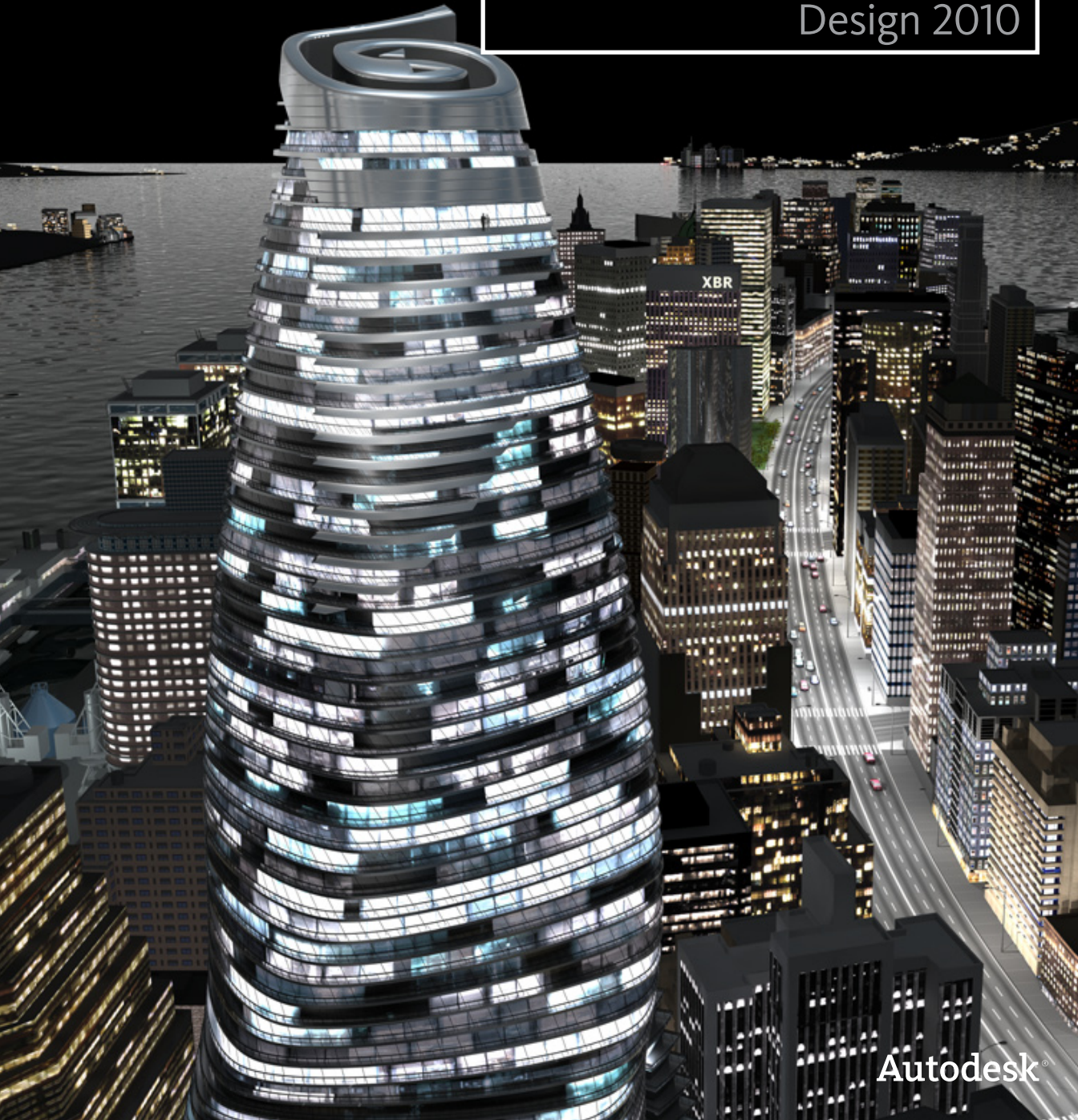


**Tutorials:  
Animation**

# Autodesk® 3ds Max®

Design 2010



Autodesk®

## Autodesk® 3ds® Max Design 2010 Software

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# Animation Tutorials

# 7

The tutorials in this section show you fundamentals of creating animation with 3ds Max Design.

## Features Covered in This Section

- Set Key animation
- Auto Key animation
- Ghosting
- Dummy objects and animation
- Track View – Dope Sheet
- Looping animation
- Weighted list controllers
- Path constraint and Path deform animation methods
- Rendering animation
- Creating movie files

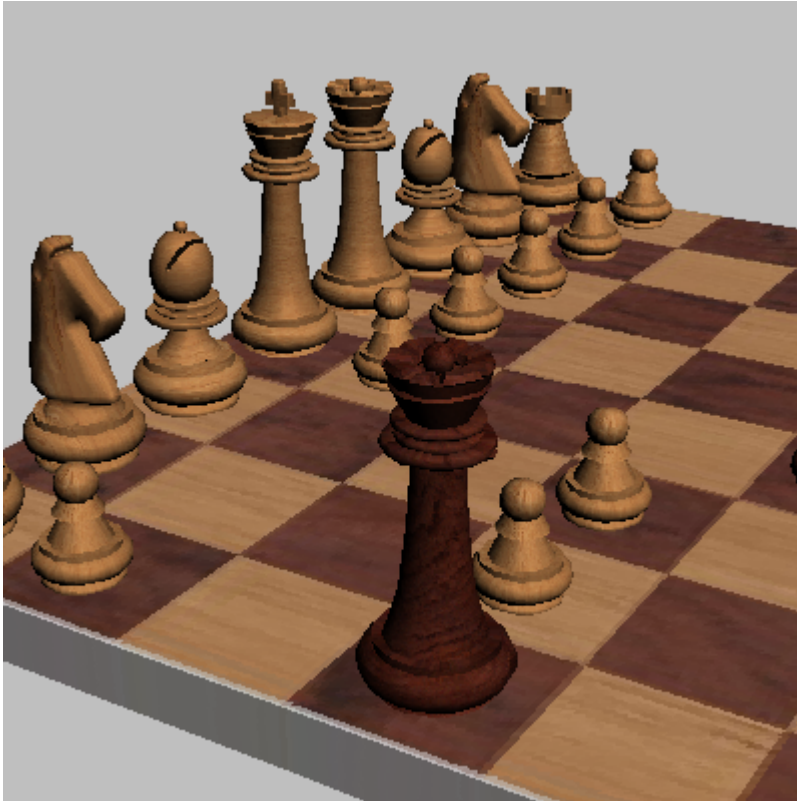
## Animating with Set Key

Set Key mode is an animation mode in 3ds Max Design that allows the professional animator to try out different poses on a character or hierarchy, and then use those poses to create keys on selected tracks. It differs from Auto Key mode, where every transform and each change to an object's animatable parameters will result in animation. In Set Key mode, you have to take an action

(clicking the Set Key button) in order to set a key. Nothing happens automatically.

Mechanical, forensic, and industrial animators might find that Set Key animation provides a precise and deliberate workflow to use instead of Auto Key mode.

While Set Key mode is intended primarily for use with character animation, this example uses a simple chess set and the quickest checkmate, a four-move game, to illustrate the typical Set Key workflow.



The moves you will animate are:

- White kingside knight's pawn moves ahead two squares.
- Black queen's pawn moves ahead two squares.
- White kingside bishop's pawn moves ahead two squares.

- Black queen moves diagonally to checkmate White king.




