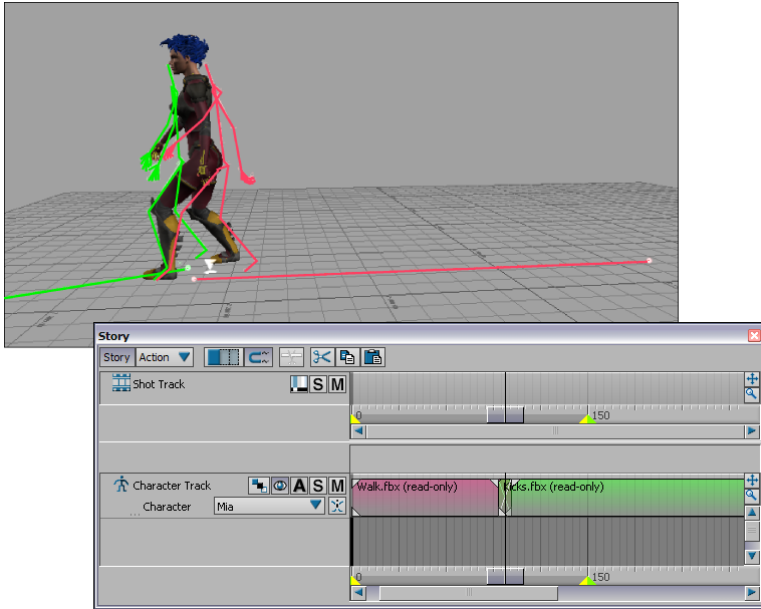
- **Track ghost:** A white wireframe ghost that shows the result of track. It is often difficult to see Track ghosts because they are usually hidden by the model .



The track ghost resembles a white skeleton on top of a model.

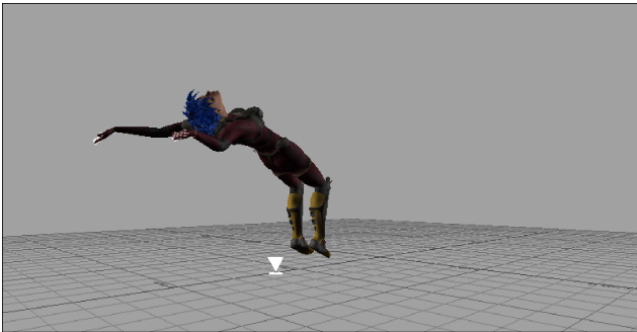
A track's ghost shows a composite of the result of the clips on that track or subtrack. (Click the Show/Hide Ghost button on that track to hide the ghost.) Track ghosts let you see the difference between the clip and the changes created by its sub-clips.

- **Clip ghost:** Clip ghosts are different-colored wireframe ghosts that show the length, location, and direction of a clip .



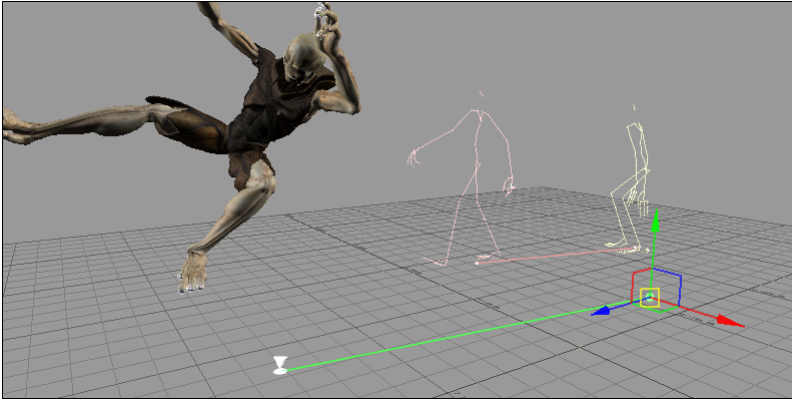
Clip ghosts show the progress of the clips on a track. Notice how the color of the ghost corresponds with the clip color.

- Travelling ghost: A Travelling ghost, also known as a Travelling node displays as a gray triangle that follows the track contents along the clip trajectories in the Viewer window .



The track ghost resembles a triangle that moves along the clip's trajectory.

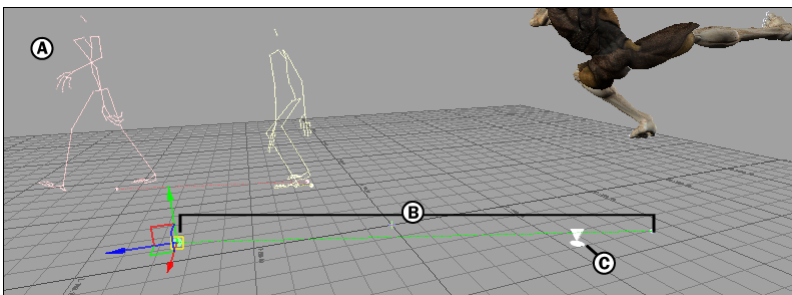
Story ghosts display in the Viewer window to let you see and manipulate the location and duration of animation in selected clips and tracks.



You can use the ghosts of clips and tracks to change the location and orientation of animation.

A ghost represents a track's content. For example, when a character is selected in the Character field of a Character track, the character's model ghost looks like the character's skeleton. When a cube is selected in a Track Content field, the cube's model ghost is a circle.

There are model ghosts for both clips and tracks. A clip's ghost has the same color as the clip on the track. A track's ghost is white and represents the result of all the animation in the track.



Viewer window A. Model ghost B. Clip vector C. Travelling node

Track ghosts

Clip vector

A clip vector ghost displays as a dotted line in the Viewer window. It represents the length, location, and direction of a clip. You can select and manipulate clip vector ghosts in the Viewer window. See [Selecting Story ghosts](#) on page 1597

Travelling node

A travelling node displays as a gray triangle in the Viewer window and follows the track contents along the each clip's trajectory.

A travelling node is the ghost of the track content or part of the track content. The default travelling node differs depending on the type of track content. For example, a character's default travelling node is its hips, but a cube's default travelling node is the entire cube.

By default, the travelling node displays on the floor (XZ plane), underneath the part of the track content that defines the travelling node.

You can modify a track's travelling node and where it displays using settings in the Asset Settings window. See [Travelling nodes](#) on page 1601 for more information.

- [Selecting Story ghosts](#) on page 1597
- [Ghosts options](#) on page 1598
- [Travelling nodes](#) on page 1601

Showing Story ghosts

Story ghosts can include model, clip vector, travelling node, and match object ghosts, depending on whether tracks or clips are selected.

NOTE A clip ghost is the same color as its associated clip on the track. You can make clip ghosts more visible by changing the clip's color.

- 1 Switch into X-Ray mode (Ctrl-A).
- 2 Select either a track or a clip.
 - When a clip is selected, the Ghost option hides or shows only that clip's ghosts.
 - When a track is selected, the Ghost option hides or shows that track's ghosts as well as the shown ghosts of the track's clips.

NOTE A track has a model ghost, a match object ghost, and a travelling node. A clip has its own model and match object ghosts, as well as a clip vector ghost (A, B, and C).

- 3 Select the Ghost option to hide or show all ghosts of selected tracks or clips .



Ghosts option

- [Story ghosts](#) on page 1593

Selecting Story ghosts

Select ghosts to change their location and orientation, or to select a match object.

To select and move a clip vector ghost:

- 1 Double-click a clip in the Story window.
- 2 The clip vector of the clip is selected in the Viewer window.
You can also click the clip vector in the Viewer window.

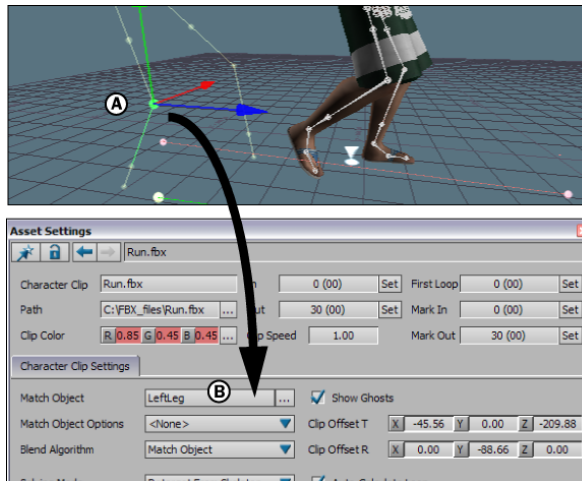
TIP The color of a ghost in the Viewer window matches the color of its clip in the Story window.

- 3 Translate and rotate the selected clip vector ghost.

To select a match object:

- 1 Double-click an animation, character, or camera animation clip in the Story window to access the Match Object field in the Asset Settings window.
The match object you select affects how clips match. By default, a clip has no match object and the travelling node is used to match clips.

- Alt-drag an object into the Match Object field . You should only select a match object from part of the track contents.



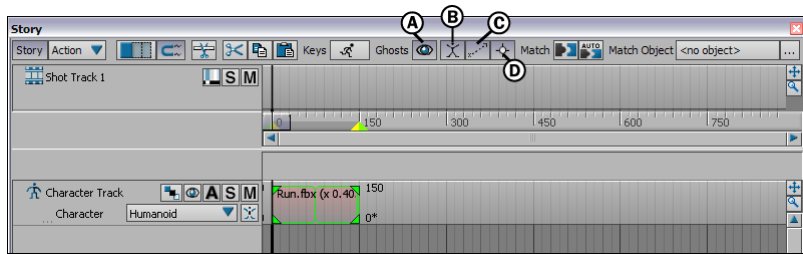
Selecting a match object A. Drag a selected node into the Match Object field B. The name of the custom match object displays in the Match Object field

The content of the Match Object field is affected by the options selected in Match Object Options menu and in the Blend Algorithm menu. See [Ghost Match Object option](#) on page 1600 and [Blend Algorithm menu](#) on page 1610 for more information.

Ghosts options

The Ghosts options let you hide and show various ghosts. These options display only when Animation, Camera Animation, and Character tracks or clips are selected.

Tracks and clips each have their own ghosts. Which ghost you hide or show depends on whether tracks or clips are selected as well as on which option you click. For example, you can hide a clip's model ghost but show a track's model ghost at the same time.



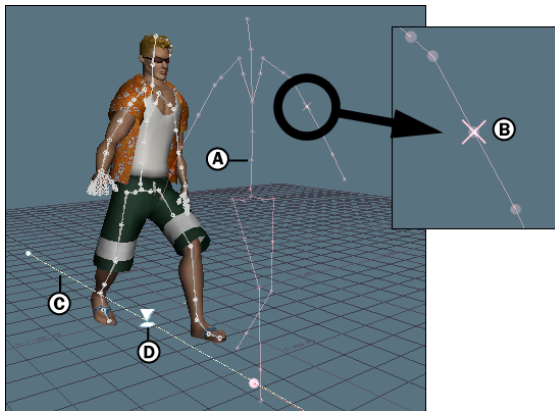
Ghosts options in the Story window A. Ghost option B. Model option C. Clip Vector/Travelling Node option D. Match Object option

The Ghost options consist of the following:

- [Ghost option](#) on page 1599
- [Model option](#) on page 1600
- [Clip Vector/Travelling Node](#) on page 1600
- [Ghost Match Object option](#) on page 1600

Ghost option

The Ghost option hides or shows all ghosts of selected tracks or clips . These ghosts can include model, clip vector, travelling node, and match object ghosts depending on whether you select tracks or clips.



Story ghosts A. Clip's model ghost B. Match object ghost C. Clip vector ghost D. Travelling node

A track has a model ghost, a match object ghost, and a travelling node. A clip has its own model ghost and its own match object ghost, as well as a clip vector ghost.

Model option

The Model option hides and shows a model's ghost.

Models have ghosts when the models are a track's content (the selected asset of a track). For example, when a character is selected in the Character field of a Character track, the character's model ghost looks like the character's skeleton. When a cube is selected in a Track Content field, the cube's model ghost is a circle.

When a clip is selected, the Model option lets you hide and show the clip's model ghost. A clip's model ghost is the same color as the clip.

When a track is selected, the Model option lets you hide or show the track's model ghost. A track's model ghost is white and represents the result of all the animation in the track.

Clip Vector/Travelling Node

The Clip Vector/Travelling Node option hides or shows either clip vector ghosts or travelling nodes, depending on whether tracks or clips are selected.

When a clip is selected, the Clip Vector/Travelling Node option lets you show or hide the clip vector ghost for a selected clip. When a track is selected, the Clip Vector/Travelling Node option lets you show or hide the track's travelling node.

See [Clip vector](#) on page 1596 and [Travelling node](#) on page 1596 for more information.

Ghost Match Object option

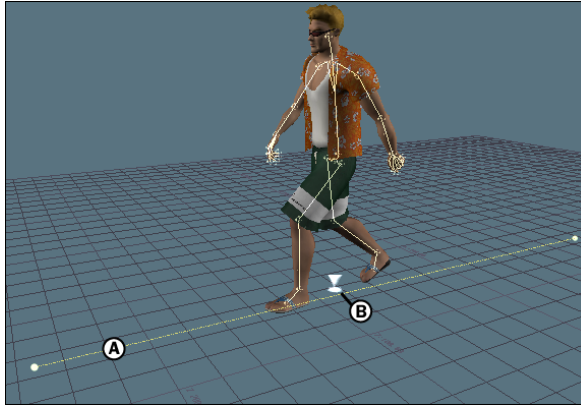
The Match Object option hides or shows the match object ghosts of tracks and clips. Ghosts of match objects look like crosses in the Viewer window. See [Matching clips](#) on page 1582 for more information on match objects.

- [Ghost Visibility option](#) on page 1534
- [Showing Story ghosts](#) on page 1596

Travelling nodes

A travelling node is the ghost of the track content or part of the track content. The default travelling node is different depending on the type of track content. For example, a character's default travelling node is its hips, but a cube's default travelling node is the entire cube.

A travelling node displays as a gray triangle in the Viewer window and follows the track contents along the clip trajectories.



Ghosts A. Clip vector B. Travelling node

By default, the travelling node displays on the floor (XZ plane), underneath the part of the track content that defines the travelling node.

NOTE

You can show and hide the travelling node using the Clip Vector/Travelling Node option. See [Clip Vector/Travelling Node](#) on page 1600 for more information.

- [Changing the position of a travelling node](#) on page 1601

Changing the position of a travelling node

You can change where the travelling node for an Animation, Character, or Camera Animation track displays by changing the option in the Travelling Node function menu.

By default, travelling nodes display on the floor (XZ plane), underneath the part of the track content that defines the travelling node.

To change the default travelling node:

- 1 Alt-drag a selected asset or bone from the Viewer window into the Travelling Node field, or click the Travelling Node button and select an asset or bone from the Asset list that is part of the track contents.

NOTE You can use more than one asset or bone as a travelling node. For example, you can Alt-drag a bone and a Null into the Travelling Node(s) field.

- 2 Select either Project on XZ Plane or Average from the Tr. Node function menu to specify where the node displays in the scene.

| Option | Position |
|---------------------|--|
| Project on XZ Plane | Displays the travelling node on the floor (XZ plane). If more than one asset or bone is selected in the Travelling Node menu, the travelling node displays at an average distance between the assets or bones on the XZ plane. |
| Average | Displays the travelling node at the average distance between the assets or bones selected in the Travelling Node field. When only one asset or bone is selected in the Travelling Node(s) field, the travelling node displays at the location of the selected asset or bone. |

Story clips in the Asset Settings window

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Clip settings display in the Asset Settings window when you double-click on a clip in the Story window. Select Layout > Story from the menu bar to see both windows at the same time.

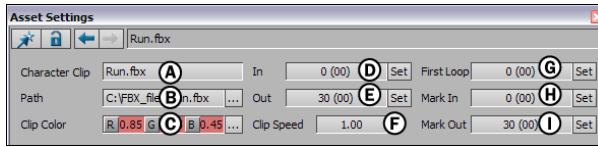
- Common clip settings display in the top half of the Asset Settings window when you select any type of clip. See [Common clip settings](#) on page 1603.
- Additional clip settings display in the bottom half of the Asset Settings window when specific types of clips are selected. See [Additional clip settings](#) on page 1607.

Common clip settings

This section describes all the settings that display in the top half of the Asset Settings window when most types of clip are selected. The settings in this section are:

- [Clip Name field](#) on page 1604
- [Path field](#) on page 1604
- [File Path field](#) on page 1604
- [Clip Content field](#) on page 1605
- [Clip Color settings](#) on page 1605
- [In and Out fields](#) on page 1605
- [Clip Speed field](#) on page 1606

- [First Loop field](#) on page 1606
- [Mark In and Mark Out fields](#) on page 1607



Common clip settings A. Clip Name field for a selected Character clip B. Path field and button C. Clip Color D. In field E. Out field F. Clip Speed G. First Loop field H. Mark In field I. Mark Out field

Clip Name field

The Clip Name field lets you rename each clip. Renaming a clip this way does not change the name of the clip's *.fbx* file.

Path field

The Path field displays the path of the selected animation, character, camera animation, audio, or video clip. An empty Path field indicates that the selected clip has not been saved.

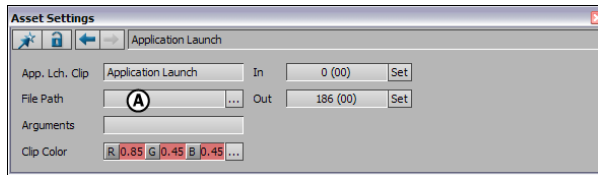
You can also click the browse (...) button beside the field to locate and load a different *.fbx* file for the clip.

File Path field

The File Path field displays in the Asset Settings window when an Application Launch command clip is selected. The File Path field lets you choose the application you want to launch when the command clip plays.

You can type the path in the field, or you can click the browse (...) button beside the field to locate the file.

You can create Application Launch command clips by dragging an Application Launch asset from the Command folder in the Asset browser to a Command track in the Story window.



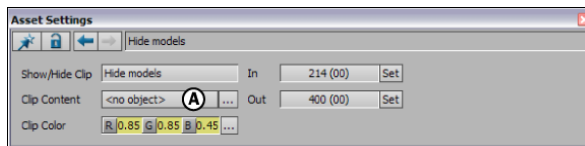
Common clip settings A. File Path field

Clip Content field

The Clip Content field lets you assign assets to Hide command and Show command clips. When you drag a Hide Models or Show Models asset from the Command folder in the Asset browser to the Story window, the new command clip that appears displays the name of the command followed by a <No models> message.

To assign a model to a Show Models or Hide Models command clip, select a model from the Viewer window and Alt-drag it into the Clip Content. You can also Alt-drag models from the Scene browser or from the Schematic view in the Viewer window.

You can Alt-drag a group of models into a single clip or its Clip content field.



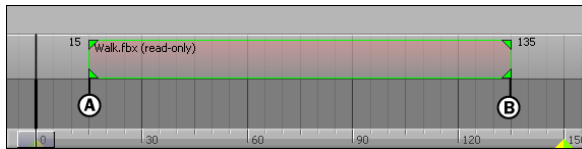
Common clip settings A. Clip Content field

Clip Color settings

The Clip Color settings let you change the color of a selected clip. You can also click the clip's Color (...) button to open the Color window.

In and Out fields

The In field lets you determine the selected clip's In point without changing the clip's Out point. The Out field lets you determine a clip's Out point without changing the clip's In point.



Clip A. In point B. Out point

The In and Out fields' Set buttons lets you change the value of the field to the current timecode.

Clip Speed field

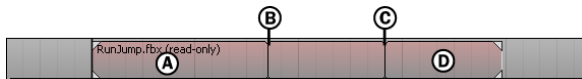
The Clip Speed field lets you change the speed of the clip's animation or video without changing the clip's In point or Out point.

First Loop field

The First Loop field lets you determine at which part of a clip the loop begins. The field uses the local time of the selected clip. You can loop every type of clip except command and constraint clips. See [Looping clips](#) on page 1575 for more information.

When you use the First Loop field, the first loop can be of a different length than the loops in the rest of the clip.

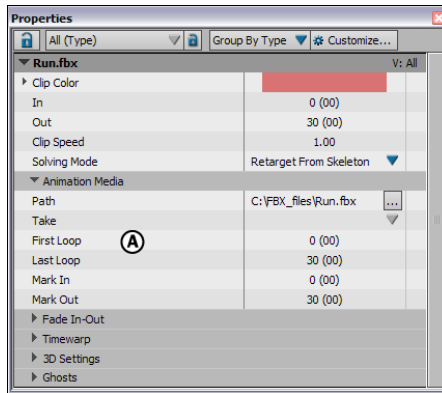
The First Loop field's Set button lets you change the value of the field to the current timecode.



Looping clip A. First loop B. Mark In C. Mark Out D. Last loop

Last Loop field

The Last Loop field in the Properties window lets you trim the end of the clip and determine at which part of the clip the last loop ends. The value uses the local time of the clip. For example, if you have a clip that loops three times, you can set the end of the third loop so that it is shorter than the previous loop.



Properties window A. Last Loop field

Mark In and Mark Out fields

The Mark In and Mark Out fields let you trim the beginning or end of a selected clip. The fields use the local time of the selected clip. The Mark In and Mark Out fields appear for selected animation, character, camera animation, video, and audio clips.

Trimming a clip lets you select a segment of the original animation, audio or video, which you can then loop or scale. Trimming does not change the length of the clip itself and does not permanently remove the ends of clip that are trimmed.

Each field's Set button lets you change the value of the field to the current timecode.

Additional clip settings

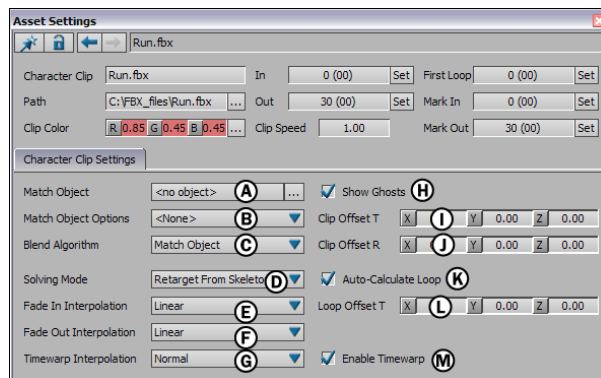
This section describes additional settings that display when animation, character, and camera animation clips are selected. These settings consist of the following:

- [Match Object field](#) on page 1608
- [Match Object Options field](#) on page 1609
- [Blend Algorithm menu](#) on page 1610
- [Solving Mode menu](#) on page 1610

- [Interpolation menus](#) on page 1611
- [Timewarp Interpolation menu](#) on page 1612
- [Enable Timewarp option](#) on page 1614
- [Show Ghosts option](#) on page 1614
- [Clip Offset T settings](#) on page 1614
- [Clip Offset R settings](#) on page 1614
- [Auto-Calculate Loop option](#) on page 1614
- [Loop Offset T settings](#) on page 1615

The settings that display for video and audio clips are the same settings that display when video and audio files are selected in the Scene browser.

There are no additional settings for command and constraint clips.



Additional clip settings A. Match Object field B. Match Object Options menu C. Blend Algorithm menu D. Solving Mode menu E. Fade In Interpolation menu F. Fade Out Interpolation menu G. Timewarp Interpolation menu H. Show Ghosts option I. Clip Offset T settings J. Clip Offset R settings K. Auto-Calculate Loop option L. Loop Offset T settings M. Enable Timewarp option

Match Object field

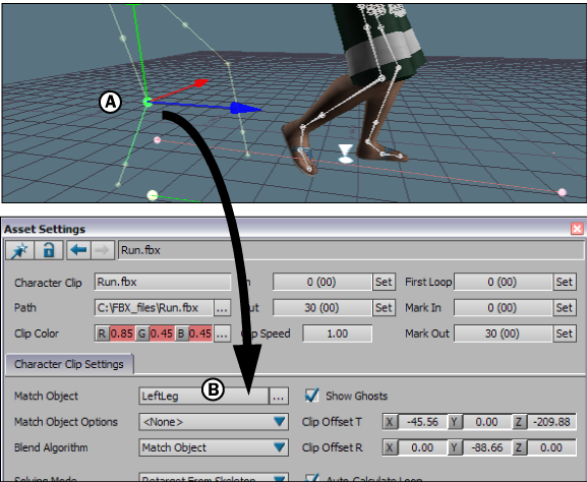
Double-click an animation, character, or camera animation clip in the Story window to access the Match Object field in the Asset Settings window.

The Match Object field lets you select a match object for each selected animation, character, or camera animation clip. The match object you select

affects how clips match. By default, a clip has no match object and the travelling node is used to match clips.

To select a match object, Alt-drag an object into the Match Object field . You should only select a match object from part of the track contents.

The content of the Match Object field is affected by the options selected in Match Object Options menu and in the Blend Algorithm menu. See [Match Object Options field](#) on page 1609 and [Blend Algorithm menu](#) on page 1610 for more information.



Selecting a match object A. Drag a selected node into the Match Object field B. The name of the custom match object displays in the Match Object field

Match Object Options field

Double-click an animation, character, or camera animation clip in the Story window to access the Match Object Options field in the Asset Settings window.

The Match Object Options menu lets you select options that determine the position of the match object's ghost.

| Match option | Ghost position |
|--------------|---|
| <None> | Uses the travelling node to match clips instead of a match object. A match object does not display when <None> is selected. |

| Match option | Ghost position |
|---------------------|---|
| Project on XZ Plane | Displays match object's ghost on the floor (XZ plane). If more than one asset or bone is selected as the match object, the match object displays at an average distance between the assets or bones on the XZ plane. |
| Average | Displays the match object at the average distance between the assets or bones selected as the match object. When only one asset or bone is selected as the match object, the match object displays at the location of the selected asset or bone. |

Blend Algorithm menu

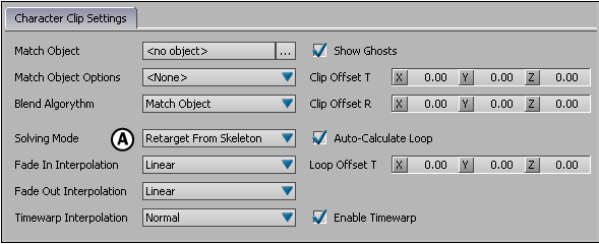
Double-click an animation, character, or camera animation clip in the Story window to access the Blend Algorithm menu in the Asset Settings window.

The Blend Algorithm menu lets you select between Normal and Match Object blend options. These options activate and disable a track's match object, which affect the way clips match.

| Option | Match behavior |
|--------------|--|
| Normal | Does not take the match object into account when you match clips. |
| Match Object | Uses the match objects when you click the Match Options button. For more information on matching and match objects, see Match Options dialog box on page 1584. |

Solving Mode menu

The Solving Mode menu, which displays for selected character clips, displays the current solving mode.



Character clip settings A. Solving Mode menu

| Solving mode | Behavior |
|------------------------|---|
| Retarget From Skeleton | This option is automatically selected when animation is retargeted from one Character to another. Retargeting occurs when the skeleton to which the clip’s animation was plotted is different than the skeleton of the Character selected in the track’s Character field. |
| Skeleton | This option is automatically selected when the selected clip is created using the same skeleton as the skeleton of the Character in the track. |
| Control Rig | This option is automatically selected when the selected clip was created using the Character’s control rig. |

Interpolation menus

The Fade In and Fade Out Interpolation menus (E and F) let you choose interpolation options for the In and Out points of selected animation, character, and camera animation clips.

| Option | Behavior |
|--------|---|
| Custom | The Custom options open panes which let you create your own interpolation using function curves. When you select the Custom option from the Fade In or Fade Out |

| Option | Behavior |
|--------|--|
| | Interpolation menus, the Custom Fade In Interpolation or Custom Fade Out Interpolation panes appear. See Function curves on page 737” for more information on using the settings in these panes. |
| Linear | Creates Linear interpolation at the In or Out point of the clip. Linear interpolation is the default setting for both the Fade In and Fade Out menus. |
| Smooth | Creates smooth interpolation at the In or Out point of the clip. |
| Slow | Slows a clip’s animation at the In or Out point of a clip. |
| Fast | Speeds up a clip’s animation at the In or Out point of a clip. |

Timewarp Interpolation menu

Double-click an animation, character, or camera animation clip in the Story window to access the Timewarp Interpolation menu in the Asset Settings window.

The Timewarp Interpolation menu lets you modify the clip’s animation rate, for example, you can speed up, slow down, or reverse animation without changing its length. This menu is affected by the Enable Timewarp option (see [Enable Timewarp option](#) on page 1614).

| Option | Behavior |
|--------|--|
| Custom | Opens the Custom Timewarp pane, which lets you edit the selected clip’s animation using function curves. The settings in this pane are similar to those in the FCurves window (see Function curves on page 737). Use the Enable Timewarp option (see En- |

| Option | Behavior |
|-------------------------|---|
| | able Timewarp option on page 1614) to disable the result of the pane without deleting it. |
| Normal | The clip plays normally. |
| Smoothed Ends | The clip's animation begins slowly, speeds up, and then ends slowly. The length of the animation does not change. |
| Going Faster | The clip's animation speeds up as it plays, starting very slowly and ending very fast. The length of the animation does not change. |
| Slowing Down | The clip's animation slows down as it plays, starting very fast and ending very slowly. The length of the animation does not change. |
| Reversed | The clip's animation plays backwards. |
| Reversed, Smoothed Ends | The clip's animation plays backward and its speed is affected. The animation begins slowly, speeds up, and then ends slowly. The length of the animation does not change. |
| Reversed, Going Faster | The clip's animation plays backwards and speeds up as it plays, starting very slowly and ending very fast. The length of the animation does not change. |
| Reversed, Slowing Down | The clip's animation plays backwards and speeds up as it plays, starting very fast and ending very slowly. The length of the animation does not change. |

Enable Timewarp option

Double-click an animation, character, or camera animation clip in the Story window to access the Enable Timewarp option in the Asset Settings window. The Enable Timewarp option lets you disable or activate the result of the Custom Timewarp pane.

Show Ghosts option

Double-click an animation, character, or camera animation clip in the Story window to access the Show Ghost option in the Asset Settings window.

The Show Ghost option lets you show or hide the ghosts of a selected clip. Ghosts are hidden by default. This option displays when an animation, camera animation, or character clip is selected.

The ghosts affected by the Show Ghost option include a selected clip's model, clip vector, and match object ghosts. The Show Ghost option controls the visibility of these ghosts as a group.

Also, clip ghosts can display only if the ghost visibility options of the clip's track is active. See [Ghosts options](#) on page 1598 for more information on track ghosts.

Clip Offset T settings

Double-click a character or animation clip in the Story window to access the Clip Offset T settings in the Asset Settings window.

The Clip Offset T settings let you translate a selected clip's clip vector in the Viewer window. You can also translate a clip's clip vector by manipulating it in the Viewer window. See [Moving clips](#) on page 1569 for more information.

Clip Offset R settings

Double-click a character or animation clip in the Story window to access the Clip Offset R settings in the Asset Settings window.

The Clip Offset R settings let you rotate a selected clip's clip vector in the Viewer window. You can also rotate a clip's clip vector by manipulating it in the Viewer window. See [Moving clips](#) on page 1569 for more information.

Auto-Calculate Loop option

Double-click a character clip in the Story window to access the Auto-Calculate Loop option in the Asset Settings window.

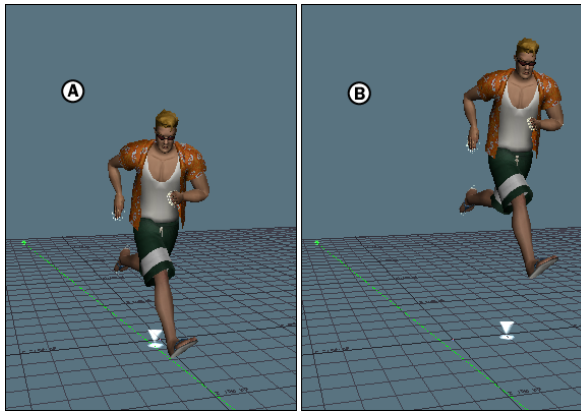
The Auto-Calculate Loop option lets you turn off or on the automatic calculation of the loop offset. To change the loop translation offset, use the Loop Offset T settings (see [Loop Offset T settings](#) on page 1615).

Loop Offset T settings

Double-click a character clip in the Story window to access the Loop Offset T settings in the Asset Settings window.

The Loop Offset T settings let you change the loop's translation offset.

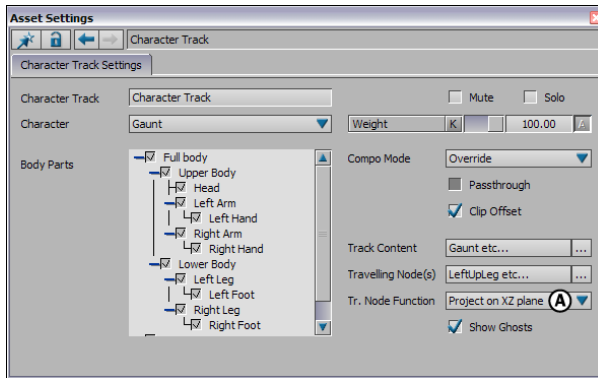
The loop offset is calculated automatically by default. Changing a loop's translation offset causes the animation to jump at the beginning of each loop. For example, when you loop a basic run cycle, a Character runs forward in a straight line. If you change the loop's translation offset, the Character jumps at the beginning of each loop.



Creating loop offsets A. The loop offset is calculated automatically, Surfer runs in a straight line. B. The loop is offset along the Y and X axes, causing Surfer to jump at the beginning of each loop.

Tr. Node Function

The Travelling Node Function menu lets you determine where the travelling node displays for a selected Animation, Character, or Camera Animation track. See [Changing the position of a travelling node](#) on page 1601 for more information on travelling nodes.



Travelling node options in the Asset Settings window A.
Travelling Node Function menu

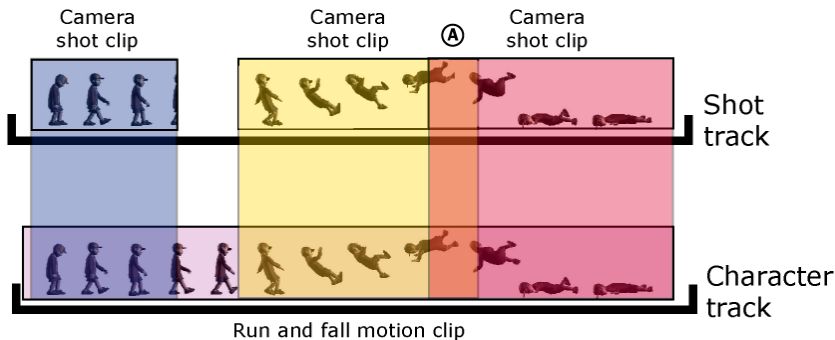
| Option | Travelling node position |
|---------------------|--|
| Project on XZ Plane | Displays the travelling node on the floor (XZ plane). If more than one asset or bone is selected in the Travelling Node menu, the travelling node displays at an average distance between the assets or bones on the XZ plane. |
| Average | Displays the travelling node at the average distance between the assets or bones selected in the Travelling Node field (See Changing the position of a travelling node on page 1601). When only one asset or bone is selected in the Travelling Node(s) field, the travelling node displays at the location of the selected asset or bone. |

Editing with shot clips

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Once you have built a scene using clips in the Story window, you can use camera shot clips to edit the result on the Story window's Edit timeline.

A shot clip represents action captured with a single camera. You can use multiple shot clips to create a series of camera switches on the Edit timeline, but unlike the Camera Switcher, you can also blend your shot clips to create cross dissolves.



Camera shots on the Edit timeline covering the corresponding areas of the action on the Character track on the Action timeline. A. Two camera shots blended creates a cross dissolve.

You can also use shot clips to create storyboards with Camera Back Plates, or edit your how scene is filmed without changing what is set up along the Action timeline.

- [Creating shot clips](#) on page 1618
- [Creating a storyboard](#) on page 1506
- [Changing the order of events in a scene with Time Discontinuity](#) on page 1625

Creating shot clips

A shot clip is a visual representation of a camera view of the action playing in the Action timeline.

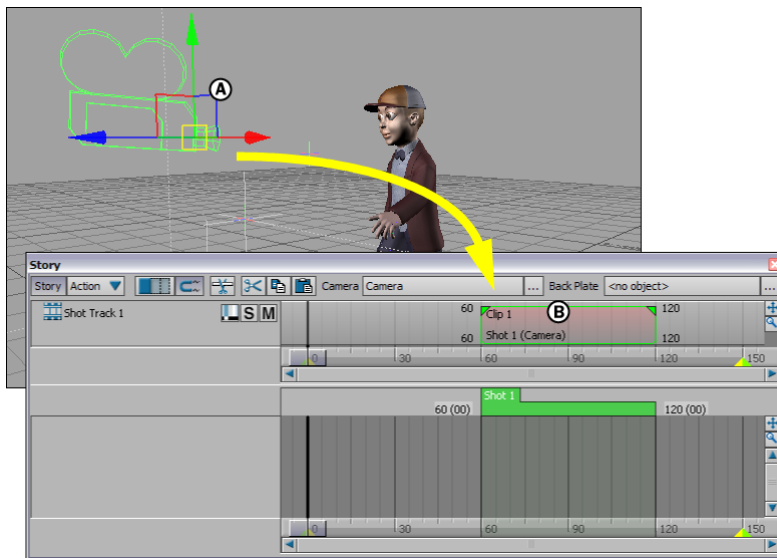
NOTE

You cannot create a shot clip with Producer cameras.

To create a shot clip:

- 1 Add cameras to your scene and position them.
- 2 Alt-drag cameras from the Viewer window or Scene browser into the Edit Track.

A Shot track appears, and a shot clip is created for each camera you drag onto the Edit track

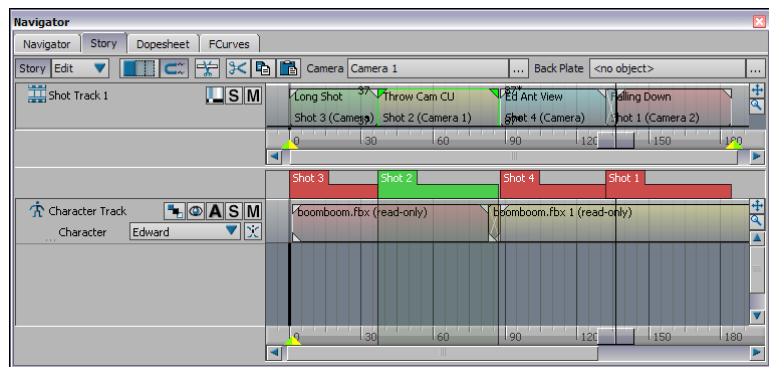


Creating a shot A. Alt-drag a custom camera from the Viewer window. B. Drop the camera into a Shot track to create a shot clip.

NOTE

You can use one camera to create multiple shots, or use different cameras for each shot

- 3 Make sure that the Story mode is set to Action so that the camera shots play in order of their positions, from left to right, on the Edit timeline.
- 4 Right-click a shot clip and select Make Camera Switcher current from the contextual menu so you can view the results of the Edit track in the Viewer window.
- 5 Do any of the following to the shot clips on the Edit track:
 - Drag the clips along the Edit track to arrange them.
 - Stretch the beginning or end of clips to increase or decrease the duration of the camera shot.
 - Overlap the clips to create a cross fade effect (this must be done in Edit mode)



Three camera arranged into four shot clips on the Edit track. (The first and third camera shot are the same camera but the shot clip has been renamed.)

- 6 Click Play in the Transport controls to view the scene.
- 7 Fine-tune the camera angles so that they cover the action the way you want. If you want to reposition a camera, right-click the shot clip on the Edit track and select Make Camera Current to reposition that shot's camera view.
- 8 When you are satisfied with the camera set-up, you can plot the resulting camera switches from the Edit track to a take by right-clicking a shot clip and selecting Plot Shot Track To from the contextual menu.
This way, you can use the camera switches in the Camera Switcher settings.

- 9 To combine all animation in a scene with the take selected in the Transport controls, right-click any shot clip and select Plot Scene to Current Take.

NOTE

This plotting includes the animation of the take selected in the Transport Controls window as well as the animation in the Story window.

To rearrange shots so they are out of sequence using the Time Discontinuity function, see [Changing the order of events in a scene with Time Discontinuity](#) on page 1625.

Creating a cross-fade effect with camera shots

You can blend or cross fade camera shots using camera shots in the Story window.

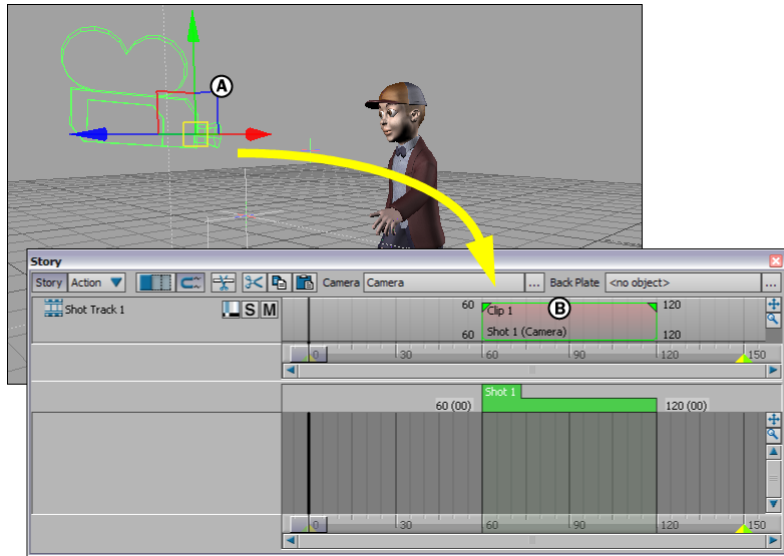
To cross-dissolve shot clips:

- 1 If you have not done so already, add cameras to your scene and position them.

NOTE

You cannot create a shot clip with Producer cameras.

- 2 Open the Story layout (Layout > Story).
- 3 Alt-drag the cameras from the Viewer window or Scene browser into the Edit Track.
A Shot track appears, and a shot clip is created for each camera you drag onto the Edit track

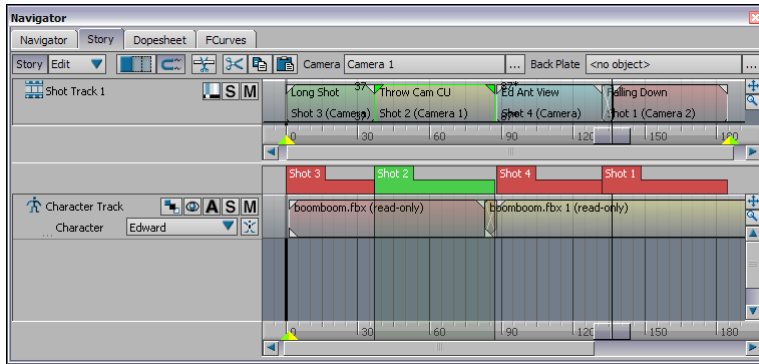


Creating a shot A. Alt-drag a custom camera from the Viewer window. B. Drop the camera into a Shot track to create a shot clip.

NOTE

You can use one camera to create multiple shots, or use different cameras for each shot

- 4 Switch the Story window into Edit mode.
- 5 Right-click a shot clip and select Make Camera Switcher current from the contextual menu so you can watch the results of your work in Edit track in the Viewer window.
- 6 Overlap the clips to create a cross fade effect.



Three camera arranged into four shot clips on the Edit track. (The first and third camera shot are the same camera but the shot clip has been renamed.)

- 7 Click Play in the Transport controls to view the scene.
- 8 Fine-tune the camera angles so that they cover the action the way you want. To reposition a camera, right-click the shot clip on the Edit track and select Make Camera Current to reposition that shot's camera view.
- 9 When you are satisfied with the camera set-up, you can plot the resulting camera switches from the Edit track to a take by right-clicking a shot clip and selecting Plot Shot Track To from the contextual menu.
This way, you can use the camera switches in the Camera Switcher settings.
- 10 To combine all animation in a scene with the take selected in the Transport Controls window, right-click any shot clip and select Plot Scene to Current Take.

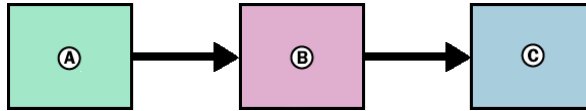
NOTE

This plotting includes the animation of the take selected in the Transport Controls window as well as the animation in the Story window.

To rearrange shots so they are out of sequence using the Time Discontinuity function, see [Changing the order of events in a scene with Time Discontinuity](#) on page 1625.

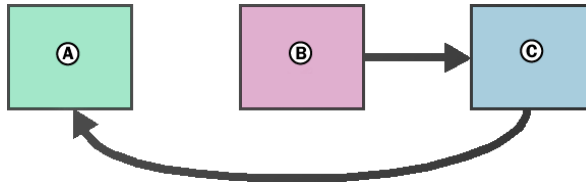
Time discontinuity

Normally, animation plays in chronological order. For example, a scene where you see character walking and then slipping is chronological. The actions in the scene unfold from start to end in a linear fashion.



Three events in the animation play in chronological order.

Time discontinuity happens whenever action is shown out of chronological order, for example, when you start a story with its end. The Time Discontinuity option in the Story window lets you re-order events in a scene so that they occur out of chronological sequence.



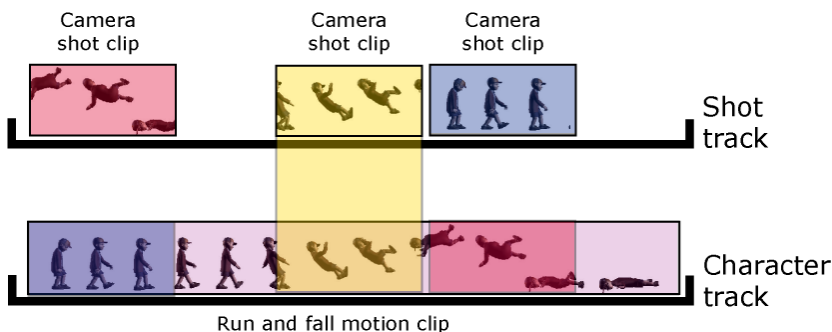
Time Discontinuity lets you edit the original sequence of events. A. The last event (C) plays first. B. The first event (A) plays second. C. The second event (B) plays last.

Activating Time Discontinuity lets you play events in the animation in a different order, edit out parts, or loop the same segment more than once, without altering your source animation. For example, you could take the scene of the character walking and slipping and have the character slip first, followed by a shot of him walking.

Once you have edited the sequence of events in your scene, you can plot it for export.

When you activate Time Discontinuity, the shot clips and Shot slider tabs disconnect so you can move them individually to rearrange the sequence of events. You can drag a shot clip to a different time in the scene, or resize a Slider tab so that the segment of action repeats itself.

In the following image, the scene of the character walking and slipping is shown in regular sequence. Each shot clip covers part of the action on the Character track below: the character starting to walk is covered by the first Camera shot clip, the character slipping by the second Camera shot clip and the character falling is covered by the third Camera shot clip.

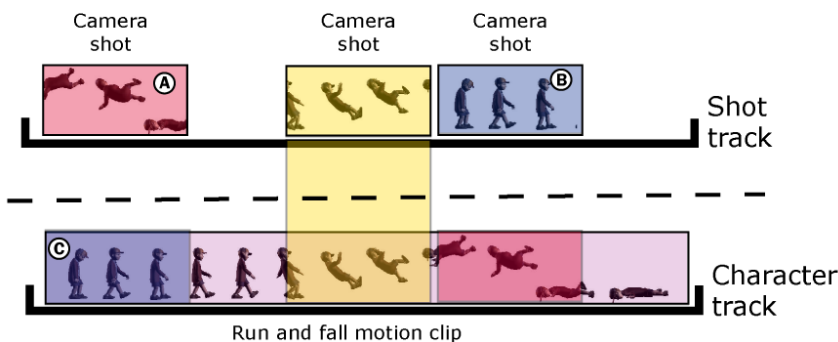


Three Camera shot clips on the Shot track covering an action of a character slipping on the Character track.

NOTE

The Timeline indicators for both the Shot track and Character tracks play from left to right simultaneously to show that the Camera shots are reading the Character track's motion in order.

In the next image, Time Discontinuity has been activated in the same scene. Now, the position of the first and last shot clips have been swapped. Even though the action on the character track has not changed, because the shot clips that have been moved with Time DIscontinuity activated, the first shot refers to the end of the action and the last shot refers to the beginning of the action.



A. The last shot clip of the character falling is moved to the beginning of the take. B. The first shot of the character starting to walk is now moved to the end of the action. C. While the events play in the sequence shown on the top track, the action of the bottom track never changes.

NOTE

When Time Discontinuity is active, the Timeline indicator for both the Shot track and Character tracks play from left to right on the Shot track, but the Character track indicator jumps back and forth through the Character track animation.

- [Changing the order of events in a scene with Time Discontinuity](#) on page 1625

Changing the order of events in a scene with Time Discontinuity

Once you have built your scene with clips and tracks along the Action timeline, you can rearrange the sequence that actions occur in your scene using the Time Discontinuity option.

Activating the Time Discontinuity option splits shot clips so you can set a camera shot's duration and content separately.

To use Time Discontinuity:

- 1 In the Story window, assemble a group of shot clips on the Edit track. (To create shot clips, see [Creating shot clips](#) on page 1618.)
- 2 Select Edit mode from the Story mode menu so the events are read from the order of shot clips on the Edit track instead of the Action track.
- 3 Right-click a shot clip and select Make Camera Switcher current from the contextual menu so you can view the results of the Edit track in the Viewer window.
- 4 Right-click a shot clip and select Time Discontinuity from the contextual menu.

NOTE

The effects of activating Time Discontinuity cannot be undone.

- 5 Switch to Edit mode so you can move the shot clips and slider tabs independently of each other.

- 6 Do any of the following:
 - Rearrange the order of events in the scene by moving the shot clips on the Edit Track. For example, you can drag the shot clip of a character falling before they slip.
 - Move and resize the Slider Tabs to create looped or edited versions of the shot clips. For example, resize a slider tab so that it only captures a small moment of animation; if the resized clip is shorter than the duration of the original shot clip on the Edit track, the action loops. For more on Looping Shot clips, see [Looping clips with the Time Discontinuity option](#) on page 1626.

Looping clips with the Time Discontinuity option

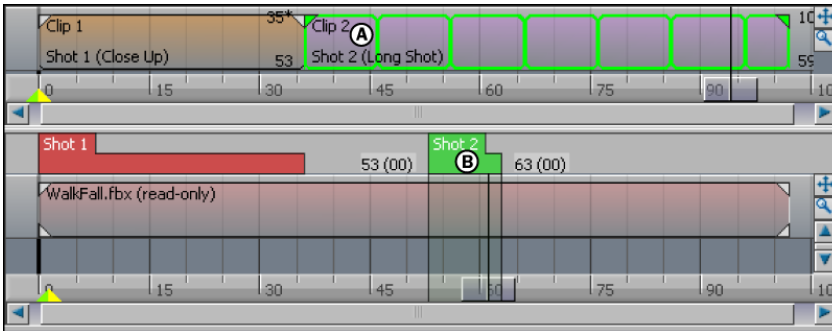
Once you have built your scene with clips and tracks along the Action timeline, you can create looped sequences in your scene using the Time Discontinuity option.

- 1 In the Story window, assemble a group of shot clips on the Edit timeline. (To assemble shot clips, see [Creating shot clips](#) on page 1618.)
- 2 Right-click a shot clip and select Make Camera Switcher current from the contextual menu so you can view the results of the Edit timeline in the Viewer window.
- 3 Right-click a shot clip and select Time Discontinuity from the contextual menu.

NOTE

The effects of activating Time Discontinuity cannot be undone.

- 4 Switch to Edit mode so you can move the shot clips and slider tabs independently of each other.
- 5 Resize a shot Slider tab so that it only captures a small moment of animation.
If the resized clip is shorter than the duration of the original shot clip on the Edit track, the action loops.



The resized Slider tab (B) is shown as a looped shot clip (A) that plays six and half times.