In this tutorial you will learn how to:

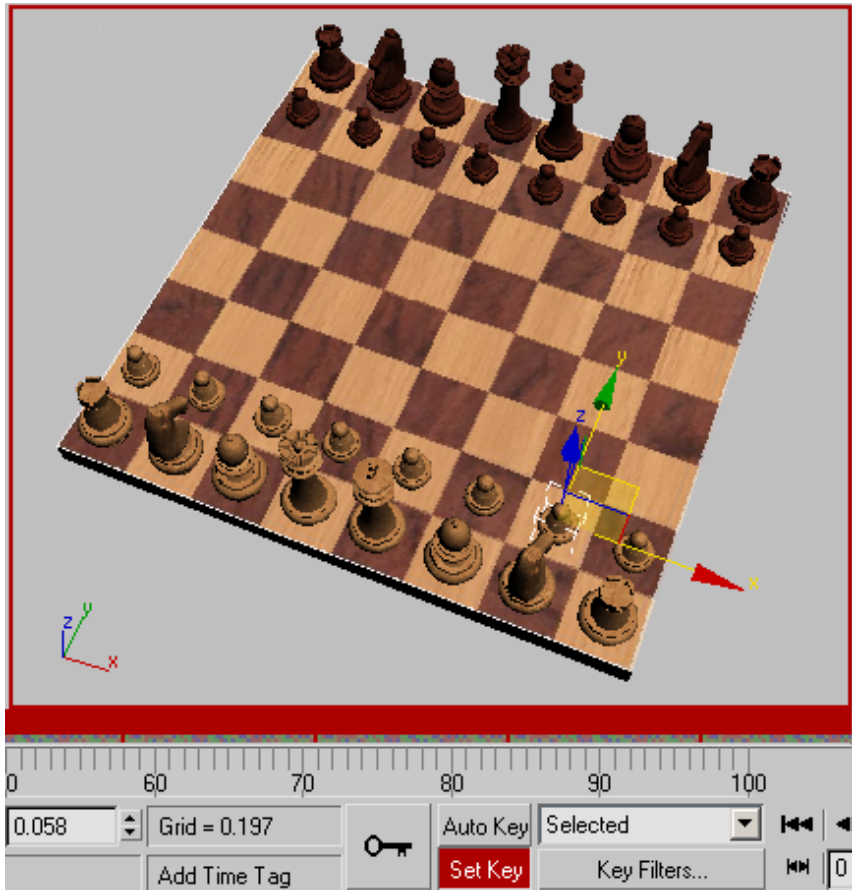
- Turn on Set Key mode.
- Use keyable icons in Track View.
- Use key filters.
- Create keys using Set Key, and using keyboard shortcuts.
- Move a pose in time.

Skill Level: Beginner

Time to complete: 20 minutes

### Use Set Key mode to move your pawns:


- 1  On the Quick Access toolbar, click Open File, navigate to the `\scenes\animation\set_key` folder, and open `wood_chess_set.max`.  
This scene is a wooden chess set. It isn't animated yet.
- 2  Turn on Set Key mode by clicking the Toggle Set Key Mode button  
 The Set Key Mode toggle turns red, as does the time slider background and the active viewport outline.
- 3 In the Perspective viewport, select the pawn in front of the white knight at the lower-right corner. If the transform gizmo isn't already displayed, right-click and choose Move from the quad menu.



**Pawn selected and Set Key mode turned on**

First, you will set a key to keep the pawn in place at frame 0.

- 4  Click Set Keys.

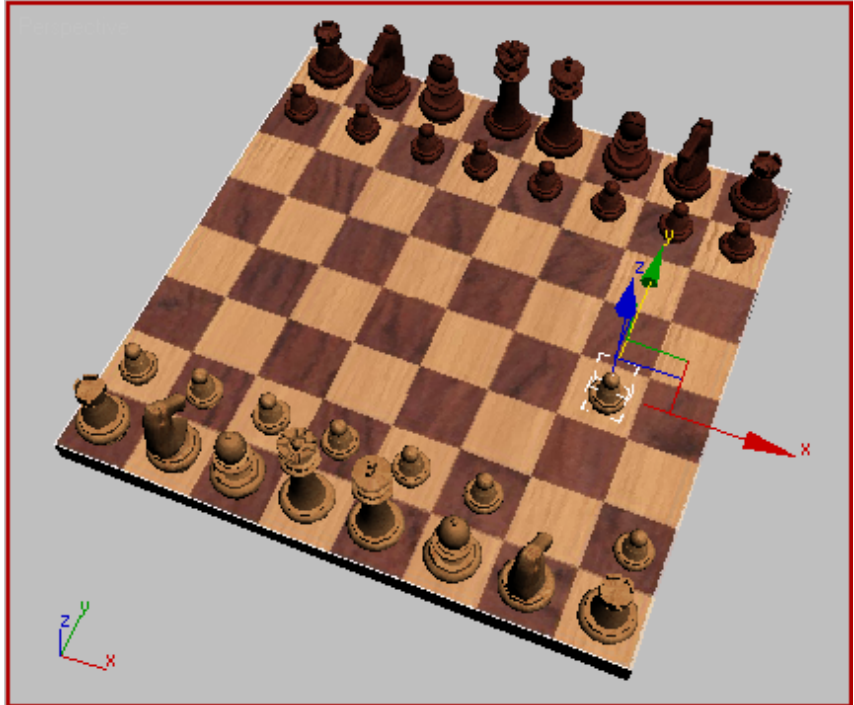
 The button turns red for a moment. A key appears at frame 0 on the track bar.

---


**NOTE** The Set Keys button also works in Auto Key mode.

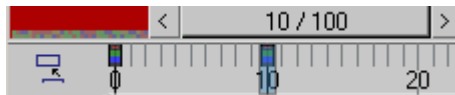
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- 5 Move the time slider to frame 10.
- 6 Using the transform gizmo, move the pawn ahead two squares.



Pawn position at frame 10

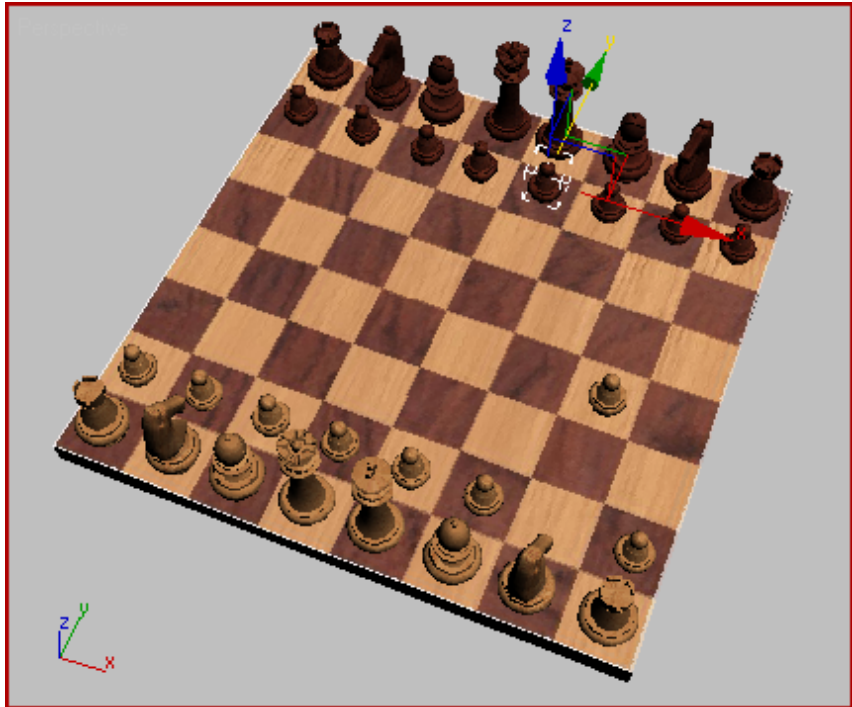
- 7  Click Set Keys to set a key at frame 10.  
A key appears in the track.