NOTE

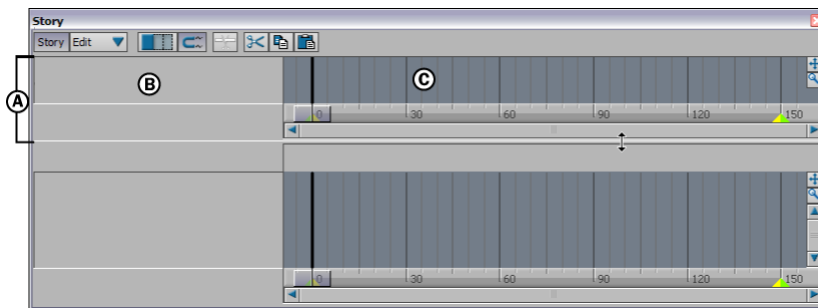
When you play the take, watch the two timeline indicators play. The Action track plays normally through the looped action while the Edit track's timeline indicator plays the resized Shot slider tab repeatedly, showing that the segment is looped.

Edit Track list

The Edit Track list is where you create camera switches along the timeline using tracks and camera shots. The Edit timeline works with scenes built along the Action timeline. When you create a shot clip, a shot slider is also created.

The Edit Track list consists of the following:

- [Edit Track controls](#) on page 1629
- [Edit timeline](#) on page 1628



Story window A. Edit Track list B. Edit Track controls C. Edit timeline

To play the results of the Edit Track list, select the Edit option from the Story Mode menu. See [Story Mode option and menu](#) on page 619 for more information.

You can insert three different types of tracks in the Edit Track list: Shot, Audio and Video. The Shot track is unique to the Edit Track list. (See [Story clips](#) on page 1549 for information on other types of tracks and clips.)

A Shot track lets you create camera switches using a series of camera shots. To use a Shot track, you need to create shot clips. See [Changing the order of events in a scene with Time Discontinuity](#) on page 1625 for information on creating shots.

You can change the order of shots from the Edit Track list and play them in a different order than the animation. See [Edit Track list](#) on page 1627 for more information.

Edit timeline

The Edit timeline displays the shot, audio, or video clips that you create and manipulate. You can add, schedule, and blend these clips along the Edit timeline.

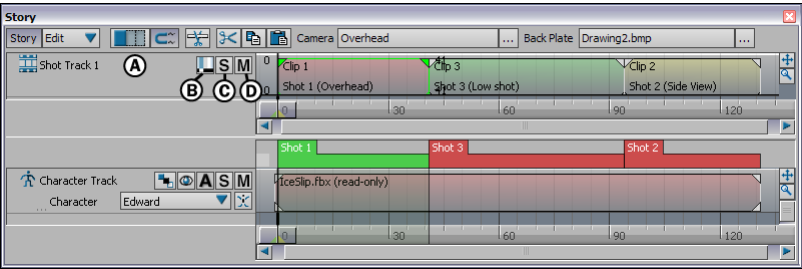
To navigate the Edit timeline, Ctrl-drag to zoom and Shift-drag to scroll. You can also click in the Edit timeline and press A to frame all clips. See [Story window time range](#) on page 1510 for information on changing the time range.

NOTE

Shot clips are unique to the Edit timeline.

Edit Track controls

The Edit Track controls let you move, stretch, and activate or disable tracks. Selecting a track from its track controls lets you view additional track options in the Asset Settings window and Properties window.



Story window A. Shot track B. Show Back Plate option C. Solo option D. Mute option

The Track controls of a Shot track consist of the following:

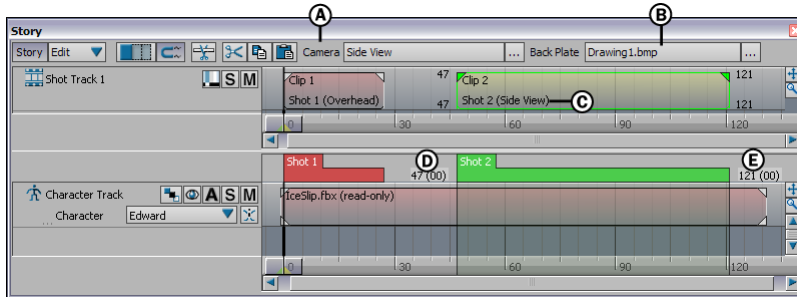
| Option | Function |
|------------------|--|
| Show Back Plates | When the Show Back Plates option is active, the back plates of all shot clips on the selected track do not display. See Back Plate menu on page 1630. |
| Solo | Use the Solo (S) option to activate or disable tracks. When a track's Solo option is active, only that track plays. |
| Mute | Use the Mute (M) option to activate or disable tracks. When a track's Mute option is active, the track is muted when you play a take. This means that any animation, video, audio, command, or constraint clip on a muted track is disabled. |

NOTE

All these options also appear in the Asset settings window if you double-click an empty area of the Shot track.

Shot settings

Each Shot clip you create has a shot, which is represented by a slider that resembles a colored tab that sits above the Action timeline.



Shot track. A. Camera menu B. Back Plate menu C. Shot field D. In field E. Out field.

This section describes the settings that display when a shot is selected.

NOTE

The Shot settings also display when a shot clip is selected in the Edit Track list.

Shot field

The Shot field lets you rename a shot. The shot's name also displays on the shot slider and at the bottom of its shot clip.

Camera menu

The Camera menu appears in the Story window when you select a shot clip in the Edit Track list or a shot in the Action Track list.

This menu lets you select custom cameras for each shot and also displays the shot's camera.

Click the Remove button at the bottom of the menu to remove the camera from the list.

Back Plate menu

The Back Plate menu appears in the Story window when you select a shot clip in the Edit Track list or a shot in the Action Track list.

This menu lets you select a back plate for each shot clip.

The back plate is attached to the shot clip, not the camera, so you can assign different back plates to multiple shot clips even when the clips use the same camera.

In field and Out field

The In field lets you change a shot's In point. The Out point field lets you change the Out point of a shot.

A shot's In and Out points can be different than its shot clip's In and Out points when the Time Discontinuity option is active. See [Time Discontinuity](#) on page 1521.

Edit track contextual menus

Right-click on a shot clip or shot track in the Edit Track list to access contextual menu options. These contextual menu options are similar to those that appear when you right-click on a clip or track in the Action track list.

NOTE

This topic includes only the contextual menu items that appear only for the Edit Track list. For information on the contextual menu options, such as Insert, Make Camera Switcher Current, and Plot Shot Tracks To, see [Story contextual menu](#) on page 1515.

The Import Camera Switcher From and Export To Camera Switcher contextual menu items appear when you right-click a selected Shot track.

The Select Camera and Make Camera Current contextual menu items appear when a clip is selected in the Story window.

| Option | Function |
|-----------------------------|--|
| Import Camera Switcher From | The Import Camera Switcher From menu lets you move these camera switches created with the Camera Switcher from the takes in the Transport Controls window to the Story window, where they appear as camera shots on a selected Shot track in |

| Option | Function |
|---------------------------|--|
| | the Edit Track list. This option is active when a Shot track is selected. |
| Export to Camera Switcher | The Export to Camera Switcher menu lets you plot camera switches from a single Shot track to a take. This lets you use the camera switches in the Camera Switcher settings. See Camera switcher on page 335 for more information. This option is active when a Shot track is selected. |
| Select Camera | Select Camera lets you select a shot clip's camera. This option is active when you select a shot in the Edit Track list. |
| Make Camera Current | Make Camera Current switches the camera view in the Viewer window to a camera that can be used by a camera shot. The Make Camera Current option is available when a shot is selected in the Edit Track list. |

Reusing camera clips

You can modify and reuse camera animation clips for use in other projects.

To save a camera clip so you can reuse it

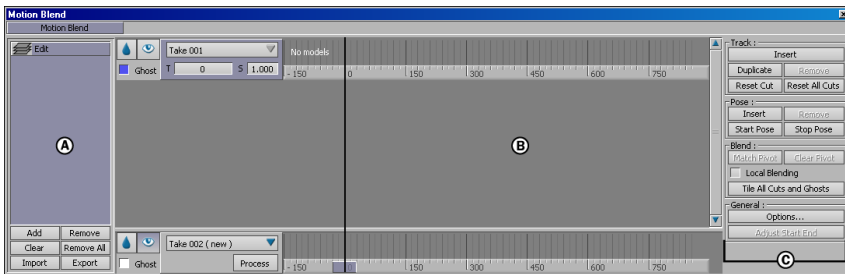
- 1 Activate the track's Animate option.
- 2 Right-click the camera clip and select Make Writeable. Black stripes appear on the clip.
- 3 Make modifications to the camera animation.
- 4 When you are finished, right-click the clip and select the Make Clip Read-Only option from the contextual menu. You can also select Export Clip.
- 5 A Save Clip dialog box appears so you can save your clip.

NOTE If you make a Camera animation clip Writable and save your scene, the saved scene crashes on reload. You can work around this limitation if you make sure all clips in Camera Animation tracks are Read-Only before you save.

- [Make Clip Writable](#) on page 1563

Blending Takes

The Motion Blend window lets you blend two or more takes of the same character to create a new take. You can also blend sections of the same take to create an animation cycle that you can use later in the Trigger window.



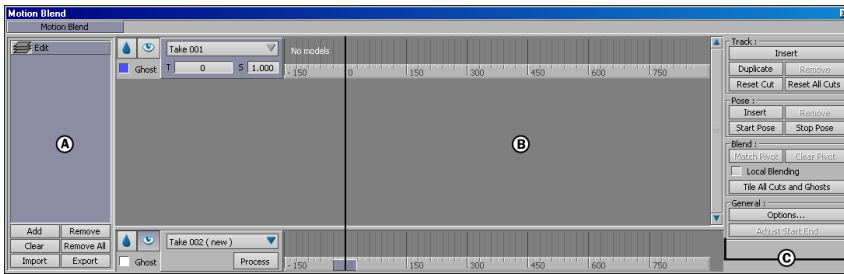
During blending, the Motion Blend window also lets you alter the timing of takes. This is useful if you want to match the speed of movements over different takes.

Before you use the Motion Blend window, you must have a model, a skeleton, or a Control rig on which at least one take is plotted.

NOTE

Before using the Motion Blend window, disable all constraints driving the animation. Otherwise, the movement you view may not accurately reflect the raw data you are blending.

To display the Motion Blend window, select Window > Motion Blend in the menu bar.



Motion Blend window A. Edits pane B. Track list C. Motion Blend Options pane

When you open the Motion Blend window, an edit containing a single track set to Take 001 is automatically added. The track contains no models, sensors, or Control rigs, as indicated by the “No models” text in the first track of the Track list.

The Motion Blend window does not support shapes or morph targets. You can only blend translation, rotation, and scaling.

The Motion Blend window consists of the following:

- [Edits Pane](#) on page 1641
- [Track list](#) on page 1642
- [Motion Blend Options pane](#) on page 1648
- [Blend Editor](#) on page 1656

See [Motion Blend shortcuts](#) on page 1656 for information on using shortcuts with this window.

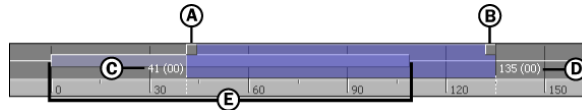
Cuts

In the Motion Blend window, a cut is a section of a take’s animation. You can edit and blend cuts to create a new take.

Each cut has its own color that corresponds to the color of its ghost, pose, and root. If a preceding cut blocks a cut on another track entirely, the cut displays in gray. Gray cuts are not included in the Result track and no blending occurs. When blends are created in the Result track, the colors of the blending cuts merge.

By default, cuts have the same length as the track's take, which is represented by the blue bar on each track. There are two ways to change the length of your selected cut:

- Drag the Start and End Cut handles (A and B).
- Double-click the Start and End Cut time codes (C and D).

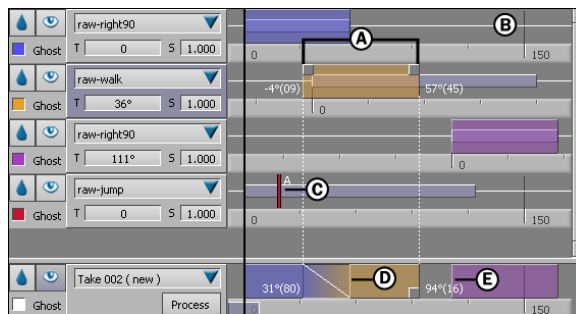


A. Start Cut handle B. End Cut handle C. Start Cut time code D. End Cut time code E. Blue bar representing the length of the take

You can also move a cut independently of the take in one of the following ways:

- Drag the cut left or right.
- Translate the track using the T field in the Take box. See [Producing an exact translation](#) on page 1639.

A standard blend is created when two cuts partly overlap, creating an area where the animation of both cuts is mixed. Blends appear in the Result track.



A. A cut B. White line representing the blending object C. A pose D. A blend E. A gap where interpolation occurs

Interpolation occurs in a gap between two cuts in the Result track. The data in the space between the cuts is interpolated from the last position of a cut to the first position of the next cut.

To move the cut back to its default length and location over the take's track, click Reset Cut or Reset All Cuts.

Result track

Every edit has a Result track where all the cuts in an edit are combined to create blends, gap interpolations, speed changes, and other edits. You can use the Result track to create a new take by clicking Process. See [Resizing the Result take](#) on page 1640.

Creating a blending object

Before you can create a blend, you must Alt-drag the blending object into the empty track in the Cut area.

The blending object can be any selection of nodes or sensors with captured data, a part or complete hierarchy of models with plotted data, or a Control rig. Only these objects are modified when you create blends in the Motion Blend window.

Each track in an edit uses the same models, sensors, or skeleton for its blending object.

To select a blending object, Alt-drag the selected nodes into an empty track. The blending object appears as a white line in each track, representing the animation data you want to blend.

You must select the blending object before you can create an interpolation, standard blend, local blend, or pose blend in your edit.

You can change the blending object at any time by Alt-dragging a new set of models, sensors, or skeleton joints into the Cut area of any track.



A. A track without a selected blending object (No models). B. A track with a defined blending object.

Changing the speed of a track

To change a track's speed in the Motion Blend window, do one of the following:

- Double-click the S field in the selected track's Take box. Type in the exact speed (time scale) increment, and press Enter.
- Click the S field in the selected track's Take box. Drag right or left to increase or decrease the speed.
- Press and hold S while dragging right or left inside the selected track.

For information on changing the scale of the Result track, see [Resizing the Result take](#) on page 1640.

Producing an exact translation

To produce an exact translation in the Motion Blend window, do one of the following:

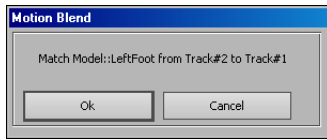
- Double-click the T field in the selected track's Take box. Type in the exact translation increment, and press Enter.
- Click the T field in the selected track's Take box. Drag right or left to increase or decrease the translation value.
- Press and hold T while dragging right or left inside the selected track.

Match Selection

When you use the Motion Blend window, you can blend takes with Match Selection. Match Selection matches the position and rotation of two ghosts based on their positions in a specific frame.

Use Match Selection to blend two tracks together when the blending object is in a different location, or facing a different direction on each track. You can also use it to blend together different parts of the same take, in which the character is in the same location for both tracks.

Match Selection matches the ghost whose node you select in the Viewer window to the corresponding node of the ghost whose Take box is selected. A dialog box appears asking if you want to match the selection.



Match Selection dialog box

You can match any ghosts in your scene, regardless of the order in which they appear in the Cut area. Match selection works with both poses and cuts.

Match Selection is always performed on the current frame and can be located anywhere on the Result track. It does not have to be within a blend.

Match Selection is not limited to using the blending object. It can use any part of a character, such as a bone, node, or sensor, to match the position and rotation of the character on each track.

You can override a Match Selection by performing another Match Selection using the same tracks. Since Match Selection can be done once per Result track, any other matching on the same Result track overrides the previous ones. If you need to match the position of ghosts more than once per result track, see [Match Pivot](#) on page 1652 for more information.

MotionBuilder rotates the character in the second track on the Y-axis and translates it along the X and Z-axes until the reference points of both characters match. The Match Selection is constrained to rotation in Y and translation on the XZ grid so that the matched character respects the floor. This ensures that the character does not end up diagonal to the floor.

Once the Match Selection is finished, you can fine-tune the match by translating or rotating the character using its root.

Resizing the Result take

If you scale a track so that the Result take is longer than the current take's duration (shown in the Action timeline), the Result track may not play the entire take. It may start playing in the middle of the track or end before the entire edit finishes playing. This happens because the timeline only plays between the Start and End time codes on the Action timeline.

To correct this problem, resize the Result take by changing the values in the Start and End time code fields in the Transport Controls window. You can

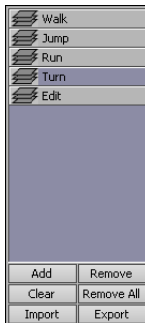
also click Adjust Take Start & End in the Motion Blend Options pane, or F-click in the Action timeline (fig 27-14).

Changing the duration of the Action timeline adjusts the Result take's Start time code to where its data or animation begins, and its End time code to where the take's data or animation ends.

You can also automatically resize the Result track by selecting Tile All Cuts and Ghosts, though this also moves the cuts. See [Tile All Cuts and Ghosts](#) on page 1654.

Edits Pane

Use the Edits pane to add, remove, clear, rename, import, or export edits.



Edits pane

The Edits pane contains the following buttons:

Add

Adds an edit. An edit is a collection of tracks and their corresponding takes, cuts, and blends. Each edit has its own Result track and an independent memory of its start and end times.

A MotionBuilder scene can have any number of edits. By default, a newly created edit is named "Edit". To rename an edit, double-click it, type in the new name, and press Enter.

By adding more than one edit, you can have several different versions of the same blends, which use different stabilizing, match selection, match pivot, and cut settings.

Remove

Deletes a selected edit.

Clear

Removes all tracks, cuts, and animation from the selected edit.

Import and Export

Let you import or export all selected edits as an *.nle* file. You can only import an *.nle* file that was exported using the Export button in the Edits pane.

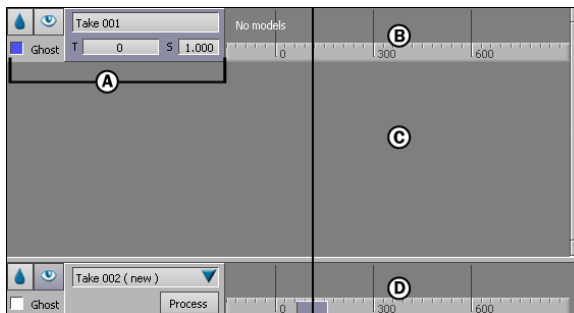
When you export edits, all edits for your current scene are exported in one *.nle* file. You cannot export only one edit at a time if there is more than one edit in your scene.

Remove All

Deletes all edits except for the default edit, which it clears.

Track list

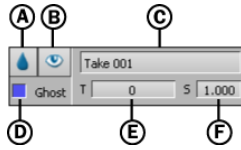
Use the Track list to manipulate each track's take, translation, speed, and ghost. The Track list also lets you select the parts of each take, known as *cuts*, that you want to blend.



Track list A. Take box B. Track C. Cut area D. Result track

Take Box

To select a track, click in the track's Take box. The Take box displays in blue.



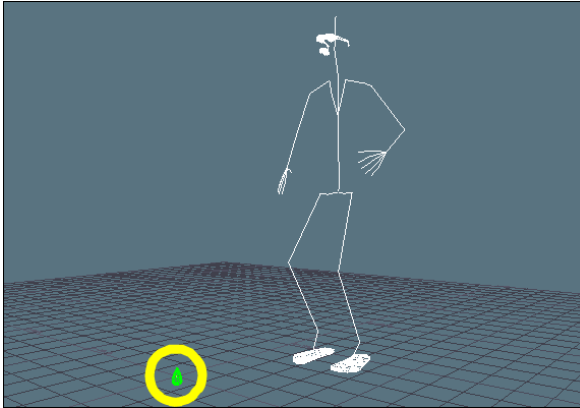
Take box A. Ghost Root selector B. Viewer Focus button C. Take menu D. Ghost option E. Time Offset (T) F. Time Scale (S)

When the Take box is selected, you can duplicate and remove tracks, insert and remove poses, and perform Match Selection on the selected track. A Take box has the following options that let you select and modify ghosts and tracks to create blends in your scene:

- [Ghost Root selector](#) on page 1643
- [Viewer Focus button](#) on page 1644
- [Ghost option](#) on page 1645
- [Take menu](#) on page 1646
- [Time Offset \(T field\)](#) on page 1646
- [Time Scale \(S field\)](#) on page 1646
- [Process button](#) on page 1647

Ghost Root selector

The Ghost Root selector selects the corresponding track's root. You can also double-click the root in the Viewer window to select it, though this method may cause you to select the wrong root. When you select the root of the ghost for a given track, everything else is deselected.

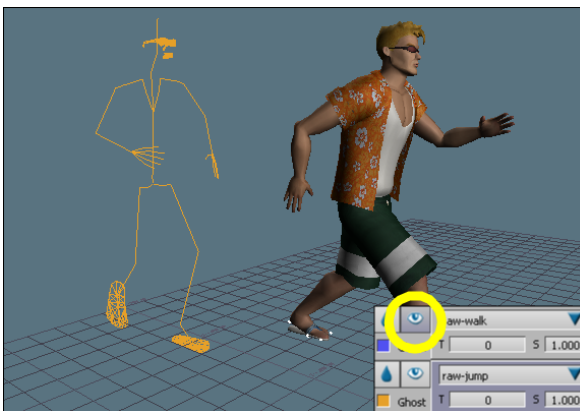


The root displays green in the Viewer window because it is selected using the Ghost Root selector.

Roots are used to apply transformations to a ghost, pose, or model in the Viewer window.

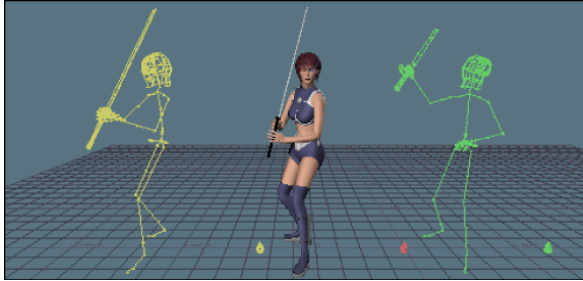
Viewer Focus button

The Viewer Focus button renders the current track's blending object in the Viewer window. Only one track can be rendered in the Viewer window at a time.

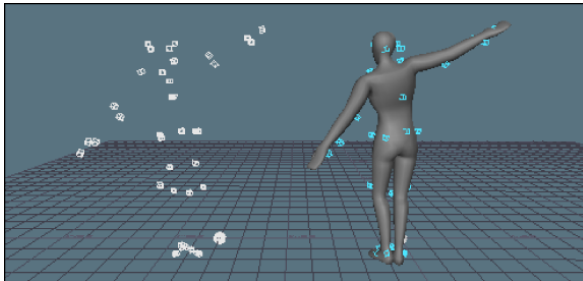


The Viewer Focus button is selected in the second track's Take box, so the skeleton for this track displays fully rendered. The blue skeleton is the active ghost from the first track's Take box.

When a blending object is not rendered, it appears as a ghost. For example, shows animation on three tracks, one of which is rendered. The blending object is a character's skeleton. The same example is shown in the figure below, but the blending object is a set of optical sensors.



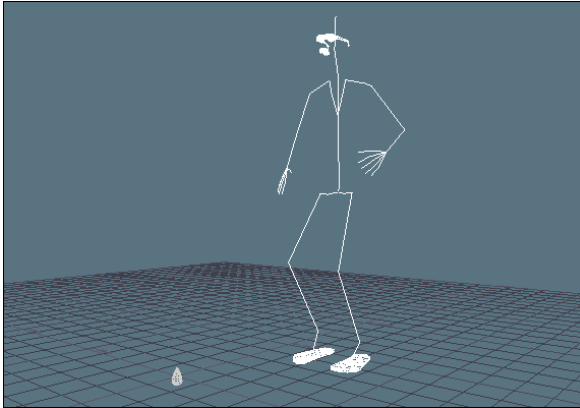
Ghost tracks and rendered track (model's skeleton)



Ghost tracks and rendered track (sensors)

Ghost option

The Ghost option lets you show and hide ghosts in the Viewer window. A ghost is a simple wireframe representation of the blending object. There is a separate ghost for each track, including the Result track.



A. Motion Blend ghost in the Viewer window.

NOTE Motion Blend ghosts only display when the Motion Blend window is open. You can only see ghosts in the X-Ray or Normal viewing mode.

You can also activate Show All Ghosts in the General options to display all the ghosts in your scene. See [Show All Ghosts](#) on page 1654.

Take menu

Use the Take menu to select the take for each corresponding track.

If the track's take contains data, a blue bar appears in the corresponding track showing the total length of the take. A cut of the same length is automatically added.

Time Offset (T field)

After you position or resize a cut, you must translate the track to create the proper blend or interpolation. When you translate a track, the track's cut moves with the take.

Time Scale (S field)

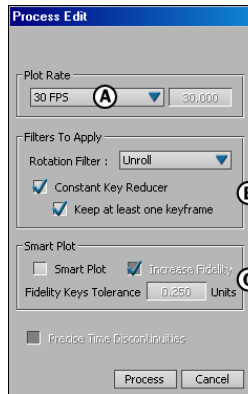
You can alter the scale of each track to speed up or slow down its cut. For example, this is useful if you want to speed up a walk cycle or slow down a few steps in a run cycle.

Process button

Click the Process button in the Result track to create a new take based on the information in your Result track.

When you click Process, a Process Edit dialog box appears, letting you specify a frame rate and select filters.

See [Plotting character animation](#) on page 1660 for more information.



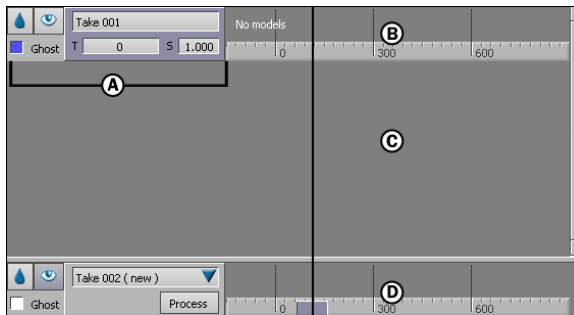
Process Edit dialog box A. Plot Rate menu B. Filters To Apply area C. Smart Plot area

Cut area

The Cut area is where all of the tracks for your edit are stored. Each track contains your blending object, a cut or a pose, and values that define when your character uses specific motion data.

The result of your edit depends on the placement and the size of the cuts and poses on each track.

To navigate in the Cut area, Ctrl-drag to zoom and Shift-drag to scroll. The Force Time option affects navigation in the Cut area. See [Force Time](#) on page 1654.



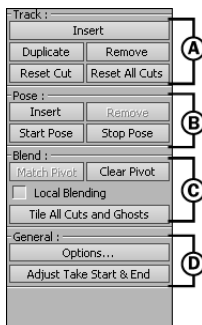
Track list A. Take box B. Track C. Cut area D. Result track

Result track

Every edit has a Result track where all the cuts in an edit are combined to create blends, gap interpolations, speed changes, and other edits. You can use the Result track to create a new take by clicking Process.

Motion Blend Options pane

Using the Motion Blend Options pane, you can insert, remove, and control tracks and poses, as well as edit cuts. Each series of buttons is organized by the interface item it affects.



Motion Blend Options pane A. Track options B. Pose options C. Blend options D. General options

Reset All Cuts

Moves all cuts in the Track list back to the default length and location over each take's blue bar.

Pose options

A pose is a stationary character position set on a specific frame. To create motion cycles, you can insert poses on tracks to determine the start or end positions of characters. If you want the beginning of a cut to start at one pose and the end of the cut to finish at another pose, you must have a separate track for each pose. The ghost of a pose appears in the Viewer window and does not move when the take plays.

Each pose has a letter to distinguish it, and a frame number that appears when you select it. When a pose is selected in the Result track, a handle appears in the middle of your cut. Adjust this handle to select when you want the blending between your cut and the pose to begin.

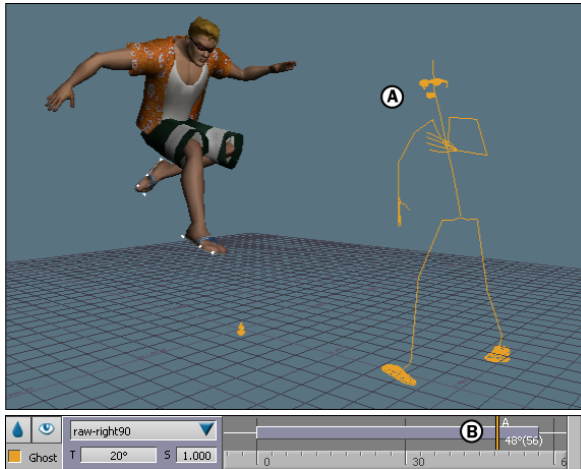
The Pose options affect poses and cuts within tracks.

Insert

Sets a pose on the selected track at the position of the Timeline indicator. You can change the position by click-dragging the pose right or left, or double-clicking its value and typing in a new frame number.

A pose is selected when its frame number is visible. The ghost of the pose displays in a static position in the Viewer window. You can no longer see the ghost's movement when you play the take.

The line representing your pose in the Cut area displays in the same color as the corresponding ghost, root, and cuts for its track.



A. The track's ghost displays for Pose A beside the rendered figure of another track. B. The frame number on Pose A indicates that the pose is selected. The line of the pose is the same color as its ghost.

You can use multiple poses, which are differentiated by sequential alphabetical tagging, in an edit.

For pose blending to work properly, you must translate and rotate the location of the pose's ghost before you set the Start or Stop Pose. This prevents jumps and slides that occur if the ghost of the pose is not standing in the same location or facing the same direction as the character at the start of the cut.

NOTE

You can only use poses on skeletons with plotted animation.

Remove

Removes the selected pose and renames remaining poses. For example, if you remove Pose A and there is a Pose B and a Pose C, the last two poses are renamed A and B.

Start Pose

Defines a pose for the beginning of the Result track. If there is more than one pose, click Start Pose repeatedly to cycle through the available poses. Start Pose can also remove the defined pose from the beginning of the cut in the Result track.

Stop Pose

Defines a pose for the end of the Result track. If there is more than one pose, click Stop Pose repeatedly to cycle through the available poses. Stop Pose can also remove the defined pose from the end of the cut in the Result, and create loops.

Blend options

The Blend options affect blends that occur when two cuts from different tracks overlap.

Match Pivot

Match Pivot matches the position and rotation of two ghosts based on a specific pivot point, called a stabilizing object. This process creates a smooth blend without jumps or other anomalies in the animation sequence.

A stabilizing object is a sensor, a node from a skeleton, or a model from a hierarchy of models that stabilizes the entire blending object and corrects problems such as foot sliding. The stabilizing object must be part of the blending object.

Alt-drag the stabilizing object into a blend or interpolation in the Result track during the Match Pivot process. Match Pivot rotates the character along the Y-axis and translates the character along the X- and Z-axes so that the location of both characters match.

Match Pivot is only available when the Timeline indicator is over a blend or interpolation containing a pivot.

It is best to use Match Pivot for an edit that has many blends in need of stabilizing. Match Pivot always matches the first part of the last cut to the last part of the first cut that frames your blend or interpolation.

To use Match Pivot, you must define a stabilizing object (which must be part of the blending object) and the Timeline indicator must be within a blend or interpolation. Match Pivot updates automatically if you drag a new stabilizing object into the blend or interpolation in your Result track.

You can perform one Match Pivot per blend or interpolation in your Result track. You cannot use Match Pivot with poses. See [Match Selection](#) on page 1639” if you are using poses.

Clear Pivot

Removes the pivot point from the current blend. This button is only available when the Timeline indicator is over a blend or interpolation containing a pivot.

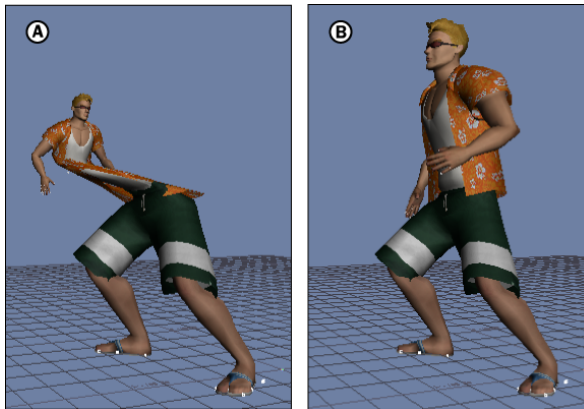
Local Blending

Snaps the blending object to the take of the skeleton in the Current Take field (see Current Take field).

NOTE

Local blending only works on skeletons with plotted animation.

Local blending is a special method of blending takes. It creates blends by replacing the motion plotted to part of a hierarchy in one take with motion from another take. Local blending lets you blend part of the body, such as an arm or the torso, with the rest of the body.



A. Before activating the Local Blending option. B. After activating the Local Blending option.

For example, shows a character before and after the Local Blending option is active. One cut animates the character's lower body, while another cut animates the character's upper body. When the Local Blending option is disabled, the animation of the upper body and the lower body do not blend properly. When the Local Blending option is active, the animation blends without distorting the character.

All the takes you use during a Local blend must contain motion data plotted to the same skeleton. For best results, the take in the Current Take field should be the same as the take in the Result track's Take menu. You should select a stabilizing object for your local blend if the blending object is made up of the bones or nodes of a character's leg.

Local blending can occur only when the Local Blending option is active.

Tile All Cuts and Ghosts

Offsets all tracks in the Cut area so that there are no blends or interpolations between your cuts. Tile All Cuts and Ghosts automatically triggers the Adjust Take Start & End feature to adjust the start and end times of the Result take and of the Current take.

After you create an animation cycle, you should test it to make sure that the last pose matches the first pose. You can accomplish this by creating a new edit and using the Tile All Cuts and Ghosts feature.

General options

The General options work with many different elements in the Motion Blend window.

Show All Ghosts

Displays all of the ghosts for the selected edit in the Viewer window. All ghosts are visible when the Show All Ghosts option is active; all ghosts are hidden when this option is disabled.

You can still select the ghosts of individual tracks that you want to display or hide by activating and disabling the Ghost options in their respective Take boxes. For more about viewing ghosts, see [Ghost Root selector](#) on page 1643 and [Ghost option](#) on page 1645.

Snap On Frames

Forces the start and end times of all cuts and poses to snap to the nearest frame.

Force Time

Snaps the Timeline indicator in place so that it cannot be moved by dragging.

When you activate Force Time, you must navigate in the Motion Blend window by Shift-dragging (translating) and Ctrl-dragging (scaling).

Keep Edit Active

Allows the result of an edit to be shown while you are working on other edits. This is helpful when you want to see the animation of one edit while working on another.

When Keep Edit Active is enabled, a white icon displays in the Edits pane to show that it is active.



Edit pane A. A white icon displays in the Edits pane on any edit to which Keep Edit Active is applied.

Keep Edit Active does not show its effects outside of the Motion Blend window, and you can only have one active edit at a time.

Adjust Take Start & End

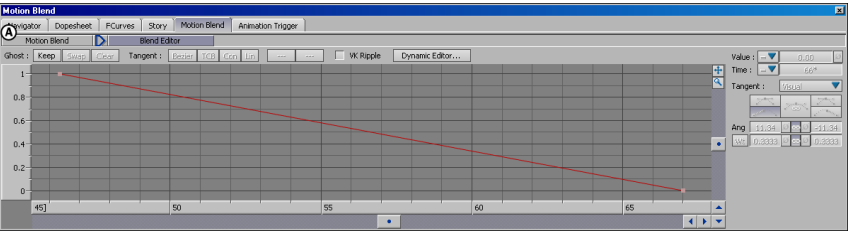
Adjusts the start and end times of the take to match the beginning time of the first cut and the end time of the last cut in the Result track.

NOTE

Be careful when using Adjust Take Start & End since it also changes the start and end times of the current take shown in the Current take field.

Blend Editor

When blending two or more tracks, the Result track shows each blend. By default, this blend is linear. Using the Blend editor, you can change the interpolation of the blend to create your own custom blending curve.



Blend editor

To access the Blend editor, double-click a blend in the Result track. When you set keyframes in the Blend editor, the keys appear on the Action timeline. See “FCurves Window” for more information on how to use the Blend editor.

To exit the Blend editor, click the Motion Blend button in the top-left corner of the Blend editor pane.

Motion Blend shortcuts

You can use the following shortcuts in the Cut area of the Motion Blend window:

| Shortcut | Description |
|------------|---|
| T-drag | Translates a selected track. |
| S-drag | Changes the scale or speed of a selected track. |
| Ctrl-drag | Zooms the view in and out. |
| Shift-drag | Scrolls the view left and right. |

| Shortcut | Description |
|------------------|--|
| Ctrl-Shift-click | If the Timeline indicator is not in the Cut area, you can make it reappear by Ctrl-Shift-clicking on the timeline. The Timeline indicator jumps to where you Ctrl-Shift-click. This short-cut only works when Force Time is disabled in the Motion Blend Options pane. |
| A-click | Frames all active cuts in the Cut area. |

Plotting Animation

Once you have created animation, you need to plot the animation if you want to import it into other compatible 3D software. Plotting is sometimes referred to as ‘baking’ or ‘transferring’, because it transfers all animation in your scene to selected models.

When you have keyframes on multiple layers, you can also plot to merge the animation from all layers to the Base Layer. Smart Plot options let you determine the number of keyframes that are added during the plotting process, to simplify editing the plotted animation.

Plotting animation also lets you create motion clips you can use in the Story window and in the Animation Trigger window.

In MotionBuilder, there are many different plotting options, depending on what you are doing, and what type of animation you are working with.

For more information on plotting, refer to the following topics:

- [The plotting process](#) on page 1659
- [Plotting character animation](#) on page 1660
- [Plotting facial animation](#) on page 1663
- [Plotting in the Story window](#) on page 1664
- [Plot Properties window](#) on page 1665

The plotting process

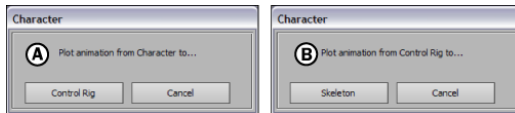
The plotting process transfers all animation data from your take to a selected model. When working with multiple layers, plotting also merges the animation from all layers to the Base Layer. Plotting can let you simplify keyframing as well as export animation to other software.

You can choose to plot selected properties or all properties using the Key Controls window and the menu bar.

Plotting from other areas

You can plot from a number of different areas while you work, such as the Character, Actor Face, and Character Face settings, depending on what you are doing.

For example, clicking Plot Character in the Character settings opens the Character dialog box, letting you plot to a Character's Control rig. After you plot to a Control rig, you can then click Plot Character once more to plot to a skeleton. Using the Plot Character option lets you access additional options, such as the [Plot Translation On Root Only option](#) on page 1678 and the [Plot Extensions option](#) on page 1676.



Plot Character A. To Control rig B. To Skeleton

To plot all properties, select Plot Selected (All Properties) from the Animation menu in the menu bar or in the Key Controls window. In the window that appears, select your plotting options, then click Plot.

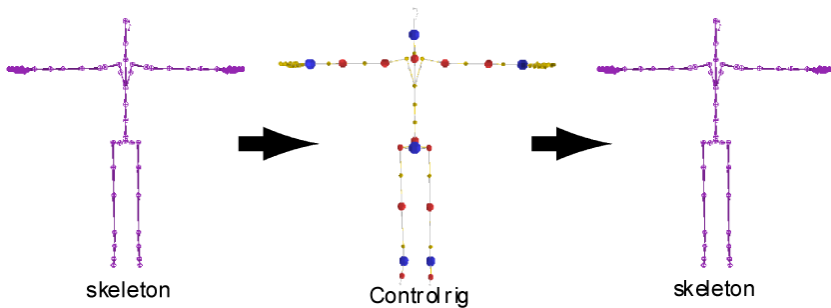
To plot selected properties, select Plot Selected (Selected Properties) from the Animation menu in the menu bar or in the Key Controls window, select your plotting options from the window that appears, then click Plot.

- [Key Controls window](#) on page 661
- MotionBuilder menu bar

Plotting character animation

When you first import an animated model into MotionBuilder, all of the animation data for that model is contained in the skeleton's bones. To edit the animation, you must first plot the animation to a Control rig.

When you are finished creating or modifying the animation on the Control rig, before you save, you can plot the animation back to the model's skeleton. This prepares your animation data to be exported so you can work with it in other software packages.



Plot the animation back to the model's skeleton to export.

- [Setting up a character](#) on page 1079
- [Control rigs](#) on page 1239
- [Plotting animation to a Control rig](#) on page 1662
- [Plot Extensions option](#) on page 1676

Plot for export from the Story window

When you are finished creating and editing a scene using the Story window, you can save the entire result to export it to other software by plotting it to the current take.

Until you plot, a scene built in the Story window is separate from the animation outside of the Story window. Plotting merges the contents of the Story window with the current take.

When the Story window is active, its contents can be included in the final scene when you plot. To plot the scene without including the contents of the Story window, you must disable the Story window. See [Animating with the Story Window](#) on page 1503 for more information.

You can plot the scene in the Story window using any plot option that appears in various MotionBuilder windows. See [Plot Properties window](#) on page 1665 for more information.

Plotting animation to a character's skeleton

Once you have a Control rig with keyframe animation or plotted animation, you can plot that data from the Control rig to your character model's skeleton. This prepares your character to be exported for use in the rest of your production pipeline.

- 1 In the Scene browser, make sure that the Control rig you want to transfer data from is attached to the selected character.
- 2 Ensure that the Active option is activated in the Character settings, enabling the link between your model and the Control rig.
- 3 In the Input Type field, select Control Rig Input.
- 4 Click Plot Character, then click Skeleton in the Character dialog box that appears.

The animation from your character's Control rig is transferred to the skeleton, and you can export the character and its animation.

- [Plotting character animation](#) on page 1660
- [Plotting animation to a Control rig](#) on page 1662

Plotting animation to a Control rig

When you first characterize a character and create a Control rig, you can plot animation from the character's skeleton to the Control rig. This lets you use the Control rig to edit the character's animation.

- 1 Make sure that the Control rig you want to transfer data to is attached to the selected character.
- 2 In the Character Settings pane, select Control Rig Output in the Input Type field.
- 3 Click Plot Character.
- 4 Click Control Rig in the Character dialog box that appears.

The animation from your character's skeleton is transferred to the Control rig, and you can use the Control rig to edit the animation. When you are

finished editing the animation, you can plot the animation back to the character.

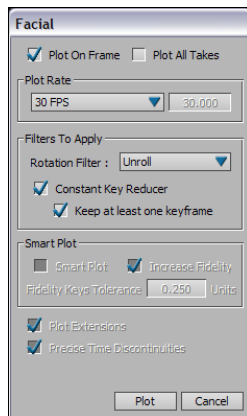
- [Plotting character animation](#) on page 1660
- [Control rigs](#) on page 1239
- [Characterizing](#) on page 1085
- [Plotting animation to a character's skeleton](#) on page 1662

Plotting facial animation

Once you have created your facial animation, you need to plot the animation if you want to import it into other compatible 3D software.

To plot facial animation:

- 1 Select the model and all its shapes.
- 2 In the Character Face Animation pane, click Plot Animation. (See [Character Face Animation pane](#) on page 1452.)
- 3 In the Facial dialog box that appears, select the plotting options you want to use.



Facial plotting dialog box

- 4 Select one of the two plotting options in the Facial dialog box:

| Option | Function |
|----------------|--|
| Plot on Frame | Activate Plot On Frame to resample the data based on the specified frame rate, and ensure that data is plotted on exact frames. Keyframes are set on each frame of the animation. This is the default setting. |
| Plot All Takes | Activate Plot All Takes to plot the data from all takes to a selected model. Plot all takes to your model if you intend to export the animation to other software. |

- 5 Set any filtering options you might need.
- 6 Click Plot. Once all the animation is plotted to the model, you can save your *.fbx* file and import it into other compatible 3D software, or reuse it in MotionBuilder.

- [Animating Faces](#) on page 1393
- [Character Face settings](#) on page 1443

Plotting in the Story window

You can combine all the animation in the Story window with the take selected in the Transport Controls window. You can also plot the camera switches from the Edit Track list to a take, letting you use the camera switcher in the Camera Switcher settings.

To plot clip animation to the current take:

- 1 Right-click anywhere in the Action Track list.
- 2 Select Plot Whole Scene To Current Take in the contextual menu.
- 3 Select plotting options in the Plot Properties window that appears, then click Plot.

The animation is merged with the current take.

To plot shot clips to the current take:

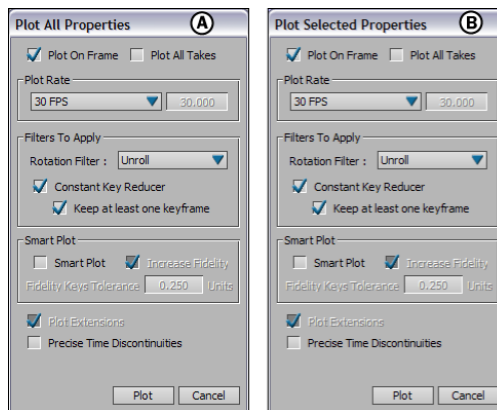
- 1 Right-click anywhere in the Edit Track list.
- 2 Select Plot Shot Track To in the contextual menu, then select either Camera Switcher - Take 001 or Camera Switcher - Take 002 (new).
- 3 If you select Camera Switcher - Take 001, you are asked if you want to overwrite the current take. If you select Camera Switcher - Take 002 (new), the camera switches are plotted to a new take.

■ [Plot Properties window](#) on page 1665

■ Camera Switcher

Plot Properties window

The general plotting options are in the Plot All Properties and Plot Selected Properties windows.



Plot Properties windows A. Plot All Properties B. Plot Selected Properties

The Plot All Properties and Plot Selected Properties windows enable you to do the following:

- Plot all properties or selected properties to selected models and Character Extensions
- Plot all takes or the current take only

- Specify a frame rate to use when plotting
- Select filters to apply while plotting

NOTE The plotting options in both the Plot All Properties and Plot Selected Properties windows are identical. However, using the Plot Selected Properties dialog box plots only the selected properties, and the Plot All Properties dialog box plots all the properties in a take.

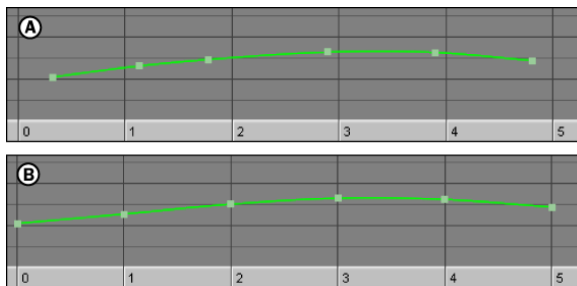
The Plot All Properties and Plot Selected Properties windows include the following options:

Plot On Frame option

Activate Plot On Frame to resample the data based on the specified frame rate, and ensure that data is plotted on exact frames. Keyframes are set on each frame of the animation.

If your take does not start or end on an exact frame, samples are taken from the frame before the beginning or after the end of the take. Plotting starts and ends on the closest exact frame.

For example, in an animation curve displays before (A) and after (B) plotting when Plot On Frames was active. The Start time code is 0 and the End time code is 5. After plotting, the keyframes are set exactly on each frame in the animation.



Plot on Frames A. Original curve before plotting B. Curve after plotting with Plot on Frame

Plot All Takes option

When activated, the Plot All Takes option lets you plot the data from all takes to a selected model. Plot all takes to your model if you intend to export the animation to other software. After you plot your data, you can disable its constraints.

When Plot All Takes is disabled, only the data from the current take is plotted to the selected model. For example, if you plot a take to a marker's Translation properties on Take 3, the marker's translation properties only contain function curves when Take 3 is the current take. If you switch to Take 2, the marker's translation properties contain no function curves.

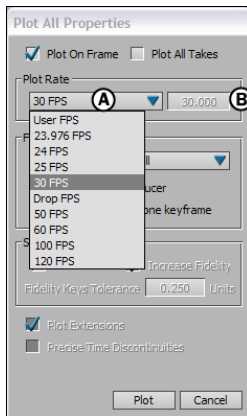
To plot the data from all takes, select the model to which you want to plot the animation, activate Plot All Takes, set other plotting options, and click Plot.

Plot Rate area

The options in the Plot Rate menu let you specify what plot rate to use when plotting the take to a selected model. Plot rate is measured in frames per second (FPS). The number to the right of the Plot Rate menu shows the frames per second of the current take.

To select a preset plot rate, choose a preset plot rate between 24 and 120 FPS in the Plot Rate menu.

To set your own plot rate, select User FPS in the Plot Rate menu, drag in the number field, or double-click in the field and type the frame rate number you want to use.

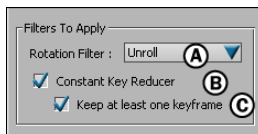


Plot All Properties A. Plot Rate menu B. Plot Rate field

NOTE Select the FPS setting in the Transport Controls window that is selected in the Plot window to see keyframes display on the selected frame rate.

Filters to Apply area

The Filters To Apply area enables you to select filters to apply when plotting. The Unroll and Constant Key Reducer filters are applied by default, but you can select your own options.



Filters To Apply area A. Rotation Filter menu B. Constant Key Reducer option C. Keep at Least One Keyframe option

The filters you can apply are:

- None
- Gimbal Killer
- Unroll

- Constant Key Reducer
- Keep At Least One Keyframe

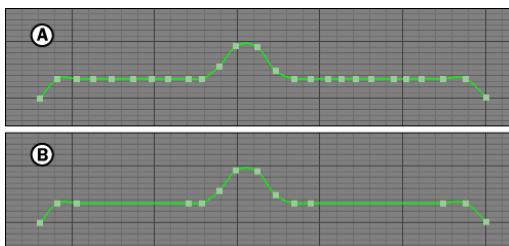
Rotation Filter menu

The Rotation Filter menu lets you to select a filtering option for rotation animation, including compensating for gimbal locking and Euler rotation. See [Rotation Filter menu options](#) on page 1670 for descriptions of each option.

Constant Key Reducer

The Constant Key Reducer filter reduces the number of keyframes by eliminating redundant keyframes. Reducing the number of keyframes reduces the file size. This filter is active by default.

For example, shows a function curve before (A) and after (B) the Constant Key Reducer filter is applied, reducing the number of redundant keyframes used by the function curve.



Constant key reducer A. Original curve B. Constant Key applied

For more information about filters, see [Filtering](#) on page 805.

Keep At Least One Keyframe

The Keep At Least One Keyframe option lets you retain at least one keyframe when the Constant Key Reducer option is active.

When your animation contains keyframes that have the same value, using the Constant Key Reducer may remove all of these keyframes. Enabling the Keep At Least One Keyframe option prevents this from happening.

Rotation Filter menu options

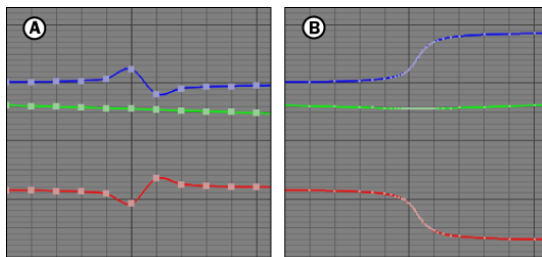
Select one of the three filtering options from the Rotation Filter menu.

None

Select None in the Rotation Filter menu if you do not want to apply any rotation filters.

Gimbal Killer

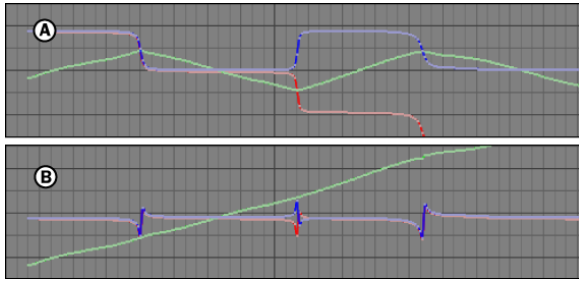
Select the Gimbal Killer option to compensate for gimbal locking effects by adding additional keyframes to your rotation function curves. These additional keyframes compensate for sudden flipping or shaking caused by the interpolation between keyframes during large rotational changes. Gimbal lock is most often encountered when you plot animation onto the skeleton of your model.