Now you'll animate the first move by the Black side.

### Animate the Black king's pawn:

- 1 Move to frame 20.
- 2 Select the Black king's pawn.

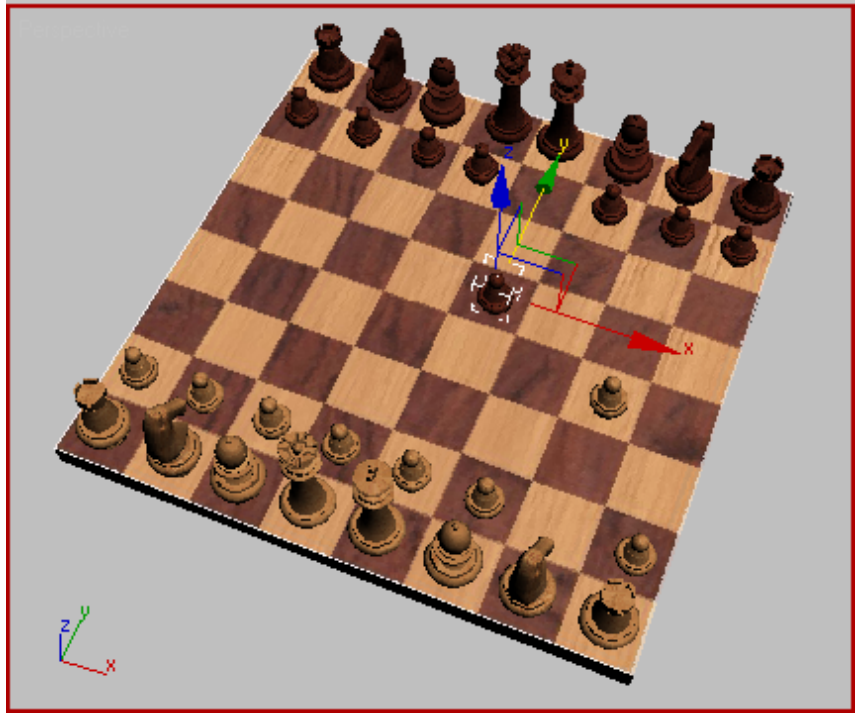


- 3 Press K on the keyboard. This is the shortcut for the Set Keys button.  
A key appears in the track bar for the Black pawn.
- 4 Move the time slider to frame 30.
- 5 Move the pawn ahead two squares.
- 6 Move the time slider to frame 35.  
The pawn jumps back.

The reason the pose was discarded is because you didn't set a key at frame 30. This is an important difference between Set Key and Auto Key. By doing this lesson, you just learned that if you don't set keys while using Set Key, you cannot retrieve your work.



- 7 Move the time slider back to frame 30 and move the pawn into place again.



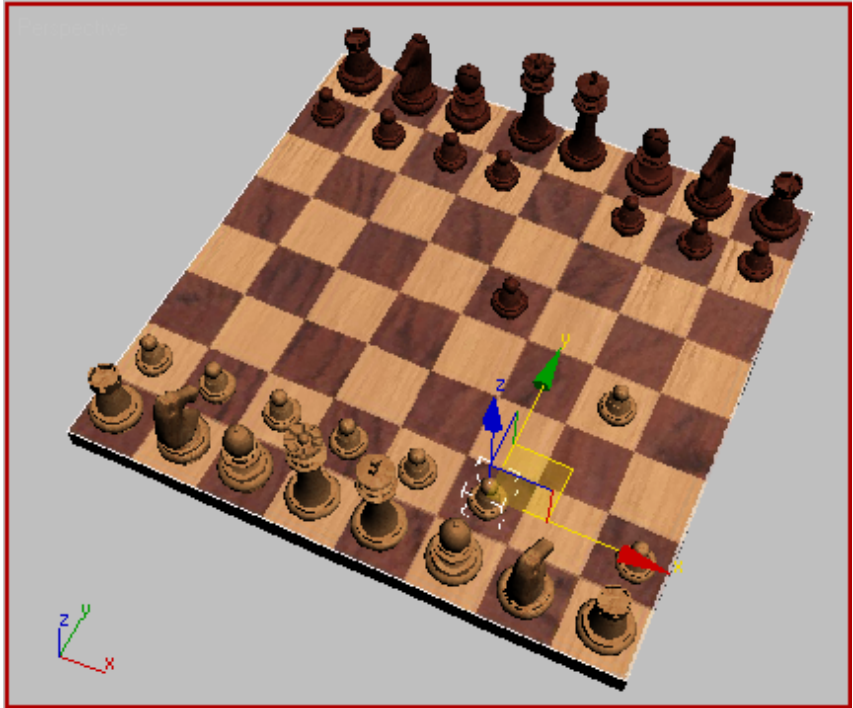
**Animation at frame 30**

Press K again to set the key.

- 8 Play the animation.  
The White pawn moves, and then the Black pawn moves.

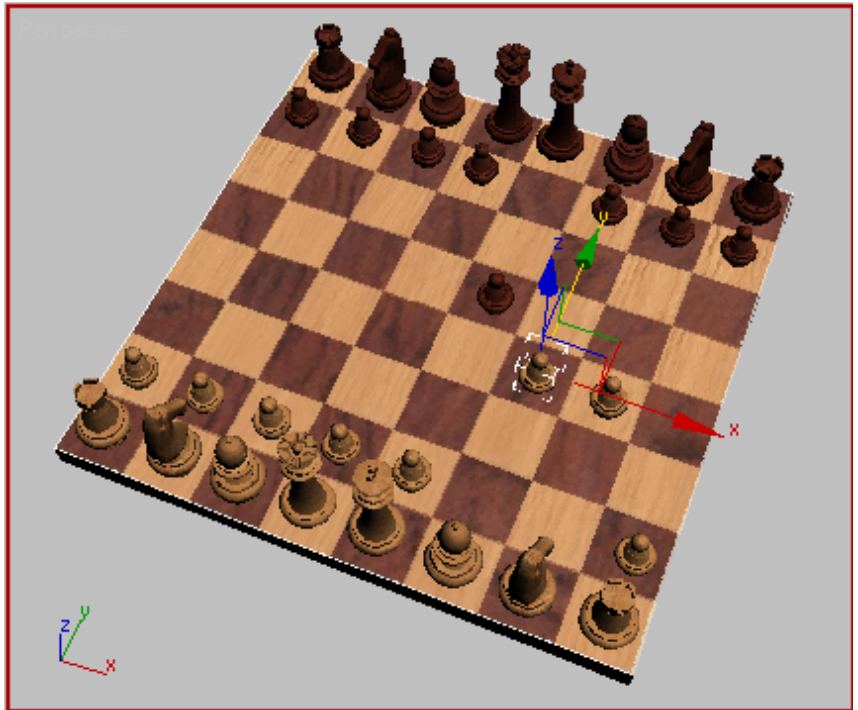
**Animate the bishop's pawn:**

- 1 Select the White kingside bishop's pawn and go to frame 40.



Select this pawn at frame 40.

- 2 Press K to set a key.
- 3 Move to frame 50. Now move the pawn two squares ahead and press K again.

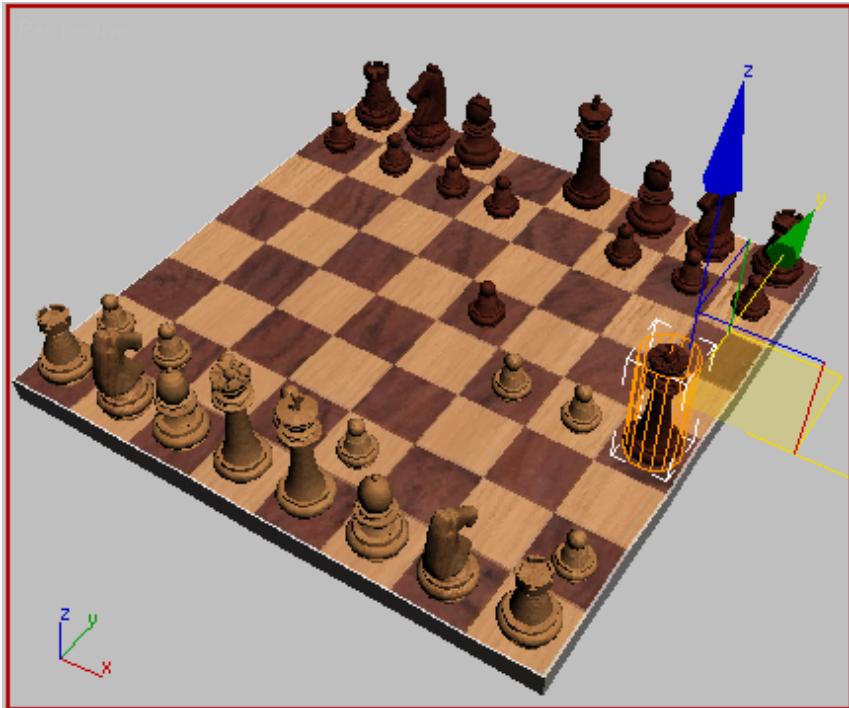


Animation at frame 50

### Move a pose in time:

You might get a pose completely set up, only to discover that you are on the wrong frame. There's a simple trick that lets you move the pose to another frame in time.

- 1 At frame 50, select the Black queen, and press K to set a key.
- 2 Move the time slider to frame 55.
- 3 Move the queen diagonally four squares. Use the corners of the transform gizmo to move in both X and Y at the same time.



Move the queen using the corners of the XY transform gizmo.

---

**TIP** Before moving the queen, arc rotate the viewport so you can see the transform gizmo corners. You can also press + on the keyboard to enlarge the gizmo.

---

Let's say you realize you need this pose to happen at frame 60, not frame 55. Here's what you do.

- 4 Right-click the time slider frame indicator (it reads 55/100) and drag to frame 60.  
Now you are at frame 60, and the queen hasn't jumped back to the previous position.
- 5 Click Set Keys or press K to set a key.

#### Set keyable tracks and key filters:

You've seen how to use Set Key in its simplest form. Now you'll add a level of complexity by selectively determining which tracks will be keyed.

The Black queen has the White king in checkmate. Traditionally the king is knocked over to end the game.

You'll set the Keyable tracks so that you can animate the rotation of the king, along with its X and Y positions, but not its Z position. You don't want the king dropping through the board.

---

**NOTE** When using Set Key animation, it's useful first to determine which tracks will be keyed and which won't. In simple transforms this isn't crucial, but if you're using Set Key to keyframe materials or object parameters, this is extremely important. If you don't define which tracks are keyable, all the animatable material or object parameters will receive keys when you click Set Keys.

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- 1 Select the White king, then right-click and choose Curve Editor.

The Curve Editor window is displayed, with the King's tracks displayed at the top of the controller window.



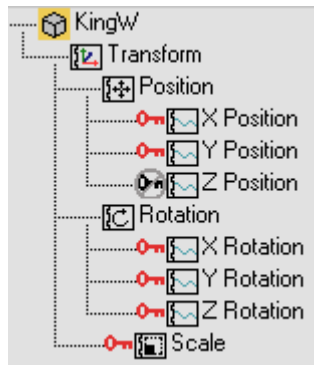
- 2 On the Track View toolbar, click Show Keyable icons.

The tracks for the White king show red “keyable” icons in the controller window.

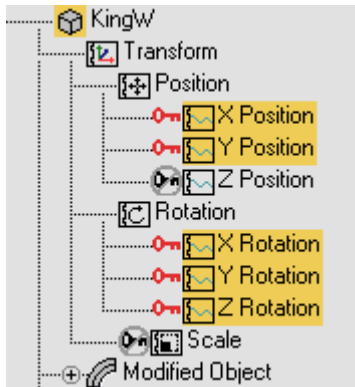
- 3 Click the red icons next to the Z position track and the Scale track.

The icons turn black to show they are inactive.

Now you will not be able to key the Z position or the scale of the king. You can still key the rotation and the XY position tracks for the king.




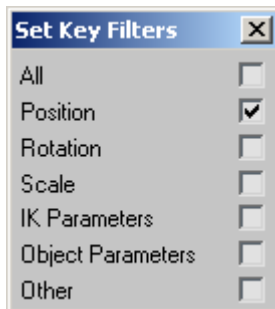
**Keyable tracks turned off for Z position and scale**

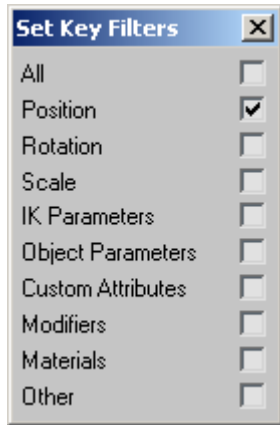


**Keyable tracks turned off for Z position and scale**

If you want to key the rotation and the position tracks individually, you can use the Key Filters.

- 4 Go to frame 75 and with the White king selected, press K. This creates a position and rotation key at frame 75.
- 5  Move to frame 90, then click Key Filters. This button is to the right of the Set Key button.
- 6 On the Set Key Filters dialog, turn off everything except Position.





- 7 Move to frame 100, then move the White king off the board to the left. Rotate the king so it is on its side, then click Set Keys to create a key.
- 8 Play the animation. The White king moves off the board, but doesn't rotate, since Key Filters did not allow the rotation track to be keyed.
- 9 Click Key Filters and turn Rotation back on.
- 10 Move to frame 100 and rotate the White king, and then set a key.

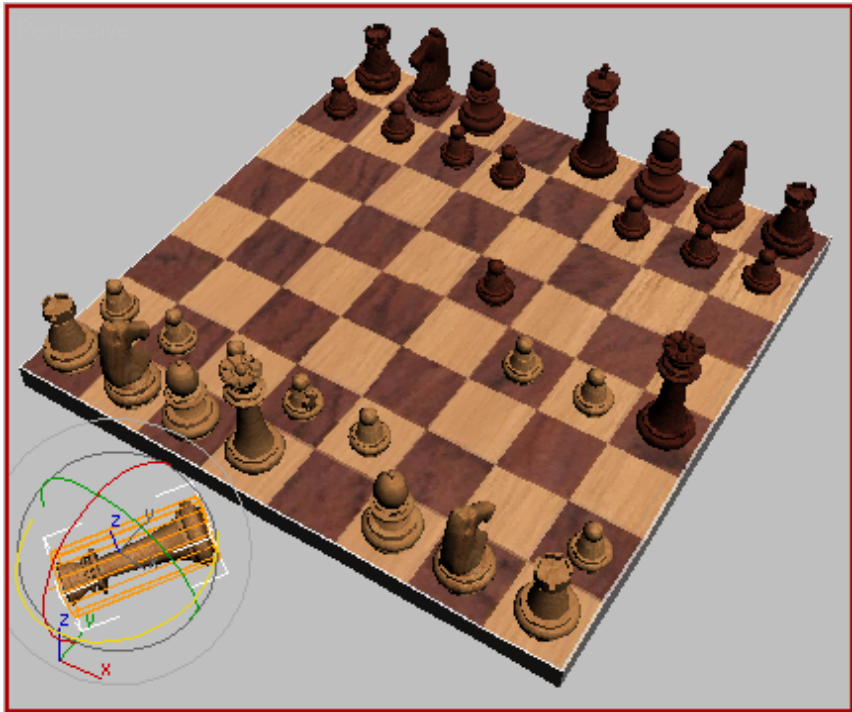
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**TIP**

If you want to replace a key with a different one, delete the key in the track bar, then use Set Keys again to set a new key. Set Keys doesn't automatically replace a key that has already been set.