Gimbal Killer A. Original curves B. Gimbal Killer applied

Unroll

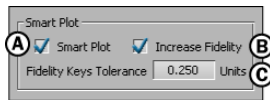
Select the Unroll option to unroll equivalent Euler rotations, making the curves continuous.



Unroll A. Original curves B. Unroll applied

Smart Plot area

The Smart Plot area contains options that let you plot keyframe animation without adding unnecessary keyframes.

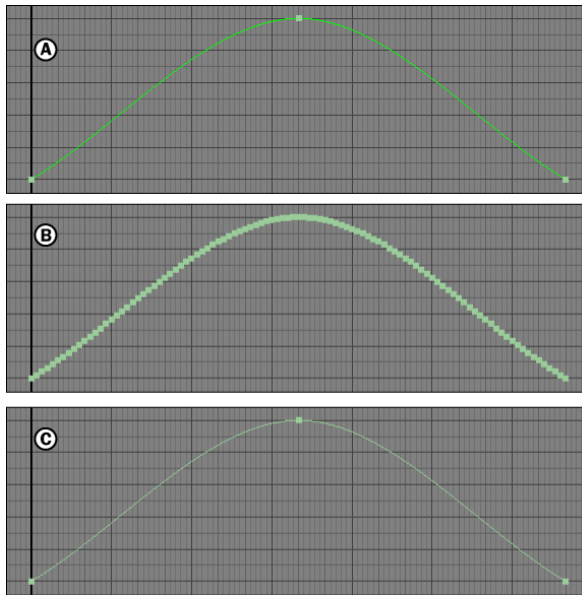


Smart Plot area A. Smart Plot option B. Increase Fidelity option C. Fidelity Keys Tolerance field

Smart Plot option

The Smart Plot option lets you plot keyframe animation without adding extra keyframes. For example, this option is useful when you want to merge the keyframes you set on many layers. Using Smart Plot, you can merge the keyframe layers without adding more keyframes, letting you continue to edit your original keyframe animation easily.

For example, plotting a function curve that has three keyframes without using Smart Plot creates many more keyframes, which are too numerous to edit easily. However, when plotted using Smart Plot, the resulting animation still has only three keyframes.



Keyframe animation A. Original keyframes B. Keyframes plotted without Smart Plot C. Keyframes plotted with Smart Plot

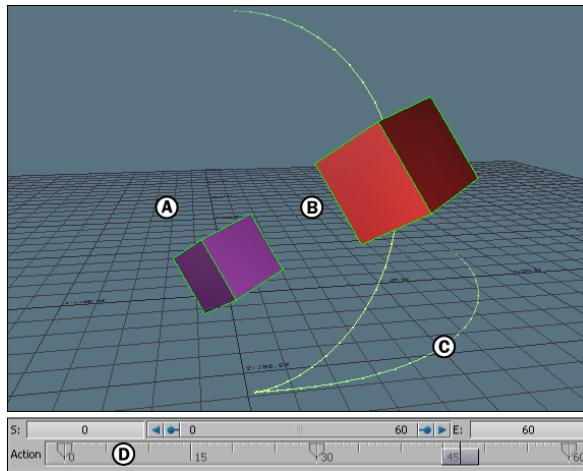
Increase Fidelity

The Increase Fidelity option lets you add the number of keyframes necessary to keep your original animation. Keyframes are added to the three curves (translation, rotation, and scaling) of each vector, making the plotted animation closer to the original animation.

There are some situations in which plotting using Smart Plot alone does not reproduce the original animation. In these cases, you can activate the Increase Fidelity option to add keyframes and correct the function curves.

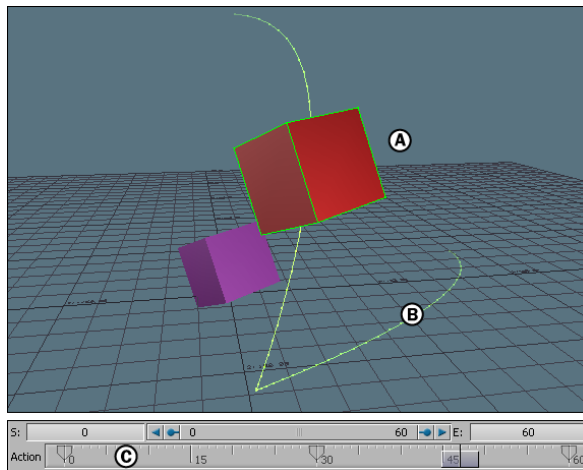
For example, Cube_source rotates to the left, then upwards. Its animation consists of three keyframes at frames 0, 30, and 60.

Cube1 is connected to Cube_source by a Parent-Child constraint, and moves beside Cube_source in two arc-like movements. No keyframes are set on Cube1, only on Cube_source.



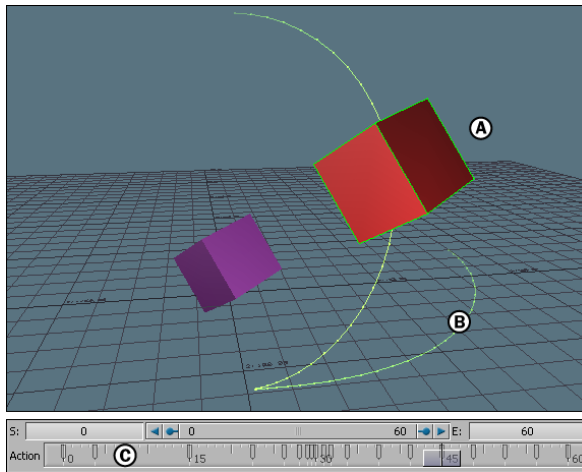
Animation using a Parent-Child constraint A. Cube_source
B. Cube1 C. Animation Trajectory of Cube1 is curved. D.
Keyframes set on Cube_source at frames 0, 30, and 60.

If you plot this animation using Smart Plot without Increase Fidelity, the keyframes at frame 0, 30, and 60 are plotted to both cubes, but the animation's trajectory changes, because Cube1 needs more keyframes to retain its original animation.



Animation plotted without Increase Fidelity A. Cube1 B.
Cube1's trajectory is altered when the Increase Fidelity
option is not used. C. There are three few keyframes plotted
to Cube1.

If the Increase Fidelity option is active when the animation is plotted, keyframes with translation values are set to correct the function curve and retain the original animation.



Animation plotted using Increase Fidelity. A. Cube1 B. Cube1's trajectory is similar to the original animation. C. The keyframes plotted to Cube1 recreate the original animation.

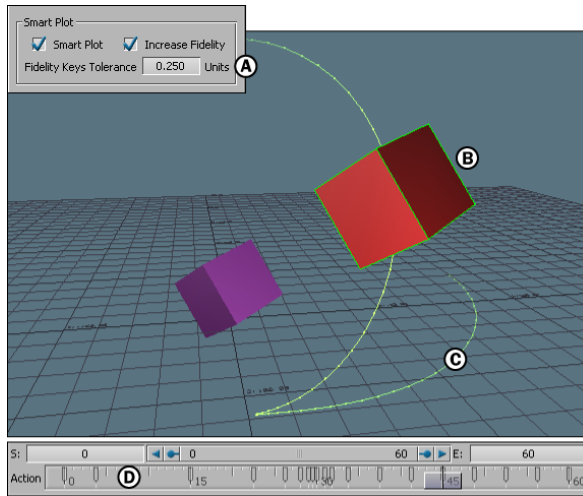
To determine the number of keyframes that are set, use the Fidelity Keys Tolerance field.

Fidelity Keys Tolerance

The Fidelity Keys Tolerance field lets you determine the plotted animation's accuracy compared to its original animation. Depending on the field's value, extra keyframes are set to duplicate the original animation.

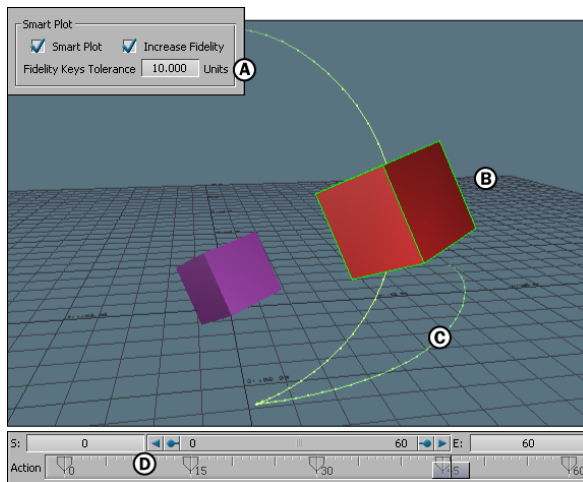
The value in the Fidelity Keys Tolerance field is a unit of measurement which represents how far, or to what degree, the plotted animation diverges from the original animation. The lower the field's value is, the more keyframes are set when plotting, correcting differences between the original animation and the plotted animation.

For example, in the following figure, the Fidelity Keys Tolerance field is set to 0.25, which is the default setting. Plotting sets many keyframes to Cube1, recreating the original animation path. However, you may not want so many keyframes.



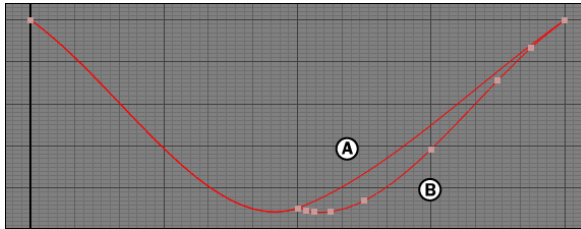
Plotting A. The Fidelity Keys Tolerance field is set to 0.25. **B.** Cube1 **C.** Cube1's trajectory is similar to the original animation. **D.** The keyframes plotted to Cube1 recreate the original animation.

When the Fidelity Keys Tolerance field is set to a higher value, plotting sets fewer keyframes, but the animation path can change depending the number of keyframes.



Plotting A. The Fidelity Keys Tolerance field is set to 10. **B.** Cube1 **C.** Cube1's trajectory is different than the original animation. **D.** Only five keyframes were plotted to Cube1.

You can also use the FCurves window to compare the animation. For example, compare the X-axis Rotation function curves of the animation shown in the following figure A and B.



FCurves window A. Rotation function curve of Cube1 in the previous figure. Rotation function curve of Cube1 in the previous figure.

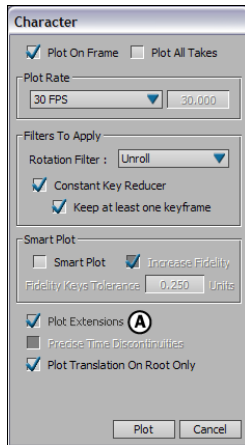
Additional plot options

The following plot options are available in the Plot Properties window depending on what is selected in MotionBuilder and which plot option you select:

- [Plot Extensions option](#) on page 1676
- [Precise Time Discontinuities](#) on page 1677
- [Plot Translation On Root Only option](#) on page 1678

Plot Extensions option

The Plot Extension option is available in the Plot Properties window when you are plotting animation from the Control rig to the skeleton on a character that has a Character Extension. This option is only available when you plot the animation by clicking Plot Character in the Character Settings, then select Skeleton in the dialog box that follows.



Plot Properties window A.
Plot Extensions option

When the Plot Extensions option is active, the animation on all Character Extensions is plotted along with the rest of the character's animation. When the Plot Extensions option is disabled, Character Extension animation is not plotted.

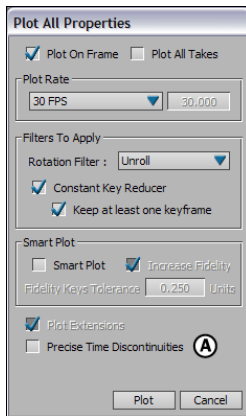
If you plot animation using an option other than Plot Character, the option is grayed out and Character Extension animation is not plotted.

In the Story window, if you want to plot Character Extension animation to the current take (see [Plot Whole Scene To Current Take](#) on page 1518), make sure that the Character Extensions option is selected in the Character track's Body Parts menu before you plot (see [Body Parts menu](#) on page 1535). If you do not want to include Character Extension animation, disable the option.

Precise Time Discontinuities

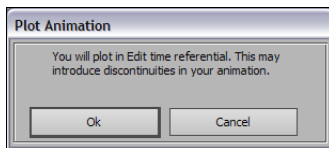
The Precise Time Discontinuities option is available when the Story Mode is set to Edit and the Time Discontinuity option is activated in the Story window.

When active, Precise Time Discontinuities plots changes in data caused by shot discontinuity. See [Edit Track list](#) on page 1627.



Plot All Properties A. Precise Time Discontinuities option

When the Story Mode is set to Edit, the Time Discontinuity option is active in the Story window, and you select an option to open a Plot window, a dialog box appears to warn you that you are about to plot animation that may be discontinuous. For more information on discontinuous animation and the Story window, see [Edit Track list](#) on page 1627.



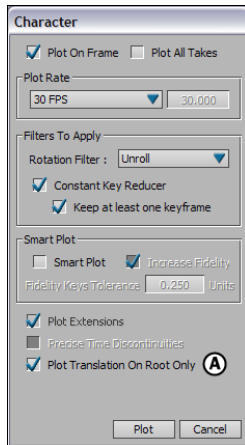
Plot Animation dialog box

Plot Translation On Root Only option

This option is available in the Plot Properties window after you click Plot Character in the Character settings and click Skeleton in the dialog box that appears. You can also access the Plot Character option in the Edit menu of the Character Controls.

This option is also available when you click Plot Options in the Batch window.

Activate the Plot Translation on Root Only option to make sure that translation animation is plotted only to the Hips of the character.



Plot Properties window A.
Plot Translation to Root
Only option

Plot and Cancel buttons

The Cancel button closes the dialog box without applying any options or plotting.

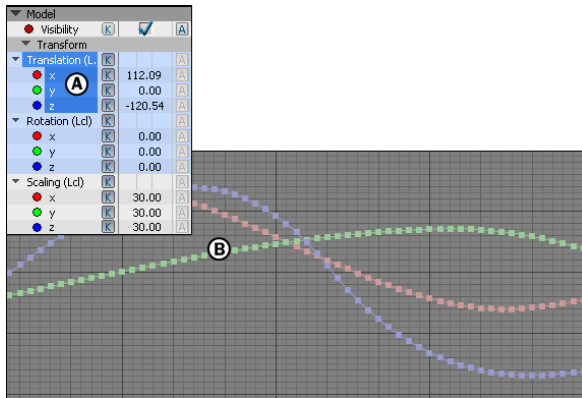
The Plot button plots the selected models and properties with the options that are set and closes the window.

Depending on your plot settings, the message “Too Many Keyframes to Edit” may appear on the Action timeline. This happens because plotting can create more keyframes than can be visually represented and edited on the Action timeline. You can still edit the plotted data in the FCurves window, and you can zoom on sections of the timeline to see all keyframes.

When you plot, the data from the take (source) is applied to the selected objects (destination). When the current take is finished plotting, the data from the take is recorded to the model.

You can view your plotted data by selecting your model and viewing the function curves in the FCurves window. When you select a property on which the take was plotted, the function curve displays the plotted data. Also, these function curves display in pastel colors.

For example, shows the result of plotting a take to a cube’s translation function curves in the FCurves window.



The result after plotting a take to a marker's translation function curves. **A.** The translation function curves are selected. **B.** Function curves of animation display.

Playing Animation

The main controls for playing animation in MotionBuilder are found in the Transport Controls. To play animation, use one of the following methods:

- In the Transport Controls, click Play to play the animation, and Stop to stop the animation.



Play Controls found in the Transport Controls A. Stop B. Play

- Press Ctrl-Spacebar to play the animation, and press Ctrl-Spacebar again to stop the animation.
- J-drag in the Viewer window or along a timeline to jog the animation. See [Jogging animation](#) on page 1681.
- [Transport Controls](#) on page 619

Jogging animation

Jogging is the easiest way to move backward and forward along the timeline at the play speed you want. Jogging also affects any audio on the timeline when the Enable Scrubbing option is active in the Audio settings.

To jog through the current take:

- 1 J-drag in the Viewer window, or on a timeline.

Drag left to jog backward, or right to jog forward. The further you move the mouse pointer relative to the location in which you J-click, the faster the take plays.

■ [Playing Animation](#) on page 1681

Changing the play speed

To change the speed at which your take plays in MotionBuilder:

- 1 Select a play speed in the Play speed field in the Transport Controls window.

By slowing down the play speed, you can analyze model and camera movements more easily. You can also speed up play or draw every frame.

NOTE To compensate for computer speed, frames may be dropped for playing in real time in all play speeds, excluding the ALL FR option.

■ [Transport Controls](#) on page 619

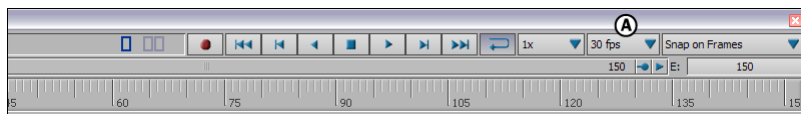
Selecting a frame rate

You can change the frame rate at which the take plays. You can select frames-per-second (fps), NTSC, or PAL formats from the menu, or use the Custom option to enter a custom frame rate. The default time format is 30 fps.

NOTE For information on changing the time display, see [Selecting a time format](#) on page 608.

To select one of the main frame rates:

- 1 In the Transport Controls, select one of the options in the Time Format field.

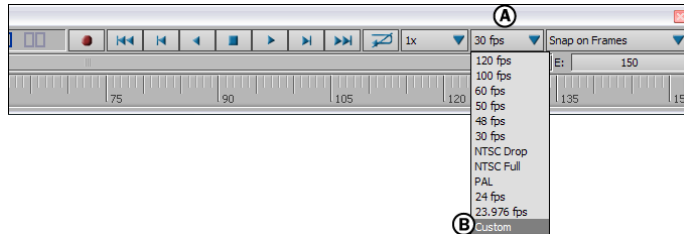


Transport Controls A. Time Format field

The frame rate is selected in the Time Format field, and the unit of measurement is changed. See [Time Format menu](#) on page 635 for more information.

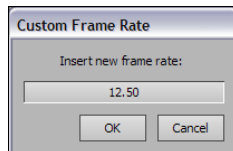
To select a custom frame rate:

- 1 Click the Time Format field in the Transport Controls, then select Custom from the menu.



Transport Controls A. Time Format field B. Custom option

The Custom Frame Rate dialog box appears .



Custom Frame Rate dialog box

- 2 Enter one of the following frame rates in the field:

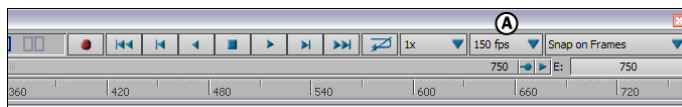
| | | | |
|---|----|-----|-----|
| 1 | 16 | 75 | 300 |
| 2 | 20 | 80 | 375 |
| 3 | 24 | 85 | 400 |
| 4 | 25 | 86 | 500 |
| 5 | 30 | 100 | 600 |
| 6 | 40 | 120 | 750 |

| | | | |
|------|----|-----|------|
| 8 | 43 | 125 | 1200 |
| 10 | 44 | 150 | 1500 |
| 12 | 48 | 200 | 2000 |
| 12.5 | 50 | 240 | 2000 |
| 15 | 60 | 250 | 6000 |

NOTE If you enter a value other than one of these supported frame rates, the next highest supported frame rate is selected.

- 3 Click Ok or press Enter.

The custom frame rate is selected in the Time Format field.



Transport Controls A. A custom frame rate is selected.

When you save your scene, the selected frame rate is also saved.

- [Transport Controls](#) on page 619

Using marks

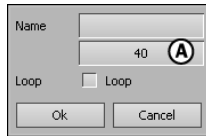
You can set marks on the Action timeline in the Transport Controls to indicate areas for filtering, blending, duplicating, or looping.

To set a mark:

- 1 Right-click on the Action timeline in the Transport Controls.
- 2 Select Add Mark from the contextual menu.

To move a mark:

- 1 Double-click the mark to open the Mark dialog box.
- 2 Enter a frame number in the Timecode field .



Mark dialog box A.
Timecode field

- 3 Click Ok.
The mark moves to the frame you specify. You can also drag the mark left or right along the Action timeline.

To create a loop between marks:

- 1 Double-click the mark to open the Mark dialog box.
- 2 Activate the Loop option , and click Ok.

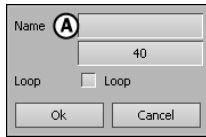


Mark dialog box A.
Loop option

- 3 Play the animation. The take loops from the beginning of the take to the current mark. If there is a previous mark, the take loops between the current and previous mark.

To name a mark:

- 1 Double-click the mark to open the Mark dialog box.
- 2 Type in the Name field to assign a name.



Mark dialog box A.
Name field

3 Click Ok to confirm the name.

■ [Transport Controls](#) on page 619

Triggering Animation

Characters in computer games not only walk, they also run, jump, climb, and perform a series of other realistic actions necessary to the action in the game.

You can create each of these actions as a motion clip with keyframe or motion capture data, then plot them to a character's skeleton, save them as individual *.fbx* files, and test them in the Animation Trigger window. The Animation Trigger window supports shape animation as well as character animation.

When you use the Animation Trigger window to test motion clips, you can make sure that they flow seamlessly to simulate realistic action. You can test motion clips that are continuous, such as walk cycles or run cycles and you can also test motion clips that are not continuous, such as jumps, to make sure that they blend into other motion clips.

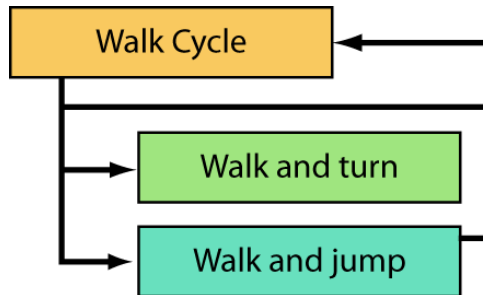
- [Planning and creating motion clips](#) on page 1687
- [Trigger groups](#) on page 1690
- [Setting up a device as a trigger](#) on page 1690
- [Recording triggered animation](#) on page 1691
- [Creating a trigger tree](#) on page 1692
- [Animation Trigger window](#) on page 1692

Planning and creating motion clips

Planning your motion clips before creating them helps to produce smooth transitions between motion clips. It is important to blend the right clips together so that the beginning and end of each motion clip blends with the previous or next triggered motion clip.

For example, when creating the “walk and turn” motion cycle, you must make sure its start and end match the “walk” cycle and “walk and jump” cycle. Each

cycle can continually trigger itself before playing the triggered motion clip. In the following graphic, the “walk cycle” continues to loop until the “walk and turn” or “walk and jump” clips are triggered.

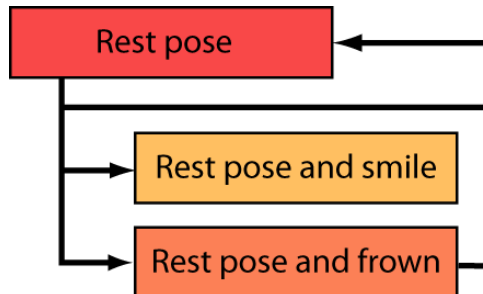


A trigger sequence with three motion cycles.

A good walk cycle has no slides or jumps that mark the start and end of the motion clip. As the motion clip loops, a character walks forward without a hitch.

The transitions between these three motion clips are smooth because the start and end of each clip matches the start and end of the other clips. In fact, the walk cycle serves as the main looping cycle, or base motion cycle. The other two animation cycles are created so that their start and end match the start and end of the walk cycle.

Similarly, in the following graphic, the “rest pose” motion clip is the base motion cycle for the other two facial motion clips. The “rest pose and smile” clip and “rest pose and frown” clip both start and end with the same rest pose as the “rest pose” cycle, to create smooth transitions.



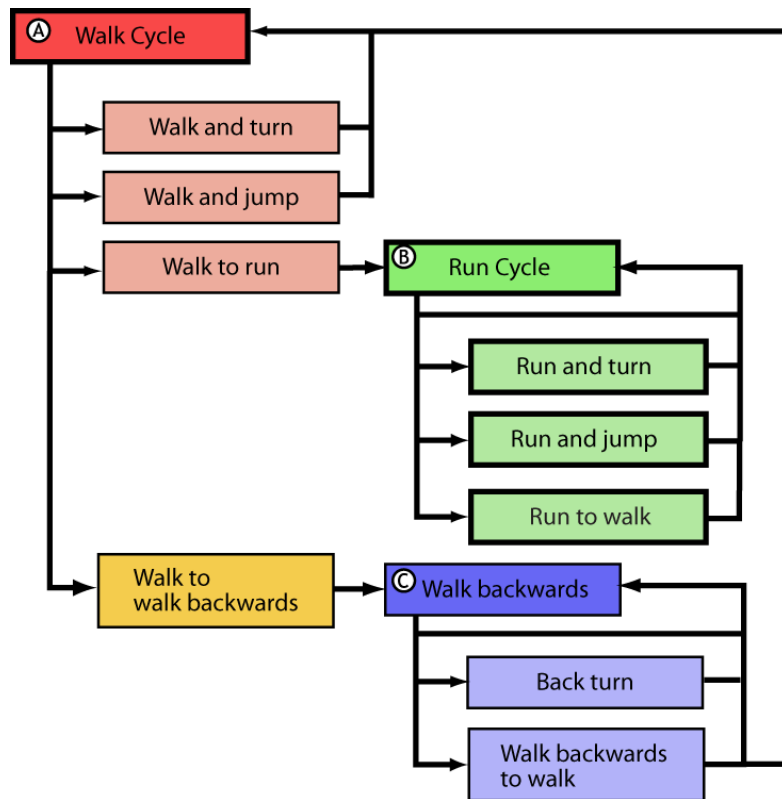
A trigger sequence for facial animation.

When you create a series of animation cycles, the first cycle you create should serve as the base motion cycle for other animation cycles.

The more motion clips you use, the more useful base motion cycles become. When you plan to use a larger series of motion clips, with run cycles and other types of animation, it is helpful to use more than one base motion cycle.