---

- 11 Play the animation. Now the rotation has been keyframed.



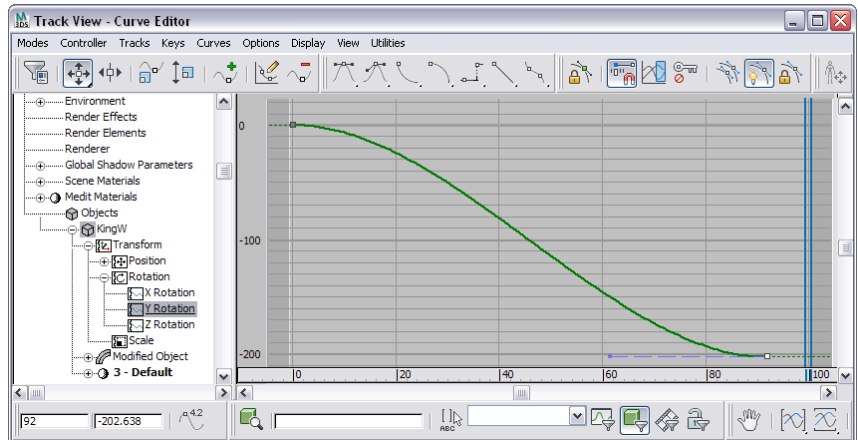
**Checkmate!**

**Use the Curve Editor to edit rotation keys:**

You can use the Curve Editor to edit the rotation of the White King.

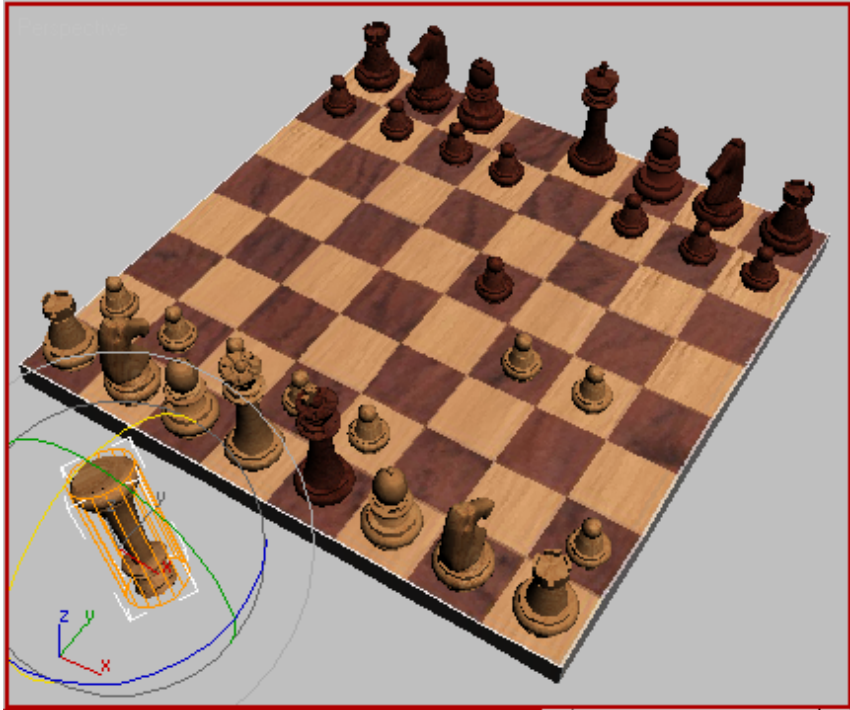
- 1 In the Curve Editor controller window select the *KingW* Y rotation track, so it is the only track that is yellow. Now you can manipulate the keys on the curve.
- 2 In the Key Window, move the key at frame 100 downward to approximately **-200**.





**Move the key downward to -200.**

In the viewport you can see the rotation change for the White King object. If you like, you can also keyframe the Black Queen moving into the White King's square.



Rotation of White King object edited using Curve Editor

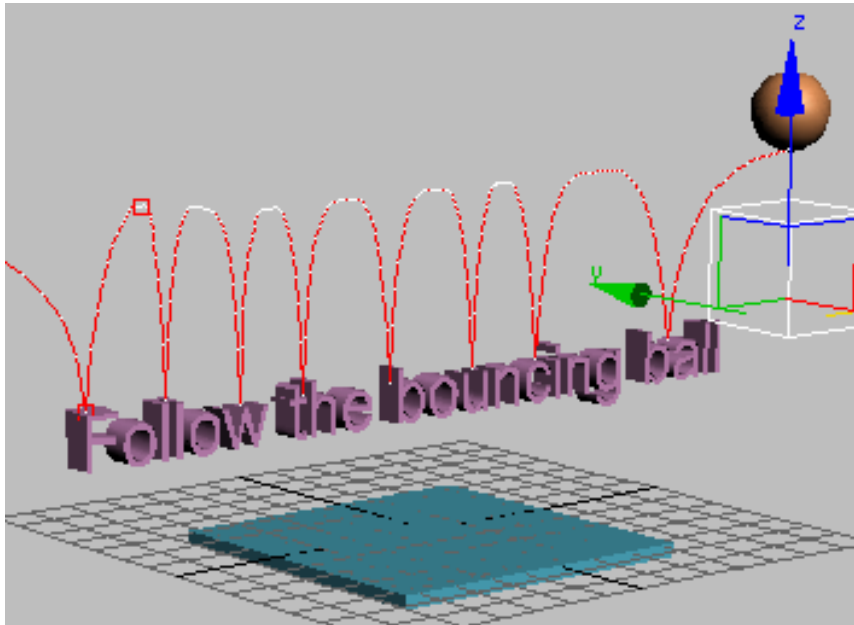
- 3 Save your file as **mycheckmate.max**. If you had trouble, you can open *quickest\_checkmate.max* to compare with your file.

### Summary

In this tutorial, you have learned to use Set Key animation. You've learned how to create keyframes with the Set Keys button, set Key Filters, and make tracks keyable in Track View. You will find it useful to apply these lessons to animating complex structures.

## Animating with Auto Key: Bouncing a Ball

A bouncing ball is a common first project for new animators. This classic example is an excellent tool for explaining basic animation processes in 3ds Max Design.



In this tutorial, you will learn how to:

- Create animation using transforms.
- Copy keys in the track bar.
- Use ghosting to visualize in-betweens.
- Use tangent handles in the Function Curve Editor to control in-betweens.
- Create looping animation using Parameter Out-of-Range Types.
- Animate using dummy objects.
- Use Layout mode.
- Apply Multiplier curves.
- Work with the Dope Sheet Editor to speed up animation and reverse time.
- Animate using Set Key mode.


Skill level: Beginner

Time to complete: 1 hour 45 minutes

# Creating Animation Using Auto Key

In this lesson, you'll start learning how to animate in 3ds Max Design.

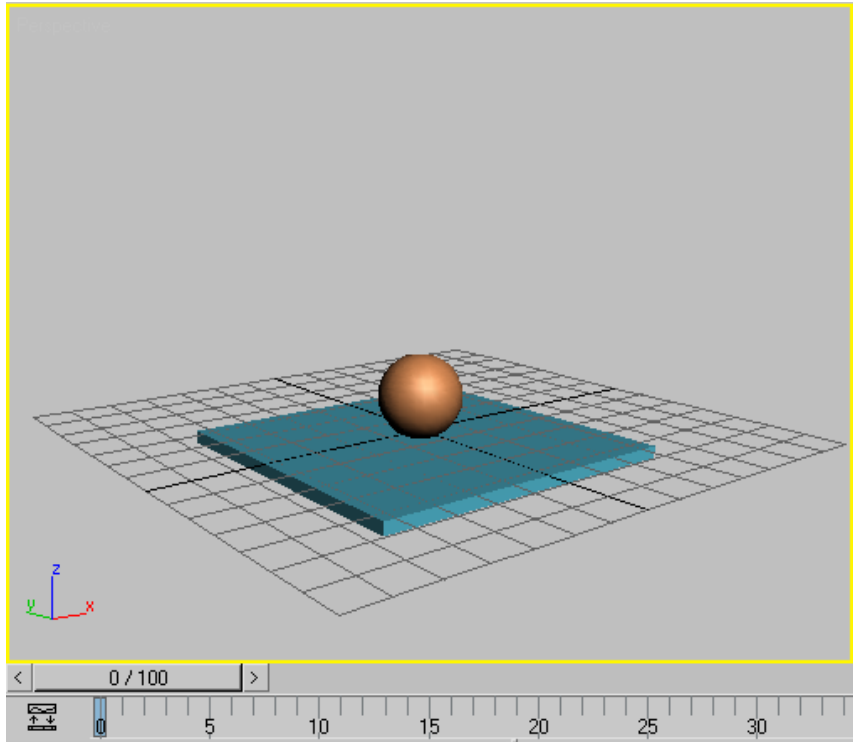
## Animate the ball using the Move transform:

- 1  On the Quick Access toolbar, click the Open File button, navigate to the `\scenes\animation\auto_key` folder, and open the scene file `bounce_start.max`.

---

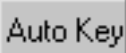
**NOTE** The following illustrations display the grid differently than you will see in your viewports. For ease of use, press G on the keyboard to hide the display of your grid.


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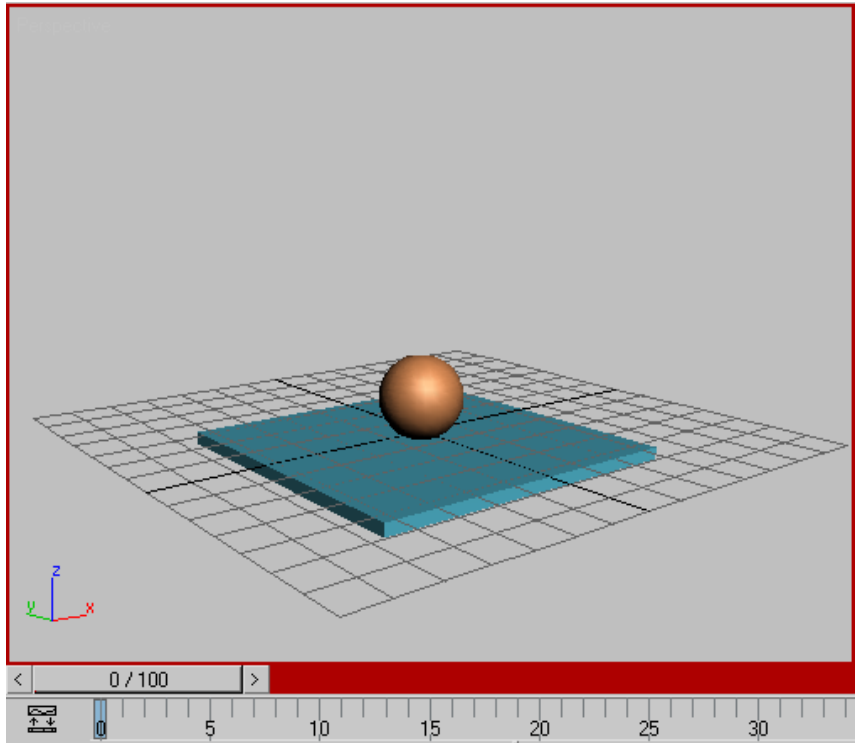


Perspective viewport: `bounce_start.max`


This file has the Perspective viewport displayed on the lower left. This is not the standard viewport layout; the layout has been customized for this lesson.

- 2  Click Auto Key to turn on this feature.

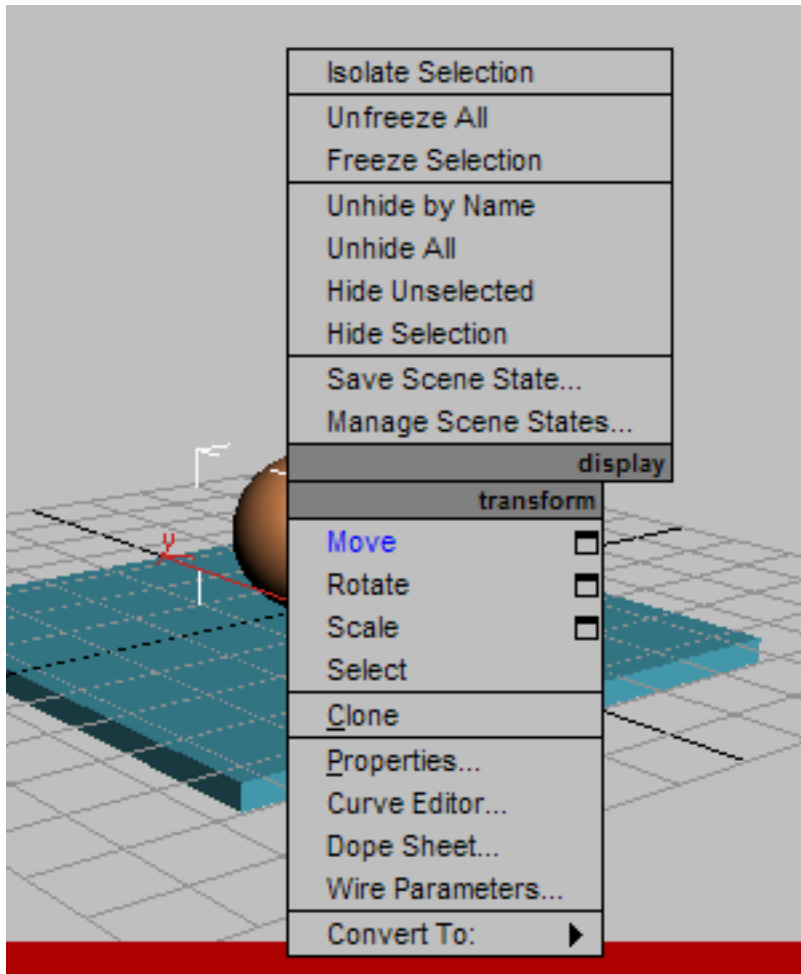
 The Auto Key button and the time slider background turn red to indicate that you are in animation mode. The viewport is outlined in red, as well. Now, when you move, rotate, or scale an object, you create keyframes automatically.