For example, the following graphic shows an expanded set of motion clips, or trigger hierarchy, that includes motion clips for running and walking backwards, as well as walking forwards. The base motion cycles in this example are the walk, run, and walk backwards cycles (A, B, and C).

The start and end of the “run and turn” and “run and jump” motion clips match the start and end of the base motion clip “run cycle”. The “run to walk” motion clip is a transition clip whose start matches the “walk cycle”, and whose end matches the “run” cycle. All these factors must be considered when creating motion clips.



A trigger hierarchy for a set of motion clips that includes cycles for running and walking backwards. A. Base walk cycle B. Base run cycle C. Base walk backwards cycle

The easiest way to create animation cycles is to use the Story window. To use them as motion clips in the Animation Trigger window, you then need to plot them to a character and save each animation cycle as a separate *.fbx* file.

- [Triggering Animation](#) on page 1687
- [Trigger groups](#) on page 1690
- [Setting up a device as a trigger](#) on page 1690
- [Recording triggered animation](#) on page 1691
- [Creating a trigger tree](#) on page 1692
- [Animation Trigger window](#) on page 1692

Trigger groups

A Trigger Group is an organizational tool, like a folder, which contains the Links settings and a trigger tree you create. You cannot trigger motion clips in the Animation Trigger window until you create and select a Trigger Group.

A Trigger Group also lets you link a character, a device, and motion clips. You can trigger motion clips only when these three elements are selected or present in the Trigger Group. Once you have done this, you can create and activate a trigger tree.

- [Triggering Animation](#) on page 1687
- [Planning and creating motion clips](#) on page 1687
- [Setting up a device as a trigger](#) on page 1690
- [Recording triggered animation](#) on page 1691
- [Creating a trigger tree](#) on page 1692
- [Animation Trigger window](#) on page 1692

Setting up a device as a trigger

You can use a device, such as a keyboard or joystick, to trigger motion clips. Once you have added a device to the scene, you can select it in the Animation

Trigger window and determine which triggers, such as keyboard keys, can execute motion clips.

- [Triggering Animation](#) on page 1687
- [Planning and creating motion clips](#) on page 1687
- [Trigger groups](#) on page 1690
- [Recording triggered animation](#) on page 1691
- [Creating a trigger tree](#) on page 1692
- [Animation Trigger window](#) on page 1692

Recording triggered animation

Once you have created a trigger tree, you can record the motion clips you play and trigger.

To record animation triggering, make sure Active is selected in the Links pane, then click Record and Play in the Transport Controls window.

As the motion clips play, the Activity Progress bar shows the progress of each motion clip, and the Timeline indicator moves across the Action timeline. Use the triggers during recording to record a sequence of movements, then click Stop to finish recording.

NOTE Activating a trigger takes effect only when the current motion clip has finished playing. It does not interrupt the current motion clip.

- [Triggering Animation](#) on page 1687
- [Planning and creating motion clips](#) on page 1687
- [Trigger groups](#) on page 1690
- [Setting up a device as a trigger](#) on page 1690
- [Creating a trigger tree](#) on page 1692
- [Animation Trigger window](#) on page 1692

Trigger trees

A trigger tree connects a motion clip to a device trigger.

Creating a trigger tree

You create a trigger tree to connect the motion clips and the device triggers. A trigger tree determines which motion clip is executed by which trigger. You can also set up the trigger tree so that some motion clips trigger other motion clips.

- [Triggering Animation](#) on page 1687
- [Planning and creating motion clips](#) on page 1687
- [Trigger groups](#) on page 1690
- [Setting up a device as a trigger](#) on page 1690
- [Recording triggered animation](#) on page 1691
- [Animation Trigger window](#) on page 1692

Animation Trigger window

The Animation Trigger window lets you set up a series of motion clips that you can execute using triggers. You can use the Animation Trigger window to define triggers, trigger motion clips, and record animation triggering.

The Animation Trigger window is most commonly used to test transitions between motion clips. For example, video game designers can use the Animation Trigger window to test the different actions, or motion clips, that a player may perform.

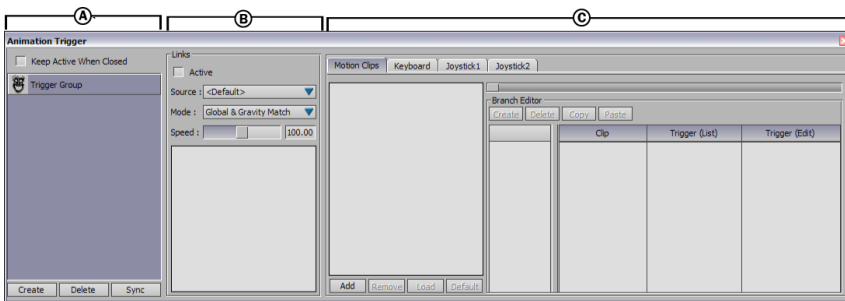
A motion clip can consist of Character animation and shape animation. See [Triggering Animation](#) on page 1687 for more information on creating motion clips.

You can trigger motion clips using a keyboard or a joystick. Before using the Animation Trigger window, you must add and activate one of these devices. See [Adding a device](#) on page 1021.

There should be a smooth transition of motion between motion clips. For example, a motion clip in which the Character rolls on the floor followed by another clip in which the Character jumps does not produce a realistic transition. To create a smooth transition, you can create base motion clips. A base motion clip loops, and other motion clips start and end with the same animation as the base clip. See [Triggering Animation](#) on page 1687 for more information on creating motion clips.

The Animation Trigger window consists of the following:

- [Groups pane](#) on page 1693
- [Links pane](#) on page 1694
- [Triggering Options area](#) on page 1696



Animation Trigger window A. Groups pane B. Links pane C. Triggering Options pane

- [Triggering Animation](#) on page 1687

Groups pane

In the Animation Trigger window, the Groups pane lets you create, delete, and synchronize a triggering group. A triggering group is a collection of motion clips and triggers. The Groups pane consists of the following options:

Keep Active When Closed

The Keep Active When Closed option lets you trigger motion clips in the Animation Trigger window even when this window is closed.

When the Keep Active When Closed option is enabled in the Animation Trigger window, the equivalent Animation Trigger option is enabled in the Viewer window and all keyframe animation features are disabled.

Create button

Creates a triggering group. The Animation Trigger window must contain at least one triggering group for the other features in the Groups pane to be available.

Delete button

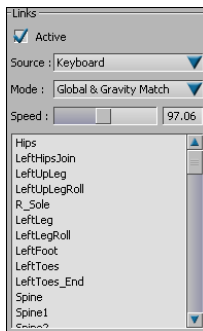
Deletes the selected triggering group.

Sync button

The Sync button lets you continue playing from the first motion clip of the triggering group.

Links pane

In the Animation Trigger window, the Links pane lets you play motion clips and define various parameters. The Links pane also contains a list of the animated nodes of the selected triggering group in the Groups pane.



Links pane

The Links pane contains the following options:

Active option

The Active option plays the motion clips in the Motion Clips pane (see [Motion Clips pane](#) on page 1696), starting with the first branch of the selected motion clip in the Motion Clips list. When disabled, the motion clips stop playing.

Select Active to view the Activity Progress bar, and to record animation triggering.

Source menu

Lets you choose the source of the triggers, which is the device that is used to start motion clips. The source can be a keyboard or one of 16 joysticks. See [Keyboard and Joystick panes](#) on page 1699.

Mode menu

Displays the playing mode of motion clips. There are four modes:

| Mode | Function |
|------------------------|---|
| Local | Animates the models according to their parenting definition. This mode is usually selected to animate parts of models, such as an arm or leg, without animating the rest of the body. |
| Global | Animates the models in a loop according to the global axis of the scene. The animation loops at the first branch of the first motion clip. |
| Global & Match | Animates the models in a loop according to the global axis of the scene. The animation loops at the current location of the scene and the beginning of the new loop is matched to the end of the last loop. |
| Global & Gravity Match | Animates the models as in Global & Match mode with the addition of gravity, which links the models to the floor (or Y-axis). |

Speed setting

Lets you set the percentage of the original speed used to play the motion clips. The values range from 50% to 400% (100% plays the motion clips using the original speed). The value can be changed by double-clicking in the field to write a new value, or by dragging its slider left or right.

Nodes list

The Nodes list displays all of the nodes of your model that you want to animate with triggers, usually the hips and skeleton of a model. Alt-drag the selection nodes from your Viewer window into the Nodes list.

You can define a new list by Alt-dragging a new selection into the Nodes list. All previous nodes are replaced.

NOTE Do not drag the model's reference into the Nodes list.

Triggering Options area

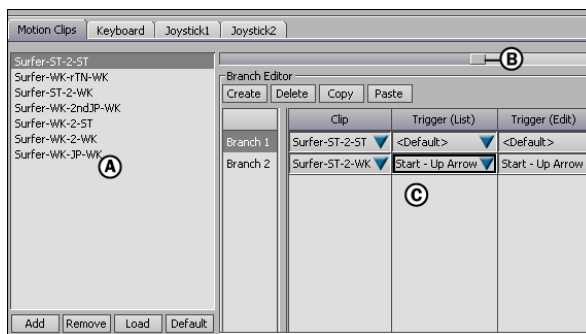
The Triggering Options area lets you select the motion clips of the triggering group and define triggers.

The Triggering Options area can be divided into two parts:

- [Motion Clips pane](#) on page 1696
- [Keyboard and Joystick panes](#) on page 1699

Motion Clips pane

The Motion Clips pane lets you add motion clips to the triggering group and select the triggers that initiate their execution.



Motion Clips pane A. Motion Clips list B. Activity Progress bar C. Branch editor

The Motion Clips list displays all of the motion clips for the selected trigger group and provides the following buttons:

Add

Adds a motion clip to the triggering group. You can use *.fbx* or *.bvh* files as motion clips in the Animation Trigger window.

You can load all motion clips in a folder at the same time by entering **.fbx* (or **.bvh*) in the File Name field of the Open directory dialog box.

These files must contain data matching the models. For example, if you are animating a bipedal model, you select a clip that has a compatible set of nodes.

Remove

Deletes the selected motion clip from the Motion Clips list, and also deletes the branches that use this motion clip.

Load

Loads the content of a motion clip into a selected motion clip whose link has been broken. The name of the selected motion clip remains unchanged.

Default

Positions the selected motion clip at the top of the Motion Clips list, which makes it the motion clip that is played when no other clip is selected for playing. Default also deselects all motion clips so that the Branch editor is empty.

Activity Progress bar

Shows the progress of each motion clip and is only active when the Active option in the Links pane is selected.

Branch Editor

The Branch editor lets you create branches of motion clips that can be triggered using the source device. Only one motion clip of a given branch can be triggered at a time.

The following columns and options make up the Branch editor:

Create button

Adds a branch. By default, the clip of a new branch is set to the selected motion clip and is named consecutively Branch 1,

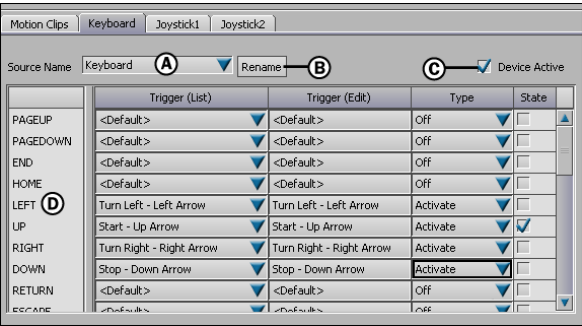
Branch 2, and so on. You cannot rename branches.

| | |
|-----------------------|---|
| Delete button | Deletes the selected branch. |
| Copy button | Copies the entire list of branches associated with the selected motion clip. You can paste this list onto another motion clip using the Paste button. |
| Paste button | Pastes the list of branches onto the selected motion clip and replaces the previous list. |
| Clip column | Selects the motion clip to execute from the Motion Clips list. If the Active option in the Links pane is selected when you modify the Clip column, the current motion clip in the Motion Clips list switches to the clip you just selected. |
| Trigger (List) column | Specifies the trigger that executes the branch. Triggers are defined in the Keyboard, Joystick1, or Joystick2 panes depending on the device. See Keyboard and Joystick panes on page 1699. |
| Trigger (Edit) column | Edits the name of the trigger selected in the Trigger (List) column. To edit the name, double-click the field, type the new name, and press Enter. This option is useful only when you are creating branches for your motion clips before you define the triggers in the Keyboard/Joystick panes. |

NOTE Be careful when changing the name of a trigger in the Branch editor. The corresponding name is changed in the Keyboard or Joystick pane. The triggers that are not defined in the Keyboard or Joystick panes are deleted when you exit MotionBuilder.

Keyboard and Joystick panes

The Keyboard and Joystick panes define the triggers used by the Branch editor. You must define keyboard or joystick triggers before you can trigger motion clips.



Keyboard pane A. Source Name field B. Rename button C. Device Active option D. Controls list

NOTE MotionBuilder is compatible with all the joysticks supported by the operating system on which MotionBuilder is installed.

The Joystick panes are almost identical to the Keyboard pane, except that they have different trigger options. The contents of the Keyboard, Joystick1, and Joystick2 panes are as follows:

Source Name

Displays the device for which the triggers are defined. The Rename button lets you enter a new name for the source.

Rename

Lets you rename the Source Name.

Device Active

When activated, it indicates that the Animation Trigger window is set to receive data from the source.

Controls List

Lists the controls available with the selected source. In the Keyboard pane, the keyboard keys are listed. In the Joystick panes, the joystick directions and buttons are listed.

- [Triggering Animation](#) on page 1687

Keyboard Shortcuts

MotionBuilder has keyboard configurations that simulate the keyboard shortcuts from four popular 3D software applications.

This lets you switch between those applications and MotionBuilder without having to learn a new set of shortcuts.

Choose the version that best suits your needs:

- MotionBuilder keyboard shortcuts
- 3ds Max keyboard shortcuts
- Maya keyboard shortcuts

Activating shortcuts

Activate a new shortcut configuration by selecting Settings > Keyboard Configuration and choosing one of the configurations listed. The keyboard configuration change comes into effect immediately; there is no need to restart MotionBuilder.

MotionBuilder keyboard shortcuts

The following shortcuts represent the MotionBuilder default keyboard commands. The left column lists the action the shortcut performs and the right column lists which keys you press to trigger them.

General shortcuts

You can use the following shortcuts for general actions in MotionBuilder.

| Action | Shortcut |
|--|-------------|
| Undo last action | Ctrl-Z |
| Redo last action | Ctrl-Y |
| Cut | Ctrl-X |
| Copy | Ctrl-C |
| Paste | Ctrl-V |
| Paste special | Ctrl-B |
| Delete selection | Delete |
| Global accept | Enter |
| Global cancel | Escape |
| New scene | Ctrl-N |
| Open scene | Ctrl-O |
| Save scene | Ctrl-S |
| Pan window | Shift-drag |
| Zoom In/Out | Ctrl-drag |
| Select a range of assets in the Navigator window | Shift-click |

| Action | Shortcut |
|-----------------------------|------------------|
| Position timeline indicator | Ctrl-Shift-click |
| Drag and drop asset | Alt-drag |

Transport Controls shortcuts

You can use the following shortcuts for Transport Control window actions in MotionBuilder.

| Action | Shortcut |
|--|--------------------------------|
| Play/stop | Ctrl-Spacebar or Ctrl-Up arrow |
| Play backwards/stop | Ctrl-Down arrow |
| Forward one frame | Ctrl-Right arrow |
| Back one frame | Ctrl-Left arrow |
| Go to start | Ctrl-Home |
| Go to end | Ctrl-End |
| Jog/audio shuttle | J-drag |
| Frame zoom bar on Start and End (full-size Zoom bar) | A |
| Frame Zoom bar on selected keyframe region | F |
| Frame Start and End of all animation ("Frame Take" function) | Ctrl-Shift-A |

| Action | Shortcut |
|---|--------------|
| Frame Start and End of a selected keyframe region | Ctrl-Shift-F |

Keyframing shortcuts

You can use the following shortcuts for keyframing in MotionBuilder.

| Action | Shortcut |
|-------------------------|--------------|
| Add keyframe | K |
| Add Zero keyframe | Shift-K |
| Add Flat keyframe | Ctrl-K |
| Go to next keyframe | Right arrow |
| Go to previous keyframe | Left arrow |
| Add Key at time x | Ctrl-Shift-K |
| Add FK key | , (comma) |
| Add IK key | . (period) |

FCurves shortcuts

You can use the following shortcuts for FCurve window actions in MotionBuilder.

| Action | Shortcut |
|-----------------|----------|
| Select keyframe | Click |

| Action | Shortcut |
|---------------------------|---------------|
| Select keyframe region | Spacebar-drag |
| Add keyframe to selection | Ctrl-click |
| Select range of keyframes | Shift-click |
| Zoom rectangular | Z-drag |
| Frame all keyframes | A |
| Frame selected keyframes | F |
| Add keyframe on a curve | I-click |

Motion blend shortcuts

You can use the following shortcuts for Motion Blend actions.

| Action | Shortcut |
|-------------------------------|----------|
| Scale/change speed of a track | S-drag |
| Translate a track | T-drag |

Layout shortcuts

You can use the following shortcuts for working with Layouts.

| Action | Shortcut |
|-------------------------|--------------|
| Select Creation layout | Ctrl-Shift-1 |
| Select Animation layout | Ctrl-Shift-2 |

| Action | Shortcut |
|-------------------------|------------------|
| Select Editing layout | Ctrl-Shift-3 |
| Select Preview layout | Ctrl-Shift-4 |
| Select Story layout | Ctrl-Shift-5 |
| Select User layouts 1-5 | Ctrl-Shift-6 - 0 |

Character shortcuts

You can use the following shortcuts for working with Characters.

| Action | Shortcut |
|-----------------------------------|----------|
| Pin Rotation | W |
| Pin Translation | E |
| Activate/Disable effector release | Q |

Pose shortcuts

You can use the following shortcuts for working with Pose controls.

| Action | Shortcut |
|------------|----------|
| Copy pose | Ctrl-F12 |
| Paste pose | Alt-F12 |

Viewer window shortcuts

You can use the following shortcuts for working with the Viewer window.

| Action | Shortcut |
|--|--------------------|
| Select number of views | Ctrl-1, 2, 3, or 4 |
| Switch to full screen mode | Alt-Enter |
| Switch to Perspective/Custom | Ctrl-E |
| Switch/cycle to front/back | Ctrl-F |
| Switch/cycle to right/left | Ctrl-R |
| Switch/cycle to top/bottom | Ctrl-T |
| Switch to/from Schematic view | Ctrl-W |
| Camera switcher | Ctrl-I |
| Frame selected objects | F |
| Frame all objects | A |
| Cycle Normal/Models Only/X-Ray mode | Ctrl-A |
| Display performance statistics | Shift-F |
| Display memory statistics | Shift-M |
| Switch to Object selection | O |
| Switch to Vertex selection (When Skins window is open) | V |

| Action | Shortcut |
|---|-----------------------|
| Switch to Pivot Selection | Shift-O |
| Switch to Parenting mode | P |
| Find models by name | Shift-N |
| Pan camera | Shift-drag |
| Slide camera | Shift-right-drag |
| Dolly camera | Ctrl-drag |
| Dolly camera with interest | Ctrl-right-drag |
| Orbit camera around interest | Ctrl-Shift-drag |
| Orbit interest around camera | Ctrl-Shift-right-drag |
| Zoom camera | Z-drag |
| Roll custom camera | R-drag |
| Roll custom camera (15 degree increments) | R-right-drag |

Viewer window manipulation shortcuts

You can use the following shortcuts to manipulate objects in the Viewer window.

| Action | Shortcut |
|----------------|----------|
| Parenting mode | P |

| Action | Shortcut |
|-----------------------|-------------------|
| Translate selection | T |
| Selection mode | F3 |
| Drag mode | F1 |
| Local mode | F5 |
| Global mode | F6 |
| Rotate selection | R |
| Rotate additive | F7 |
| Rotate axis | F8 |
| Rotate around | Shift-R |
| Scale uniform | S |
| Scale volumic | Shift-S |
| Drag mode | F1, then Up arrow |
| Manipulator drag | F2 |
| Switch to wireframe | 1 |
| Switch to flat shaded | 2 |
| Switch to lighted | 3 |
| Switch to textured | 4 |
| Switch to shaded | 5 |

| Action | Shortcut |
|-------------------------------|----------|
| Switch to shaded and textured | 6 |

Viewer window selection shortcuts

You can use the following shortcuts to select objects in the Viewer window.

| Action | Shortcut |
|------------------------------|------------------------------|
| Select (exclusive) | Click or drag |
| Append to selection | Middle-click or drag |
| Remove from selection | Right-click or drag |
| Toggle selection | Spacebar-click or drag |
| Select range | Click, then Shift-select |
| Hide selection | Shift-H |
| Hide all | Shift-H with no selection |
| Show selection | Shift-S |
| Show all | Shift-S with no selection |
| Select and show in Navigator | Double-click |
| Add to/remove from selection | Ctrl-click, or Spacebar-drag |
| Select all in group | G-click |
| Add group to selection | G-middle-click |

| Action | Shortcut |
|--|------------------------|
| Select object and children | Spacebar-right click |
| Select root of hierarchy | Ctrl-right-click |
| Select object and parents | Shift-right-click |
| Select whole hierarchy | Ctrl-Shift-right-click |
| Go up the hierarchy (parent) | Alt-Up arrow |
| Go down the hierarchy (first child) | Alt-Down arrow |
| Go sideways in the hierarchy (left sibling, same level) | Alt-Left-arrow |
| Go sideways in the hierarchy (right sibling, same level) | Alt-Right-arrow |

Optical shortcuts

You can use the following shortcuts for working with Optical tools.

| Action | Shortcut |
|--|-----------------------------|
| Navigate marker list (Label pane) | Up/Down arrow keys |
| Navigate marker list within same Rigid body (Label pane) | Shift-Up/Down arrow keys |
| Go to previous/next segment or gap | Shift-Left/Right arrow keys |
| Frame all segments | A |
| Zoom rectangular | Z-drag |

| Action | Shortcut |
|-----------------------------------|-----------------------------|
| Move start/end of current segment | M-drag segment edge |
| Move Timeline indicator | T-click or Ctrl-Shift-click |
| Insert a gap key (in gap only) | K |

Story window shortcuts

You can use the following shortcuts for working with the Story window.

| Action | Shortcut |
|----------------------|-------------------|
| Select next clip | Shift-right arrow |
| Select previous clip | Shift-left arrow |
| Go to first clip | Shift-Home |
| Go to last clip | Shift-End |
| Razor clip | Alt-R |
| Scale track | Alt-S |

MotionBuilder Classic keyboard shortcuts

The following shortcuts represent the MotionBuilder Classic keyboard commands. The left column lists the action the shortcut performs and the right column lists which keys you press to trigger them.