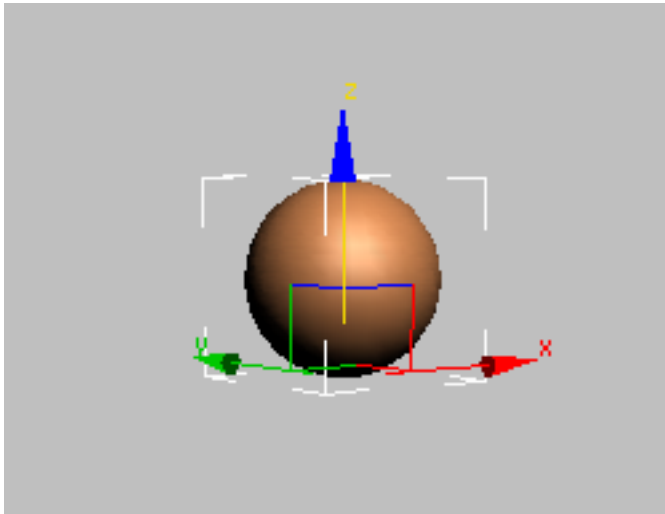
**Time Slider background turns red**

- 3  Click to select the ball in the Perspective viewport.  
It is displayed within white selection brackets, indicating that it's selected.

- 4 Right-click the ball and choose Move from the Transform quadrant of the quad menu.



The Transform gizmo appears in the viewport. The Transform gizmo lets you easily perform constrained movements. As you move your cursor over the Transform gizmo, the different axes and their labels turn yellow.



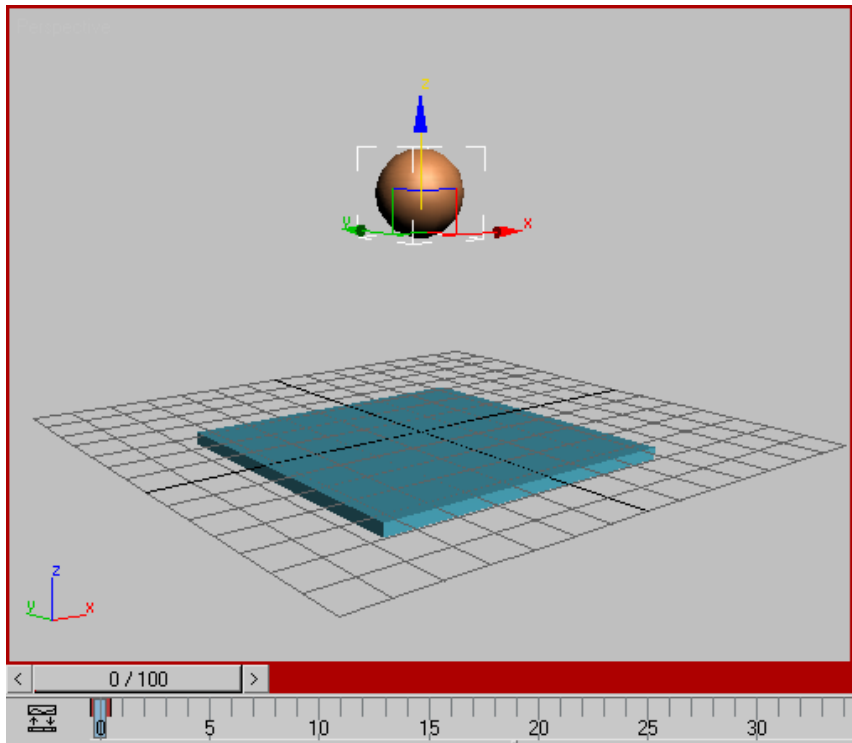
- 5 Position the mouse cursor over the Z axis, and when it turns yellow, click and drag upward to raise up the ball in the air.

As you move the ball up in the air, notice the Z value changing in the Coordinate Display below the track bar.

The ball's position at frame 1 is now fixed above the box.

A Position key is created when you do this. The key is displayed on the track bar.

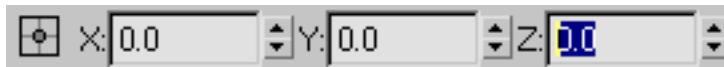
The track bar displays the keys for whatever is selected in the viewport. The track bar is found directly beneath the time slider and above the prompt area.



**Keyframe created in Auto Key Mode**

**6** Move the time slider to frame 15.

To move the ball precisely down to the table surface, put your cursor in the Coordinate display Z field, and change the value to 0.



**Coordinate Display type-in for precision animation.**

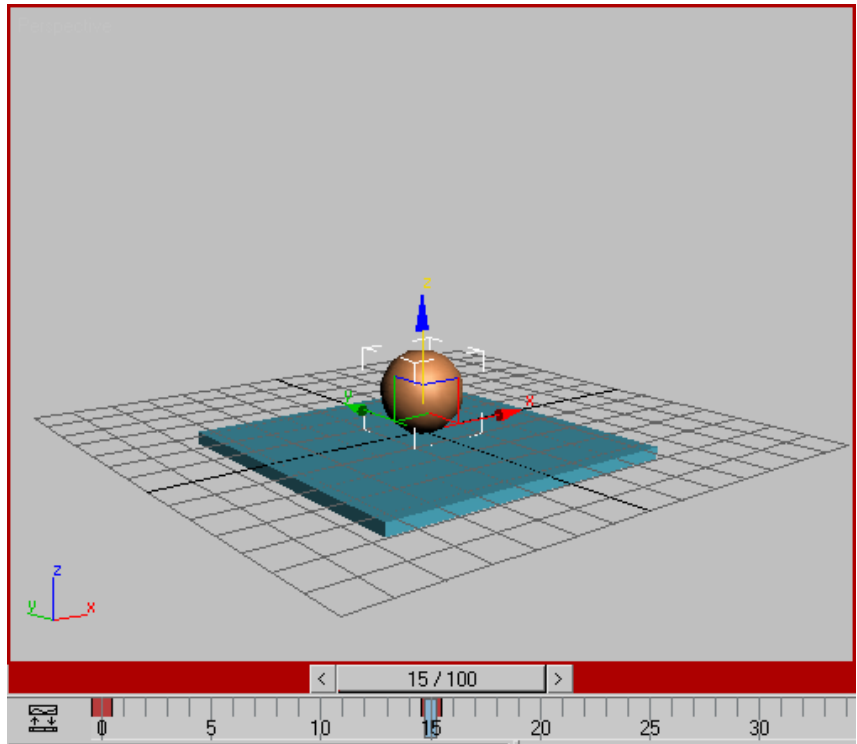
The box is built off the world origin, so a Z position value of 0 will set the ball directly in contact with the box.

---

**NOTE** The World Origin, (0,0,0) in XYZ coordinates, is shown by the intersection of the dark lines on the Home grid.

---





**Frame 15: Ball is in contact with the box**


You need to make the ball rise up to its original position at frame 30. Instead of moving to frame 30 and moving the ball back up in the air, you'll use a different method.

---


**TIP** You can zero the Z coordinate (or any other spinner) by right-clicking the spinner arrows.

---


- 7** Put your mouse over the time slider's frame indicator (the grey box that currently reads 15/100) and right-click.  
The Create Key dialog appears.
- 8** In the Create Key dialog, change the Source Time to **1** and the Destination Time to **30**, then click OK.  
This copies the key from frame 1 to frame 30.

- 9  Click Play Animation to play the animation, or drag the time slider back and forth between frames 1 and 30.

The ball moves down and up between frames 1 and 30, and stays up in the air between frames 30 and 100.