General shortcuts

You can use the following shortcuts for general actions in MotionBuilder.

| Action | Shortcut |
|--|-------------|
| Undo last action | Ctrl-Z |
| Redo last action | Ctrl-Y |
| Cut | Ctrl-X |
| Copy | Ctrl-C |
| Paste | Ctrl-V |
| Paste special | Ctrl-B |
| Delete selection | Delete |
| Global accept | Enter |
| Global cancel | Escape |
| New scene | Ctrl-N |
| Open scene | Ctrl-O |
| Save scene | Ctrl-S |
| Pan window | Shift-drag |
| Zoom In/Out | Ctrl-drag |
| Select a range of assets in the Navigator window | Shift-click |

| Action | Shortcut |
|-----------------------------|------------------|
| Position timeline indicator | Ctrl-Shift-click |
| Drag and drop asset | Alt-drag |

Transport Controls shortcuts

You can use the following shortcuts for Transport Control window actions in MotionBuilder.

| Action | Shortcut |
|--|--------------------------------|
| Play/stop | Ctrl-Spacebar or Ctrl-Up arrow |
| Play backwards/stop | Ctrl-Down arrow |
| Forward one frame | Ctrl-Right arrow |
| Back one frame | Ctrl-Left arrow |
| Go to start | Ctrl-Home |
| Go to end | Ctrl-End |
| Jog/audio shuttle | J-drag |
| Frame zoom bar on Start and End (full-size Zoom bar) | A |
| Frame Zoom bar on selected keyframe region | F |
| Frame Start and End of all animation ("Frame Take" function) | Ctrl-Shift-A |

| Action | Shortcut |
|---|--------------|
| Frame Start and End of a selected keyframe region | Ctrl-Shift-F |

Keyframing shortcuts

You can use the following shortcuts for keyframing in MotionBuilder.

| Action | Shortcut |
|-------------------------|-------------|
| Add keyframe | K |
| Add Zero keyframe | Shift-K |
| Add Flat keyframe | Ctrl-K |
| Go to next keyframe | Right arrow |
| Go to previous keyframe | Left arrow |
| Add Key at time x | X |

FCurves shortcuts

You can use the following shortcuts for FCurve window actions in MotionBuilder.

| Action | Shortcut |
|---------------------------|---------------|
| Select keyframe | Click |
| Select keyframe region | Spacebar-drag |
| Add keyframe to selection | Ctrl-click |

| Action | Shortcut |
|---------------------------|-------------|
| Select range of keyframes | Shift-click |
| Zoom rectangular | Z-drag |
| Frame all keyframes | A |
| Frame selected keyframes | F |
| Add keyframe on a curve | I-click |

Motion blend shortcuts

You can use the following shortcuts for Motion Blend actions.

| Action | Shortcut |
|-------------------------------|----------|
| Scale/change speed of a track | S-drag |
| Translate a track | T-drag |

Layout shortcuts

You can use the following shortcuts for working with Layouts.

| Action | Shortcut |
|-------------------------|--------------|
| Select Creation layout | Ctrl-Shift-1 |
| Select Animation layout | Ctrl-Shift-2 |
| Select Editing layout | Ctrl-Shift-3 |
| Select Preview layout | Ctrl-Shift-4 |

| Action | Shortcut |
|-------------------------|------------------|
| Select Story layout | Ctrl-Shift-5 |
| Select User layouts 1-5 | Ctrl-Shift-6 - 0 |

Character shortcuts

You can use the following shortcuts for working with Characters.

| Action | Shortcut |
|-----------------------------------|----------|
| Pin Rotation | W |
| Pin Translation | E |
| Activate/Disable effector release | Q |
| Use IK Pivot option | D |

Viewer window shortcuts

You can use the following shortcuts for working with the Viewer window.

| Action | Shortcut |
|------------------------------|--------------------|
| Select number of views | Ctrl-1, 2, 3, or 4 |
| Switch to full screen mode | Alt-Enter |
| Switch to Perspective/Custom | Ctrl-E |
| Switch/cycle to front/back | Ctrl-F |
| Switch/cycle to right/left | Ctrl-R |

| Action | Shortcut |
|--|------------------|
| Switch/cycle to top/bottom | Ctrl-T |
| Switch to/from Schematic view | Ctrl-W |
| Camera switcher | Ctrl-I |
| Frame selected objects | F |
| Frame all objects | A |
| Cycle Normal/Models Only/X-Ray mode | Ctrl-A |
| Display performance statistics | Shift-F |
| Display memory statistics | Shift-M |
| Display cycle statistics | Shift-D |
| Switch to Object selection | O |
| Switch to Vertex selection (When Skins window is open) | V |
| Switch to Pivot Selection | Shift-O |
| Switch to Parenting mode | P |
| Find models by name | Shift-N |
| Pan camera | Shift-drag |
| Slide camera | Shift-right-drag |
| Dolly camera | Ctrl-drag |

| Action | Shortcut |
|---|-----------------------|
| Dolly camera with interest | Ctrl-right-drag |
| Orbit camera around interest | Ctrl-Shift-drag |
| Orbit interest around camera | Ctrl-Shift-right-drag |
| Zoom camera | Z-drag |
| Roll custom camera | R-drag |
| Roll custom camera (15 degree increments) | R-right-drag |

Viewer window manipulation shortcuts

You can use the following shortcuts to manipulate objects in the Viewer window.

| Action | Shortcut |
|---------------------|----------|
| Parenting mode | P |
| Translate selection | T |
| Drag | F1 |
| Rotate selection | R |
| Rotate additive | F4 |
| Rotate axis | F5 |
| Rotate around | C |

| Action | Shortcut |
|-------------------------------|----------|
| Scale uniform | S |
| Switch to wireframe | Shift-W |
| Switch to lighted | Shift-E |
| Switch to textured | Shift-R |
| Switch to shaded and textured | Shift-T |

Viewer window selection shortcuts

You can use the following shortcuts to select objects in the Viewer window.

| Action | Shortcut |
|-----------------------|---|
| Select (exclusive) | Spacebar-click in an empty part of the Viewer window. |
| Append to selection | Spacebar-middle-click or drag |
| Remove from selection | Spacebar-Right-click or drag |
| Toggle selection | Spacebar-click or drag |
| Select range | Click, then Shift-select |
| Hide selection | Shift-H |
| Hide all | Shift-H with no selection |
| Show selection | Shift-S |
| Show all | Shift-S with no selection |

| Action | Shortcut |
|--|--|
| Select and show in Navigator | Double-click |
| Add to/remove from selection | Spacebar-Ctrl-click, or Spacebar-Ctrl-drag |
| Select all in group | G-click |
| Add group to selection | G-click |
| Select object and children | Spacebar-right click |
| Select root of hierarchy | Ctrl-right-click |
| Select object and parents | Shift-right-click |
| Select whole hierarchy | Ctrl-Shift-right-click |
| Go up the hierarchy (parent) | Alt-Up arrow |
| Go down the hierarchy (first child) | Alt-Down arrow |
| Go sideways in the hierarchy (left sibling, same level) | Alt-Left-arrow |
| Go sideways in the hierarchy (right sibling, same level) | Alt-Right-arrow |

Optical shortcuts

You can use the following shortcuts for working with Optical tools.

| Action | Shortcut |
|-----------------------------------|--------------------|
| Navigate marker list (Label pane) | Up/Down arrow keys |

| Action | Shortcut |
|--|-----------------------------|
| Navigate marker list within same Rigid body (Label pane) | Shift-Up/Down arrow keys |
| Go to previous/next segment or gap | Shift-Left/Right arrow keys |
| Frame all segments | A |
| Zoom rectangular | Z-drag |
| Move start/end of current segment | M-drag segment edge |
| Move Timeline indicator | T-click or Ctrl-Shift-click |
| Insert a gap key (in gap only) | K |

3ds Max keyboard shortcuts

The following shortcuts are familiar to users of 3ds Max. The left column lists the operation and the right columns list the keyboard shortcuts you can press for Macintosh and Windows.

General shortcuts

You can use the following shortcuts for general work within MotionBuilder.

| Action | Shortcut |
|------------------|----------|
| Undo last action | Ctrl-Z |
| Redo last action | Ctrl-Y |
| Cut | Ctrl-X |
| Copy | Ctrl-C |

| Action | Shortcut |
|---|----------------------------------|
| Paste | Ctrl-V |
| Paste Special | Ctrl-B |
| Delete selection | Delete |
| New scene | Ctrl-N |
| Open scene | Ctrl-O |
| Save scene | Ctrl-S |
| Pan window | (Middle-drag) Shift-drag |
| Zoom in/out | (Alt-Ctrl-middle-drag) Ctrl-drag |
| Select a range of assets in the Navigator | Shift-click |
| Position Time cursor | Ctrl-Shift-click |
| Drag and drop asset | Alt-drag |

Transport Controls shortcuts

You can use the following shortcuts for working with the Transport Controls.

| Action | Shortcut |
|---------------------|-----------------|
| Play/stop | / (slash) |
| Play Backwards/Stop | Shift-/ (slash) |
| Forward one frame | . (period) |

| Action | Shortcut |
|--|--------------|
| Back one frame | , (comma) |
| Go to start | Home |
| Go to end | End |
| Jog | J-drag |
| Frame Zoom bar on Start and End (Full-size Zoom bar) | Ctrl-Shift-Z |
| Frame Zoom bar on selected keyframe region | Z |
| Frame Start and End of all animation ("Frame Take" function) | Ctrl-Shift-A |
| Frame Start and End of a selected keyframe region | A |

Keyframing shortcuts

You can use the following shortcuts for working with the keyframes.

| Action | Shortcut |
|---------------------------|--------------|
| Select a keyframe | Click |
| Select range of keyframes | Shift-click |
| Frame all keyframes | Ctrl-Shift-Z |
| Frame selected keyframes | Z |

| Action | Shortcut |
|---------------------------|----------------|
| Add keyframe on an FCurve | A-middle-click |

Motion Blend shortcuts

You can use the following shortcuts for working with the Motion Blend window.

| Action | Shortcut |
|-------------------------------|----------|
| Scale/change speed of a track | S-drag |
| Translate a track | T-drag |

Character shortcuts

You can use the following shortcuts for working with Characters.

| Action | Shortcut |
|-----------------------------------|----------|
| Pin Rotation | U |
| Pin Translation | Y |
| Activate/Disable effector release | Q |
| Use IK Pivot option | D |

Pose shortcuts

You can use the following shortcuts for working with Pose controls.

| Action | Shortcut |
|------------|----------|
| Copy pose | Ctrl-F12 |
| Paste pose | Alt-F12 |

Viewer shortcuts

Certain 3ds Max keyboard shortcuts used in MotionBuilder for camera navigation and Viewer window display modes are mapped incorrectly.

You can use the following shortcuts for working with the Viewer window.

| Action | Shortcut |
|------------------------------------|--------------------|
| Select number of views | Ctrl-1, 2, 3, or 4 |
| Switch to full screen mode | Alt-Enter |
| Cycle/Switch to Perspective/Camera | P |
| Cycle/Switch to Front/Back | F |
| Cycle/Switch to left/right | L |
| Cycle/Switch to Top/Bottom | T |
| Switch to/from Schematic view | Ctrl-W |
| Camera switcher | Ctrl-I |
| Frame selected objects | Z |

| Action | Shortcut |
|---|-----------------------|
| Frame all objects | Ctrl-Shift-Z |
| Cycle Normal/Models Only/X-Ray displays | Ctrl-A |
| Display performance statistics | Shift-F |
| Display memory statistics | Shift-M |
| Find models by name | Shift-N |
| Switch object selection | O |
| Switch object vertex | V |
| Switch object pivot | Shift-O |
| Pan camera | Middle-drag |
| Slide camera | Shift-right-drag |
| Dolly camera | Alt-Ctrl-middle-drag |
| Dolly camera with interest | Ctrl-right-drag |
| Orbit camera around interest | Alt-middle-drag |
| Orbit interest around camera | Ctrl-Shift-right-drag |
| Roll custom camera | R-middle-drag |

Viewer window model display shortcuts

You can use the following shortcuts for manipulating objects in the Viewer window.

| Action | Shortcut |
|----------------------------|----------|
| Switch to wireframe | F1 |
| Switch to textures/shaders | F2 |

Viewer window selection shortcuts

You can use the following shortcuts for selecting objects in the Viewer window.

| Action | Shortcut |
|------------------------------|------------------------------|
| Hide selection | H |
| Hide all | H with no selection |
| Show selection | S |
| Show all | S |
| Toggle selection | Spacebar-click or drag |
| Select and show in Navigator | Double-click |
| Add to/remove from selection | Ctrl-click, or Spacebar-drag |
| Select and show in Navigator | Double-click |
| Add to/remove from selection | Ctrl-click |
| Select all in group | G-click |

| Action | Shortcut |
|-------------------------------------|------------------------|
| Add group to selection | G-right-click |
| Select object and children | Spacebar-right-click |
| Select root of hierarchy | Ctrl-right-click |
| Select object and parents | Shift-right-click |
| Select whole hierarchy | Ctrl-Shift-right-click |
| Go up the hierarchy (parent) | Page Up |
| Go down the hierarchy (first child) | Page Down |

Optical shortcuts

You can use the following shortcuts for working with Optical tools in MotionBuilder.

| Action | Shortcut |
|--|-----------------------------|
| Navigate marker list (Label pane) | Up/Down arrow keys |
| Navigate marker list within same Rigid body (Label pane) | Shift-Up/Down arrow keys |
| Go to previous/next segment or gap | Shift-Left/Right arrow keys |
| Frame all segments | A |
| Move start/end of current segment | M-drag segment edge |
| Move Timeline indicator | T-click or Ctrl-Shift-click |

| Action | Shortcut |
|--------------------------------|----------|
| Insert a gap key (in gap only) | K |

Story window shortcuts

You can use the following shortcuts for working with the Story window.

| Action | Shortcut |
|----------------------|-------------------|
| Select next clip | Shift-right arrow |
| Select previous clip | Shift-left arrow |
| Go to first clip | Shift-Home |
| Go to last clip | Shift-End |
| Razor clip | Alt-R |
| Scale track | Alt-S |

Maya keyboard shortcuts

The following shortcuts are familiar to users of Maya. The left column lists the operation and the right columns list the keyboard shortcuts you can use for Windows.

General shortcuts

You can use the following shortcuts for general work in MotionBuilder.

| Action | Shortcut |
|------------------|----------|
| Undo last action | Z |

| Action | Shortcut |
|---|-------------------|
| Redo last action | Ctrl-Z |
| Cut | Ctrl-X |
| Copy | Ctrl-C |
| Paste | Ctrl-V |
| Paste special | Ctrl-B |
| Delete selection | Delete |
| Global accept | Enter |
| Global cancel | Escape |
| Save scene | Ctrl-S |
| Pan window | Alt-middle-drag |
| Zoom in/out | Alt-right-drag |
| Zoom rectangular | Z-drag |
| Select a range of assets in the navigator | Shift-click |
| Drag and drop asset | X-select and drag |

Transport controls shortcuts

You can use the following shortcuts for working with the Transport controls.

| Action | Shortcut |
|--|--------------------------------|
| Play/stop | Ctrl-Spacebar or Ctrl-Up-arrow |
| Play backwards/stop | Ctrl-Down-arrow |
| Forward one frame | Ctrl-right-arrow |
| Back one frame | Ctrl-Left-arrow |
| Go to start | Ctrl-Home |
| Go to end | Ctrl-End |
| Frame zoom bar on Start and End (full-size Zoom bar) | A |
| Frame Zoom bar on selected keyframe region | F |
| Frame Start and End of all animation ("Frame Take" function) | Ctrl-Shift-A |
| Frame Start and End of selected keyframe region | Ctrl-Shift-F |

Keyframing shortcuts

You can use the following shortcuts for keyframing in MotionBuilder.

| Action | Shortcut |
|--------------|----------|
| Add keyframe | S |

| Action | Shortcut |
|-------------------------|--------------|
| Add Zero keyframe | Shift-S |
| Add Flat keyframe | Alt-S |
| Go to next keyframe | . (period) |
| Go to previous keyframe | , (comma) |
| Key at Time x | Ctrl-Shift-S |

FCurves shortcuts

You can use the following shortcuts for working in the FCurves window.

| Action | Shortcut |
|---------------------------|------------------|
| Select a keyframe | Click |
| Add keyframe to selection | Ctrl-Shift-click |
| Select range of keyframes | Shift-click |
| Frame all keyframes | A |
| Frame selected keyframes | F |
| Add keyframe on a curve | M-middle-click |

Motion Blend shortcuts

You can use the following shortcuts for working in the Motion Blend window.

| Action | Shortcut |
|-------------------------------|----------|
| Scale/change speed of a track | R-drag |
| Translate a track | W-drag |

Layout shortcuts

You can use the following shortcuts for working with Layouts.

| Action | Shortcut |
|-------------------------|------------------|
| Select Creation layout | Ctrl-Shift-1 |
| Select Animation layout | Ctrl-Shift-2 |
| Select Editing layout | Ctrl-Shift-3 |
| Select Preview layout | Ctrl-Shift-4 |
| Select Story layout | Ctrl-Shift-5 |
| Select User layouts 1-5 | Ctrl-Shift-6 - 0 |

Character shortcuts

You can use the following shortcuts when working with Characters in MotionBuilder.

| Action | Shortcut |
|--------------|----------|
| Pin Rotation | Y |

| Action | Shortcut |
|-----------------------------------|----------|
| Pin Translation | T |
| Activate/Disable effector release | O |

Viewer window shortcuts

You can use the following shortcuts for working in the Viewer window.

| Action | Shortcut |
|---|--------------------|
| Select number of views | Ctrl-1, 2, 3, or 4 |
| Switch to full screen mode | Alt-Enter |
| Switch to Perspective/Custom | Ctrl-E |
| Switch/cycle to front/back | Ctrl-F |
| Switch/cycle to right/left | Ctrl-R |
| Switch/cycle to top/bottom | Ctrl-T |
| Switch to/from Schematic view | Ctrl-W |
| Camera switcher | Ctrl-I |
| Frame selected objects | F |
| Frame all objects | A |
| Cycle Normal/Models Only/X-Ray displays | Ctrl-A |
| Display performance statistics | Shift-F |

| Action | Shortcut |
|--|-----------------|
| Display memory statistics | Shift-M |
| Switch to object selection | O |
| Switch to vertex selection (When Skins window is open) | V |
| Switch to Pivot Selection | Shift-O |
| Switch to Parenting mode | P |
| Find models by name | Shift-N |
| Pan camera | Alt-middle-drag |
| Zoom camera | Z-drag |

Viewer window manipulation shortcuts

You can use the following shortcuts to manipulate objects in the Viewer window.

| Action | Shortcut |
|---------------------|----------|
| Parenting mode | P |
| Translate selection | W |
| Selection mode | F3 |
| Drag mode | F1 |
| Local mode | F5 |

| Action | Shortcut |
|-------------------------------|-------------------|
| Global mode | F6 |
| Rotate selection | E |
| Rotate additive | F7 |
| Rotate axis | F8 |
| Rotate around | Shift-E |
| Scale uniform | R |
| Scale volumic | Shift-R |
| Drag mode | F1, then Up arrow |
| XYZ mode | F2 |
| Switch to wireframe | 1 |
| Switch to flat shaded | 2 |
| Switch to lighted | 3 |
| Switch to textured | 4 |
| Switch to shaded | 5 |
| Switch to shaded and textured | 6 |
| Switch to wireframe | 4 |
| Switch to Flat shaded | 2 |
| Switch to lighted | 5 |

| Action | Shortcut |
|-------------------------------|----------|
| Switch to textured | 6 |
| Switch to shaded | 3 |
| Switch to textured and shaded | 7 |
| Selection mode | F3 |

Viewer window selection shortcuts

You can use the following shortcuts for selecting objects in the Viewer window.

| Action | Shortcut |
|-----------------------|---------------------------|
| Hide selection | Shift-H |
| Hide all | Shift-H with no selection |
| Show selection | Ctrl-H |
| Show all | Ctrl-H with no selection |
| Select/deselect | Spacebar-click |
| Toggle selection | Spacebar-click and drag |
| Select | Click |
| Add to selection | Ctrl-Shift-click |
| Remove from selection | Ctrl-click |
| Select all in group | G-click |

| Action | Shortcut |
|--|------------------------|
| Add group to selection | Ctrl-Shift-G |
| Select object and children | Spacebar-right-click |
| Select root of hierarchy | Ctrl-right-click |
| Select object and parents | Shift-right-click |
| Select whole hierarchy | Ctrl-Shift-right-click |
| Go up the hierarchy (parent) | Up arrow |
| Go down the hierarchy (first child) | Down arrow |
| Go sideways in the hierarchy (left sibling, same level) | Left arrow |
| Go sideways in the hierarchy (right sibling, same level) | Right arrow |

Optical shortcuts

You can use the following shortcuts for working with Optical tools.

| Action | Shortcut |
|--|-----------------------------|
| Navigate marker list (Label pane) | Up/Down arrow keys |
| Navigate marker list within same Rigid body (Label pane) | Shift-Up/Down arrow keys |
| Go to previous/next segment or gap | Shift-Left/Right arrow keys |
| Frame all segments | A |

| Action | Shortcut |
|-----------------------------------|-----------------------------|
| Move start/end of current segment | M-drag segment edge |
| Move Timeline indicator | T-click or Ctrl-Shift-click |
| Insert a gap key (in gap only) | K |

XSI shortcuts

The following shortcuts are familiar to users of Softimage's XSI. The left column lists the operation and the right columns list the keyboard shortcuts you can use for Windows.

General shortcuts

You can use the following shortcuts for general work within MotionBuilder.

| Action | Shortcut |
|------------------|----------|
| Undo last action | Ctrl-Z |
| Redo last action | Ctrl-Y |
| Cut | Ctrl-X |
| Copy | Ctrl-C |
| Paste | Ctrl-V |
| Paste Special | Ctrl-B |
| Delete selection | Delete |
| Global accept | Enter |

| Action | Shortcut |
|---|------------------|
| Global cancel | Escape |
| Save scene | Ctrl-S |
| Pan window | I-click-drag |
| Zoom in/out | P |
| Zoom rectangular | Middle-click |
| Select a range of assets in the Navigator | Shift-click |
| Position Time cursor | Ctrl-Shift-click |
| Drag and drop asset | Alt-drag |
| Open scene | Ctrl-O |

Motion Blend shortcuts

You can use the following shortcuts to work with the Motion Blend window.

| Action | Shortcut |
|-------------------------------|----------|
| Scale/change speed of a track | X-drag |
| Translate a track | V-drag |

Transport controls shortcuts

You can use the following shortcuts for working with the Transport controls.

| Action | Shortcut |
|--|----------------|
| Play/stop | Up arrow |
| Play backwards/stop | Shift-Up arrow |
| Forward one frame | Right arrow |
| Back one frame | Left arrow |
| Go to start | Home |
| Go to end | End |
| Jog/Audio shuttle | J-drag |
| Frame Zoom bar on Start and End (Full-size Zoom bar) | A |
| Frame Zoom bar on selected keyframe region | F |
| Frame Start and End of all animation ("Frame Take" function) | Ctrl-Shift-A |
| Frame Start and End of a selected keyframe region | Ctrl-Shift-F |

Keyframing shortcuts

You can use the following shortcuts when you are keyframing.

| Action | Shortcut |
|-------------------------|------------|
| Add keyframe | K |
| Add Zero keyframe | Shift-K |
| Add Flat keyframe | Ctrl-K |
| Go to next keyframe | . (period) |
| Go to previous keyframe | , (comma) |

FCurves shortcuts

You can use the following shortcuts for working in the FCurves window.

| Action | Shortcut |
|---------------------------|---------------|
| Select a keyframe | Click |
| Select a keyframe region | Spacebar-drag |
| Add keyframe to selection | Ctrl-click |
| Select range of keyframes | Shift-click |
| Frame all keyframes | A |
| Frame selected keyframes | F |
| Add keyframe on a curve | I-click |

Viewer shortcuts

You can use the following shortcuts for working in the Viewer window.

| Action | Shortcut |
|---|--------------------|
| Select number of views | Ctrl-1, 2, 3, or 4 |
| Switch to full screen mode | Alt-Enter |
| Switch to Perspective/Custom | Ctrl-E |
| Switch/cycle to front/back | Ctrl-F |
| Switch/cycle to right/left | Ctrl-R |
| Switch/cycle to top/bottom | Ctrl-T |
| Switch to/from Schematic view | 9 |
| Camera switcher | Ctrl-I |
| Frame selected objects | F |
| Frame all objects | A |
| Cycle Normal/Models Only/X-Ray displays | Ctrl-A |
| Display performance statistics | Shift-F |
| Display memory statistics | Shift-M |
| Switch to Parenting mode /Find models by name | Shift-N |
| Pan Camera | Z-click-drag |

| Action | Shortcut |
|------------------------------|---------------------|
| Slide camera | Z-right-drag |
| Dolly camera | P-click-drag |
| Dolly camera with interest | P-right-drag |
| Orbit camera around interest | O-click-drag |
| Orbit interest around camera | O-right-drag |
| Zoom camera | Z-middle-click drag |
| Roll custom camera | L-click-drag |
| Roll angle | L-right-drag |

Viewer window manipulation shortcuts

You can use the following shortcuts for manipulating objects in the Viewer window.

| Action | Shortcut |
|--------------------------|----------|
| Translate selection | V |
| Translate object's Pivot | Shift-V |
| Rotate mode | C |
| Selection mode | F3 |
| Rotate additive | F7 |
| Rotate axis | F8 |

| Action | Shortcut |
|--|----------|
| Rotate around | Shift-C |
| Scale mode | X |
| Scale volumic | Shift-X |
| Switch to wireframe | 1 |
| Switch to flat shaded | 2 |
| Switch to lighted/shaded | 3 |
| Switch to textured/shaded and textured | 4 |

Viewer window selection shortcuts

You can use the following shortcuts for selecting objects in the Viewer window.

| Action | Shortcut |
|------------------------------|------------------------|
| Hide selection | H |
| Hide all | H with no selection |
| Show selection | S |
| Show all | S with no selection |
| Select exclusive | Spacebar-click or drag |
| Select and show in Navigator | Double-click |
| Add to/Remove from selection | Ctrl-click |

| Action | Shortcut |
|--|------------------------|
| Select all in group | G-click |
| Add/remove group to selection | G-Ctrl-click |
| Select object and children | Spacebar-right-click |
| Select root of hierarchy | Ctrl-right-click |
| Select object and parents and children | Shift-right-click |
| Select whole hierarchy | Ctrl-Shift-right-click |
| Go up the hierarchy (parent) | Alt-Up arrow |
| Go down the hierarchy (first child) | Alt-Down arrow |
| Go sideways in the hierarchy (left sibling, same level) | Alt-Left arrow |
| Go sideways in the hierarchy (right sibling, same level) | Alt-Right arrow |

Optical shortcuts

You can use the following shortcuts for working with Optical tools.

| Action | Shortcut |
|--|-----------------------------|
| Navigate marker list (Label pane) | Up/Down arrow keys |
| Navigate marker list within same Rigid body (Label pane) | Shift-Up/Down arrow keys |
| Go to previous/next segment or gap | Shift-Left/Right arrow keys |

| Action | Shortcut |
|-----------------------------------|-----------------------------|
| Frame all segments | A |
| Move start/end of current segment | M-drag segment edge |
| Move Timeline indicator | T-click or Ctrl-Shift-click |
| Insert a gap key (in gap only) | K |

Glossary

0-9

3D coordinate space

The Euclidian/Cartesian environment that defines three dimensions by X-, Y-, and Z-axes, and their corresponding coordinate values.

See also [X-axis](#) on page 1789, [Y-axis](#) on page 1789, and [Z-axis](#) on page 1790.

3D matte

A color signal that is used to fill areas of keys and borders. Unlike a regular matte, a 3D matte has depth and is respected by all other 3D objects in the scene, letting you block out parts of a scene and replace it with video footage.

A

Actor

A humanoid model used to link captured optical or magnetic motion data to a character.

Actor Face

A set of magnetic or optical motion data captured from a performer's face, which can be mapped to a Character Face asset.

aliasing

A defect or distortion in a television picture caused by interference between two frequencies, for example the luminance and chrominance frequencies. Aliasing appears as moire or herringbone patterns, straight lines that become wavy, or rainbow colors.

Alpha-blend

An effect in which you assign pixel values that are solid, invisible, or partially transparent. Alpha-blending is often used in games for special effects such as explosions and weapons discharge. When mapped onto polygons, Alpha-blending simulates semi-transparent objects, such as water and glass.

Alpha channel

The portion of each pixel's data reserved for transparency information. 32-bit graphics systems contain four channels: three 8-bit channels for red, green, and blue (RGB) and one 8-bit alpha channel.

animation

The process of creating the illusion of moving images by displaying sequential images in rapid succession. In each successive image, two or more values are changed over time, and the items drawn or recorded in the images appear to move.

Anti-aliasing

A technique that corrects aliasing by smoothing the edges of diagonal lines on the screen. Without Anti-aliasing, diagonal lines often have a “jaggy” appearance caused by the stair-step effect of the pixels. Anti-aliasing blurs the edges of the lines.

See also [aliasing](#) on page 1750.

artifact

An undesirable element or defect in motion capture data. These may occur naturally and can be eliminated in order to achieve a better-quality capture.

asset

Any element used to create animation, such as models, textures, and shaders.

attribute

See [property](#).

Auxiliary effector

A supplementary effector in a Control rig that corresponds to an existing IK effector. Auxiliary effectors provide additional IK control for a character's reach, and display as a cube on the corresponding IK effector.

See also [effector](#) on page 1762.

Auxiliary pivot

A sub-control that lets you translate and rotate an IK Control rig effector from a point other than its current location.

See also [pivot](#) on page 1777.

B

Back Plate

A background image, video clip, or video feed to be displayed on the background plane in a scene.

Background color cancellation (BCC)

A chroma key feature that senses the color of the chroma key backing and replaces it with a complementary color. As a result, the two colors cancel each other. This eliminates the halo or fringing effect surrounding the foreground object in the chroma key.

Background color suppression (BCS)

A chroma key feature that senses the color of the chroma key backing and replaces it with an adjustable luminance level. This prevents the backing color from appearing in the chroma key.

Background generator

A video generator that produces a solid-color output which can be adjusted for hue, chroma, and luminance.

background plane

A plane in a scene on which images, video clips, or video feeds are projected.

Base Layer

The default animation layer to which all other layers are merged when you plot an animation.

See also [layer](#) on page 1769.

batch

The process of automating a frequently performed task by storing commands in a script or “batch file”.

For example, batch load refers to the process of loading or processing more than one file with a single command.

Baud rate

The bits per second (bps) rate at which the information carrying capacity of a communication channel is measured.

BCC

See Background color cancellation (BCC).

BCS

See Background color suppression (BCS).

bind pose

The position in which a character is weighted, wherein all of the character's limbs should be in neutral positions, neither fully extended nor fully contracted.

biped

A humanoid skeleton that stands on two legs, making contact with the floor using only the feet.

bitplane

The memory in a graphic display device that holds a complete one-bit-per-pixel image.

Black level

The lowest transmittable luminance level that can occur during the active picture portion of a video signal. When viewed on a monitor this signal level is seen as black.

blending object

Any selection of nodes or sensors with captured data, a part or complete hierarchy of models with plotted data, or a Control rig that can be used to perform a motion blend.

bone

The connecting lines between the joints that compose an Actor skeleton.

bound model

A 3D model that has a rigid skeleton and is covered by a mesh. The mesh contains a texture and body features that give the model a distinct appearance.

bounding box

Rigid bodies that limit the area in which the eyes, eyebrows, and mouth of a face model can move in an Actor Face.

branch

A part of a hierarchy or tree-based data structure where there is only one route between any pair of nodes. Normally, no node on a branch can have more than one parent.

brightness

Along with contrast, a property that determines the luminance of an object.

buffer

An area of memory used for storing messages.

bump map

Textures that contain two direction vectors, and are used to convey relief in a texture.

See also [texture](#) on page 1784.

burst

See color burst.

BVH

The Biovision file format for hierarchical or skeletal-based data.

C

camera

A device for viewing and recording scenes. Each camera sees the scene from a different angle or "vantage point".

camera interest

Also referred to as a look at point, the focal point of a camera, represented by a null.

channel

1. A digital effects processing path for video. 2. A particular signal path. MotionBuilder uses channels to connect Actor Face assets with Character Face assets to create expressions for 3D models.

character model

A 3D object composed of a skinned model with a skeleton. Can be animated in MotionBuilder by being linked to a motion source through a Character asset.

See also [model](#) on page 1772, [skeleton](#) on page 1782, [motion source](#) on page 1773, and [Character asset](#) on page 1756.

Character

See [Character asset](#) on page 1756.

character animation

The process of animating objects or models to give the illusion of personality, life, and character. In contrast to other types of animation, objects are meant to appear alive and to appear to act on their own accord rather than to move randomly.

Character asset

Also referred to as the Character. The link between a motion source (such as an Actor, a Control rig, or another character) and a character model.

See also [motion source](#) on page 1773, [Actor](#) on page 1749, [Control rig](#) on page 1760, [character model](#) on page 1756, and [model](#) on page 1772.

Character Face

The shapes on a face model which can be driven with live input, recorded motion capture data, devices, and constraints.

See also [shape](#) on page 1781.

Character mapping

The process of creating a link between a data source and a 3D model with a skeleton.

See also [Character asset](#) on page 1756.

child

A model or element that is placed below another in a hierarchical structure. For example: Marker2 is parented by Marker1. In the hierarchical structure, Marker2 is the child and Marker1 is the parent.

See also [hierarchy](#) on page 1767 and [parent](#) on page 1776.

chroma key

An effect that lets you sample out a colored background, and replace it with something else, such as a video layer.

chrominance

A portion of the video signal that contains color information (hue and saturation). Video picture information contains two components: luminance and chrominance.

See also [luminance](#).

clip

1. Each individual instance of animation, audio, commands, constraints, videos, or camera shots in the Story settings. **2.** A portion of data cut off at a defined boundary.

cluster

A collection of vertices that can be linked to objects.

cluster shapes

A shape made of cluster groups by translating, rotating, and scaling the clusters for use in the Shapes Mapping pane.

See also [Character Face](#) on page 1757 and [cluster](#) on page 1758.

color burst

Also referred to as a burst, a reference for establishing the picture color (hue).

color timing

The synchronization of the color burst phase of two or more video signals. Ensures that no color shifts occur in the picture when the signals are mixed in a switcher or another video device.

COM port

Also referred to as a communications port, a connector for a communications interface.

combiner

A device that controls the way two or more channels work together. It determines the priority of the channels (which picture appears in front and which ones in back) and the types of transitions that can take place between them.

See also [channel](#).

command clip

A clip that lets you show and hide models at specific frames in your track. You can also use the Command clip to launch an external application.

communications port

See [COM port](#) on page 1758.

contrast

Along with brightness, a property that determines the luminance of an object.

constrained object

An object whose movement is determined by the behavior of another object, using a constraint.

See also [constraint](#) on page 1759.

constraint

A restriction of the behavior of one object (constrained object) based on the behavior of another object (source object).

See also [constrained object](#) on page 1759 and [source object](#) on page 1783.

constraint clip

A clip that lets you select, blend, and fade constraints throughout your track.

Control rig

A data source that allows you to create and alter character animation using a combination of an IK rig and an FK rig.

cross chrominance

Also referred to as cross color, moire or rainbow effects in encoded video pictures created when the video encoder misinterprets luminance detail as color information. For example, moire effects on pin-striped clothing.

cross color

See cross chrominance.

current segment

The segment of optical data that is currently selected in the Optical editor. When a segment is selected and active (not set to Done in the Label pane), it is colored green.

See also [segment](#) on page 1781.

cut

A section of a take's animation.

D

deck

A video cassette recorder (VCR).

deformation

A method of modelling object surfaces based on a geometric mesh of control points.

dense data

Animation that displays as many keyframes, such as motion capture data or plotted animation.

device

Any hardware instrument with a specific functionality. In MotionBuilder, you can use input devices such as a mouse, or a MIDI device.

Done

A possible state of a marker in the optical system. When set to Done, the marker is no longer an active optical marker and cannot be used within the Optical settings. Done optical markers can be filtered and modified in the FCurves window.

dopesheet

A visual representation, similar to a traditional cell-animation timing sheet, that provides you with a way of moving keys, modifying timings, and activating and disabling effects over time.

In MotionBuilder, the Dopesheet window is an exploded view of the Action timeline in the Transport Controls window.

Distribution Factor

A slider that lets you adjust how the gradient is distributed between the Shadow and Highlight colors.

dummy node

A node that contains no geometric data that is used as a parent node.

See also [node](#) on page 1773.

E

effector

The markers on a Control rig that represent a character's joints. Effectors are visually represented by the cells on the character representation in the Character settings and can be selected to transform the character's corresponding body parts. There are two types of effectors: FK effectors and IK effectors.

See also [Auxiliary effector](#) on page 1751.

Effects send

A video switcher feature that lets you select a key source to be sent to a digital picture manipulator. The manipulated key and fill video are then returned to the Switcher's keyer for keying ("flying" a key) over background video.

element

A node. All of the objects that make up your scene.

Environment mapping

A form of reflection mapping best suited for situations when you are filming a model from a single point of view.

Expressions

See [expressions constraint](#) on page 1763.

expressions constraint

Also referred to as Expressions, constraints that are created using data entered in the Expressions pane.

See also [constraint](#) on page 1759.

extrapolation

The method of using a mathematical algorithm to estimate how a curve logically continues, based on the currently known values.

F

.fbx

The generic 3D data packager file format. FBX files can be unpacked, read, and used by all major 3D software packages, regardless of which package the data came from, or how it is converted.

FCurve

See [function curve](#) on page 1765.

FK effector

See [effector](#) on page 1762.

FK rig

A Forward Kinematics system that lets you control individual pivot points on a model's skeleton.

fill

In video keying, the video signal that is inserted into the “hole” cut in the background video by a key signal.

filter

A tool used to clean, manipulate, or modify captured motion data. You can use filters and filtering options to manipulate captured data according to your own specifications and to correct noisy or distorted motion capture data.

filtering

The process of cleaning, manipulating, modifying or otherwise tweaking captured motion data.

See also [filter](#) on page 1764.

fps

Frames per second.

Forward Kinematics (FK)

A method of moving a hierarchy (such as a limb) in which the lower elements of the hierarchy follow the motion of parent elements. For example, if you rotate the shoulder using forward kinematics, the upper arm, forearm, hands and fingers follow.

See also [Inverse Kinematics \(IK\)](#) on page 1768.

frame

1. A single image at a specific point in time within an animation. 2. The individual picture image on a strip of film or a complete television picture made up of two fields. Can be used as a unit of measurement.

function curve

Also referred to as an FCurve, a graphic depiction of an animated value. The time and value of the animated value displays on two axes: the vertical axis representing the value, and the horizontal axis representing the time.

G

gap

The space before, after, or between a marker's segments that does not contain sensor data.

generic channel

A channel that is a preset facial expression.

See also [Actor Face](#) on page 1749 and [channel](#) on page 1756.

ghost

A wireframe representation of an unrendered blending object in the Viewer window. Ghosts only display when the Motion Blend or Story windows are open.

See also [blending object](#) on page 1754.

Ghost curve

A visual representation of the original curve that displays in the FCurves window as you edit the curve.

global coordinates

Values that define a location relative to the origin of a scene, in the format (X, Y, Z).

See also [local coordinates](#) on page 1770, [X-coordinate](#) on page 1789, [Y-coordinate](#) on page 1789, and [Z-coordinate](#) on page 1790.

gobo

A filter placed over a light to make it project patterns.

H

Hardware FC

Hardware Full Control. A special data transfer protocol that controls the flow of data between specific hardware devices.

hierarchy

An organization structure that visually describes the relationship between elements. A hierarchy looks like an inverted tree structure, with an element at the top (referred to as a parent) and with several elements below its predecessor (referred to as children).

See also [parent](#) on page 1776 and [child](#) on page 1757.

HSB

Three numerical values, where h refers to Hue, s refers to Saturation, and b refers to Brightness.

hue

A specific color. For example, you can use the Hue slider in the Color window to set an object's hue to "green".

I

IK effector

See [effector](#) on page 1762.

IK rig

An Inverse Kinematics system that lets you transform hierarchies of bones using IK effectors.

See [Inverse Kinematics \(IK\)](#) on page 1768.

interpolation

1. The process in which a computer program automatically fills in the action between keyframes with in-between frames, creating the illusion of smooth, continuous motion when the animation is played. **2.** In the FCurves window, the shape of the function curve drawn between keyframes of an animation.

Inverse Kinematics (IK)

A method of transforming a group of connected joints (such as a limb) where the movement of the end joint influences all the preceding joints in the chain.

For example, when you transform the wrist joint of an arm, the elbow and shoulder joints are also transformed.

See also [Forward Kinematics \(FK\)](#) on page 1765.

IP address

The 32-bit host address defined by the Internet Protocol.

J

jogging

The action of smoothly moving forward and backward through time in a take by J-clicking and dragging in the Viewer window.

joint

The points on a skeleton connected by bones.

K

key

The process of setting a keyframe.

See also [keyframe](#) on page 1769 and [keyframing](#) on page 1769.

keyframe

A reference point, or key point, that marks the position of an important action or change in a scene at a specific point in time.

keyframing

The action of creating keyframe animation by transforming an object in a scene at a specific point in time and setting a keyframe.

See also [keyframe](#) on page 1769.

L

latency

The time during which the read/write heads wait for data to rotate into position after the controller starts looking for a particular data track. For example, if a disk rotates at 3,600 rpm, the maximum latency time is 16.4 milliseconds, and the average latency time is 8.2 milliseconds.

layer

A level of animation in a scene, on top of the original function curve data. You can have multiple layers in a scene and make changes to one layer without affecting the others.

See also [Base Layer](#) on page 1752.

Linear key

A luminance key effect in which the gain of the key is approximately one. This preserves the shaping of the key source edges produced by anti-aliased character generators and digital video effects devices.

See also luminance key.

local blend

The process of replacing the motion in one track with motion from another track on only part of a hierarchy.

local coordinates

Values that define a location relative to the origin of a selected object, in the format (X, Y, Z).

See also [global coordinates](#) on page 1766, [X-coordinate](#) on page 1789, [Y-coordinate](#) on page 1789, and [Z-coordinate](#) on page 1790.

look at point

See [camera interest](#) on page 1756.

loop

The area of a take that is designated to continuously play when you click Play in the Transport Controls.

luminance

The luminous intensity of a video signal. The color picture information contains two components: luminance (brightness and contrast) and chrominance (hue and saturation). Probably should remove reference to luminance within definition.

See also chrominance.

luminance key

A key effect in which the portions of a key source that are greater in luminance than the clip level cut a hole, or key, in the background video.

M

magnetic mapping

The process of mapping magnetic motion data to an Actor.

marker

1. Objects used to identify segments. One or more segments, after being labelled or identified, combine to create a marker of continuous data. 2. In the Optical tool, marker is another term for sensor.

See also [sensor](#) on page 1781.

Marker set

A set of markers that map objects containing motion data (such as magnetic markers or optical sensors) to an Actor. This association is then used to drive the Actor. In the Viewer window, a Marker set displays as a group of white markers attached to an Actor.

material

A set of properties that describe the surface appearance applied to a model. These properties may include color, shininess, opacity, and reflectivity.

Mipmap

A version of an original texture that has been reduced in size to 1 x 1 pixel. This solves the problem of textures with small objects “flickering” as the viewer gets further away.

See also [texture](#) on page 1784.

model

The mathematical description of a three dimensional object that is placed in a scene.

moire

A wavy pattern.

morph target

Operators for use with models that have shape animations, also referred to as shape operators.

motion capture

A method of collecting motion data based on the movement of a performer wearing special sensors or markers.

motion source

An asset such as an Actor, character, or Control rig that is linked to a character model through the Character asset to drive the movement of a character model.

See also [Actor](#) on page 1749, [character model](#) on page 1756, [Control rig](#) on page 1760, and [Character asset](#) on page 1756.

N

Namespace

A namespace is a group of objects collected under a name. Each item in a namespace is identified by its own name along with the namespace to which it belongs, for example, objects in the Namespace “Galaxy” could be “Galaxy:Moon”, “Galaxy:Rocket”, or “Galaxy:Alien”.

naming template

An .fbx file containing the customized naming conventions used to define a skeleton.

node

1. The individual objects (such as joints, bones, or nulls) that are linked to a model’s skeleton structure. Nodes allow you to map between a source and a model. **2.** In the Schematic view, the variously colored tiles that visually represent each asset of a hierarchy.

See also [reference node](#) on page 1778 and [dummy node](#) on page 1762.

noise

1. Irregular jumps in a segment of optical data caused by partial occlusion of a sensor on a performer’s body during a capture session. **2.** Noticeable distortion

in magnetic capture data caused by metallic objects such as aluminium heating ducts interfering with the capture session area.

Non Uniform Rational B-splines

See [NURBS](#) on page 1774.

normal

A perpendicular or vector that defines the orientation of something.

normal map

Textures that contain three direction vectors: an X, Y and Z. Unlike a bump map's two vectors, the normal map's three vectors convey height and lighting detail with greater precision, providing heightened realism.

See also [bump map](#) on page 1755 and [texture](#) on page 1784.

NTSC

National Television System Committee. A standard picture format (or resolution) for North American television broadcast (pixel ratio 640 by 480).

null

An object that you can parent to other objects for additional transformation flexibility. nulls have no specific properties and are simply used to help you build your scene. In the Viewer window, a null is visually represented as a small axis.

NURBS

Non Uniform Rational B-splines. Surfaces and curves that visually represent complex geometric information, used for modelling.

O

occlusion

A problem with optical motion capture, wherein a sensor is hidden from all but three cameras. This may occur when a performer passes by an obstructing object, or when the performer's body comes between the sensor and the camera.

opacity

The extent to which an object is transparent. If an object's opacity is set to 100%, the object displays opaque. If the opacity is set to 0%, the object displays transparent.

OpenGL

A software interface for graphics hardware that supports rendering and imaging operations.

Optical editor

An editor that lets you correct optical data, fix poor gap interpolation, switch swapped markers, and perform other optical data reconstruction.

See also [gap](#) on page 1765, [noise](#) on page 1773, [occlusion](#) on page 1775, and [partial occlusion](#) on page 1777.

optical mapping

The process of mapping optical motion data to an Actor.

Optical root

The main reference for imported optical data, represented in the Viewer window by a sphere.

origin

1. The point at the center of a 3D scene relative to which every location is defined. At the origin of a scene, the X, Y, and Z coordinates have a value of zero. **2.** The center or reference point of a selected 3D object, relative to which the surface of the object is defined. At the origin of an object, all three 3D coordinate values have a value of zero, written as (0,0,0).

See also [global coordinates](#) on page 1766 and [local coordinates](#) on page 1770.

P

parameter

See [property](#) on page 1777.

parent

A model or element that has been made the parent of another. For example, in the hierarchical structure, Marker1 is the child and Marker2 is the parent.

See also [hierarchy](#) on page 1767 and [child](#) on page 1757.

parenting

The act of making one model or element the parent of another.

partial occlusion

A problem with optical motion data that often occurs if a sensor on a performer's body has been placed too close to another sensor, or the sensor becomes partially hidden from one of the cameras during the capture session. The resulting data may display peaks, shifts, or noise.

patch

A type of tessellation, something to do with a model's surface.

pitch

A rotation based on the movement up or down the Y-axis. For example an airplane banking up or down.

pivot

The point from which a selected object is transformed. Usually the object's local origin.

See also [Auxiliary pivot](#) on page 1751.

pose

A snapshot of a selected character's position.

property

Also referred to as an attribute or parameter, a value that quantifies a specific characteristic of an object, and can be animated. For example, the fog intensity of a light is a property.

Q

quadruped

A four-legged skeleton that makes contact with the floor using all four limbs.

quaternion

A complex number made up of four geometric components.

R

reference node

A null or joint that acts as the root of an entire model and is the parent of the models' Hips.

Relations

See [relational constraint](#) on page 1778.

relational constraint

Also referred to as Relations, constraints that perform custom operations on the data of a source object to determine the behavior of the constrained object.

See also [constraint](#) on page 1759.

remote port

An additional port provided by a serial device where you can physically connect input and output devices.

render

To create an image file using the mathematical descriptions of the objects that compose the scene.

rest pose

The default position at which a Character Face asset is at rest.

retargeting

The process of applying the animation data mapped to one character to another character.

Rigid body

Two or more markers that have been grouped together to correct occlusion.

roll

A rotation around the X-axis. For example, the rolling of a log.

rotation

The process of changing all the points on an object to reflect the degree of rotation around each of the three axes.

S

sample

The position of a sensor recorded by each camera at each frame. All samples from each camera generate a three-dimensional representation of each sensor's position in time when processed.

See also [keyframe](#).

saturation

A property that helps determine the chrominance and contrast of the color of an object.

See also [clip](#) on page 1758 and [contrast](#) on page 1759.

scaling

The process of enlarging an object by moving all the points outward from the object's center, or shrinking it by drawing them all in toward that center.

scene

A representation of a three-dimensional world in which objects are placed and animated using a coordinate system.

See also [3D coordinate space](#) on page 1749.

scrubbing

The process of moving through an audio track either forward or backward, while the audio is playing. This process is used to find and hear the audio at a specific frame.

segment

The data captured from an optical motion capture session.

See also [current segment](#) on page 1760, and [motion capture](#) on page 1772.

sensor

A reflector or light source attached to a performer's body. Sensors are tracked by optical cameras during the capture process. Captured data is combined to create segments.

See also [motion capture](#) on page 1772 and [segment](#) on page 1781.

serial port

Also referred to as a COM port, A port that uses a special communication protocol to control the flow of data between devices, allowing the transfer to be made at a higher speed.

Shadow map

A .tiff image of the shadow created by the shadow map shader, projected onto planes and objects in a scene.

shape

In the Character Face settings, a Character Face that has been modified to portray a particular expression, such as “angry”.

See also [Character Face](#) on page 1757.

shape operators

Also referred to as morph targets, special operators for use with models that have shape animations.

shape animations

shuttling

The action of fast-forwarding or rewinding through an audio track while the audio is playing.

simple constraint

Constraints that use a pre-defined list of constrained objects and source objects.

See also [constraint](#) on page 1759.

skeleton

A set of points representing the joints, and of connecting lines representing the bones.

skin

The mesh of vertices that envelopes a 3D character, creating its shape.

SMPTE

Society of Motion Picture and Television Engineers.

solving

1. The process of calculating the position of both the forward kinematics and inverse kinematics rigs, then applying these results to the linked model while observing the settings in the Character Settings pane. 2. The results of calculating each rig. For example, IK solving refers to the result of calculating the IK rig. 3. In MotionBuilder, the result of all calculations, rigs, and settings when using the character engine.

source object

An object on which a constraint is based.

See also [constraint](#) on page 1759.

Sphere map

A reflection type that causes a 3D object to reflect the contents of its scene from only one point of view.

Spherical map

A reflection type that causes a 3D object to reflect the contents of its scene.

spline

A curve that is defined using control points.

stabilizing object

A sensor, a node from a skeleton, or a model from a hierarchy of models that stabilizes the entire blending object and corrects problems such as foot sliding.

See also [blending object](#) on page 1754.

stack

A data structure for storing items which are to be accessed in last-in first-out order.

stance pose

The starting or rest pose of a model.

subcarrier

Also referred to as the SC, in NTSC or PAL video, a continuous sine wave of extremely accurate frequency which constitutes a portion of the video signal. The subcarrier carries picture hue and color saturation information.

swapping

A problem with optical motion capture wherein two markers either cross or pass close to each other, causing the capture system to misinterpret the markers and label the segments incorrectly.

See also [motion capture](#) on page 1772.

T

take

tangent handle

The visual representation of the tangent of a keyframe on a function curve. Tangent handles let you change the slope of the curve on either side of the keyframe.

TCB

Tension, Continuity, Bias.

texture

An asset based on an image file or video clip that can be applied to models, planes, or models to modify their appearance.

tessellation

A step in the rendering process in which the shapes of an object's surface mesh are rearranged into triangles.

timecode

The value that indicates the current position in time of the current take.

Timewarp

A curve that alters the shape of a function curve and changes the timing of an animation.

See also [function curve](#) on page 1765.

track

1. A course along which something moves, or a sequence of events through time. 2. In MotionBuilder, there are two types of tracks. In the Motion Blend window, tracks can contain motion data and let you blend takes into a single result track. In the Story window, tracks can contain motion data, keyframe animation, audio and video, and let you blend specific types of clips along the timeline.

transparency

The level of visibility of a object, determined by the opacity setting. When the opacity is set to 0%, the object is transparent.

transformation

The process of changing the points on an object by translation, rotation, and scaling.

translation

The process of moving an object on one or all axes. Translation moves an object without changing its orientation.

trigger

In the Animation Trigger window, a device, such as a joystick or keyboard, that allows you to execute motion clips to test the transitions you have created between them.

triggering group

A collection of motion clips and the triggers that initiate their execution.

T-stance

The neutral pose of a character in which the arms and legs are fully extended, reaching towards their limits.

U

unlabelled segment

A segment of data that has not yet been labelled to associate it with a marker. This is done during optical cleaning. Unlabelled segments display as blue asterisks.

See also segment.

unweighted tangent

A tangent on a function curve that does not have weight applied to it.

See also [function curve](#) on page 1765 and [weighted tangent](#) on page 1788.

user channels

Custom channels you can create in the Character Face settings.

See also [channel](#) and [Character Face](#).

UV

U and V texture coordinates. U and V represent vectors in a 1 x 1 pixel image that connects to places on a 3D mesh. The U and V coordinates let you place the texture on the 3D mesh exactly. This placement attaches the texture to the object's surface, and it is mapped to create a seamless effect.

See also [texture](#) on page 1784.

V

value

A number that defines anything from the position, rotation, or scaling of a model, to a material's emissive, ambient, or diffuse color values.

See also [property](#) on page 1777.

vector

visual keyframe

Arrowhead-shaped tabs that display on the Action timeline and on the timeline in the Dopesheet window to indicate the location of keyframes that are set.

See also [keyframe](#) on page 1769.

voice channels

In the Character Face settings, channels that are preset mouth expressions.

See also [channel](#) on page 1756.

VK ripple

Visual keyframes ripple.

See also visual keyframe.

VTR

Video Tape Recorder.

W

waveform

A graphical depiction of the continuous fluctuation in the amplitude of a sound over time.

weighted tangent

A tangent on a function curve that has weight applied, letting you stretch the tangent handle and create special curves that you cannot create with unweighted tangents.

See also [function curve](#) on page 1765 and [unweighted tangent](#) on page 1786.

wireframe

A manner of displaying objects, such as ghosts.

X

X-axis

The dimension on which coordinates define the horizontal space of the scene.

See also [3D coordinate space](#) on page 1749.

X-coordinate

The value that defines the horizontal space in the scene relative to the origin.

Y

Y-axis

The dimension on which coordinates define the vertical space of the scene.

See also [3D coordinate space](#) on page 1749.

Y-coordinate

The value that defines the vertical space in the scene relative to the origin.

yaw

A rotation based on spinning an object using its center as the axis. For example, a record on a turntable.

Z

Z-axis

The dimension on which coordinates define the depth of the scene.

See also [3D coordinate space](#) on page 1749.

Z-coordinate

The value that defines depth in the scene, relative to the origin.

Zero keyframe

1. A keyframe in which the effect of a layer is set to zero at a given time. **2.** A keyframe set to define the start or end of an animation.

See also [layer](#) on page 1769.

zero point

The stance of an Actor where both translation and rotation are set to zero.

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