- 10  If you clicked Play Animation, click Stop (the same button) to end the playback.

Next, you will set the length of the active time segment to 30 frames.

- 11  In the time controls, click Time Configuration.

- 12 In the Time Configuration dialog > Animation group, set Start Time to **1** and End Time to **30**. *Don't* click the Re-Scale Time button. Click OK.

3ds Max Design lets you work in an active time segment that's a part of a larger animation. Here you are making frames 0 through 30 the active time segment. Notice that the time slider now shows only these frames. The other frames still exist, they just aren't part of the active segment at the moment.

- 13 Play the animation.

The ball goes up and down. Since the first and last frames are the same, the animation appears to cycle as it plays.

The ball moves, but it doesn't have "bounce" yet.

- 14 Stop the animation playback.

3ds Max Design made decisions on how the in-betweens are being distributed. Right now they are evenly distributed so the ball has no acceleration. It doesn't speed up or slow down; it just floats along with no sense of weight.

You need to simulate the effect of gravity so that the ball slows to a stop at the top of its bounce, speeds up as it approaches the table, and then bounces up again. To accomplish this, you'll use the key interpolation curves available on the Curve Editor. You'll also use the Ghosting feature to help visualize what the interpolation curves are doing.

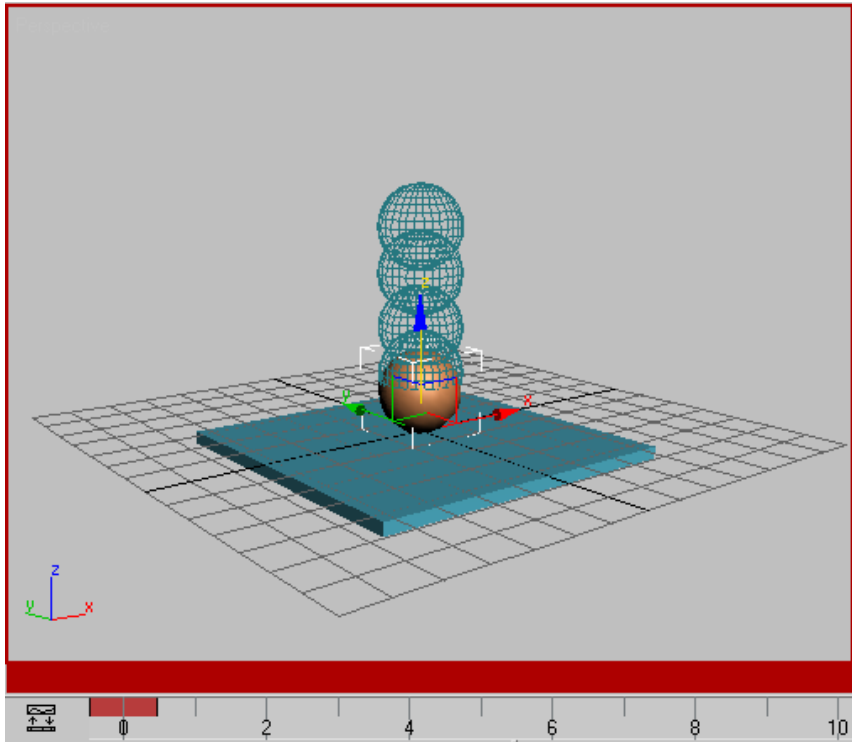
# Controlling In-Betweens

To make the ball bounce more convincingly, you'll change the interpolation on the key at frame 15.

You'll use the tangency handles available in the Curve Editor. The tangency of the curve will determine the position in space of the in-between frames. Ghosting will let you see where the in-betweens are being positioned.

## Using ghosting to visualize in-betweens:

- 1 Move the time slider to frame 15.
- 2 From the Views menu, click Show Ghosting to turn on this feature.  
The ghosting feature shows object positions before the current keyframe in an aqua color.
- 3 Go to Customize menu > Preferences > Viewports tab, and set Ghosting Frames to **4** and set Display Nth frame to **3**. Click OK to exit the dialog.  
The viewport displays the ghosting.



**Ghosting shows the object positions on previous keyframes.**

- 4 Play the animation, and then stop.
- 5 Now, to control the in-betweens, right-click the ball in the viewport and choose Curve Editor.  
The Function Curve Editor is displayed across the top two viewports.  
The Curve Editor is composed of two windows, a Controller window on the left that shows the names of tracks, and a Keys window on the right that shows keys and curves.
- 6 In the Controller window on the left, click to select only the Z position track.

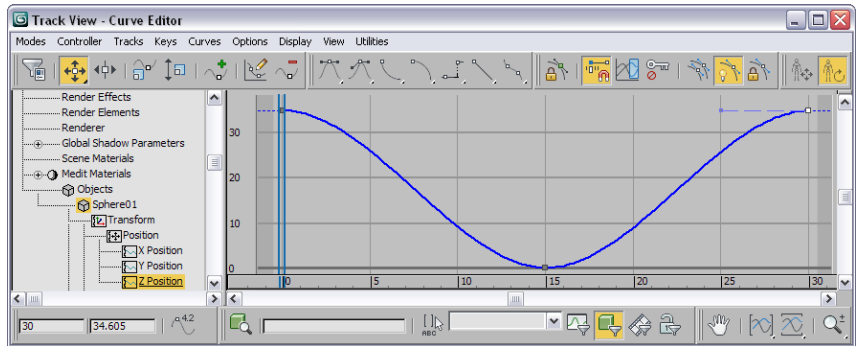
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**NOTE** If you don't see the Z Position track, click the plus icon to the left of the ball to expand the ball's tracks. If you don't see a plus icon, right-click and choose Manual Navigation, hold down Alt and right-click, and then choose Expand from the quad menu.

There are many possible configurations in the Curve Editor, so you may encounter variations from the standard.

---

Now the only curve displayed in the Keys window is the one you want to work on.



**Function curve for bouncing ball Z position**

- 7 Move the Track View time slider (the double aqua line in the Key window).

As you move back and forth the animation plays in the viewport.

If you look carefully, you'll see a dark dot on the curve at frame 15.

- 8 Drag around the dark dot (the position key) to select it.

The selected key turns white on the curve.

You will now manipulate the curve using tangency handles. To access the handles, you must change the tangency type.



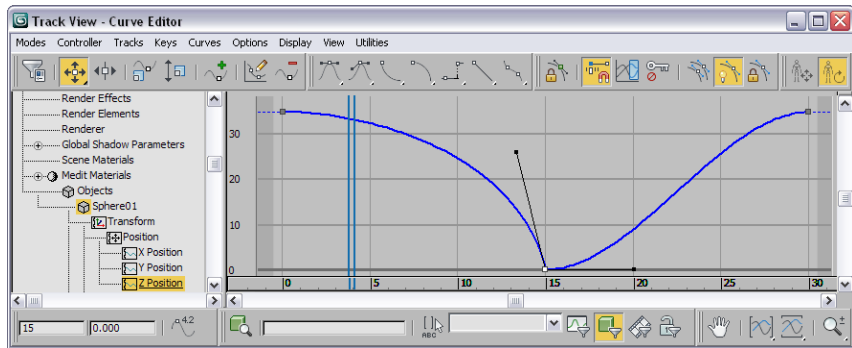
- 9 On the Track View toolbar, click Set Tangents To Custom.

If you look carefully, you'll see a pair of black tangency handles have appeared on the curve.

- 10 Hold down the Shift key and drag the left handle on the left upwards in the Key window.

Using the Shift key lets you manipulate the left handle independently from the right.

The curve now looks like this:

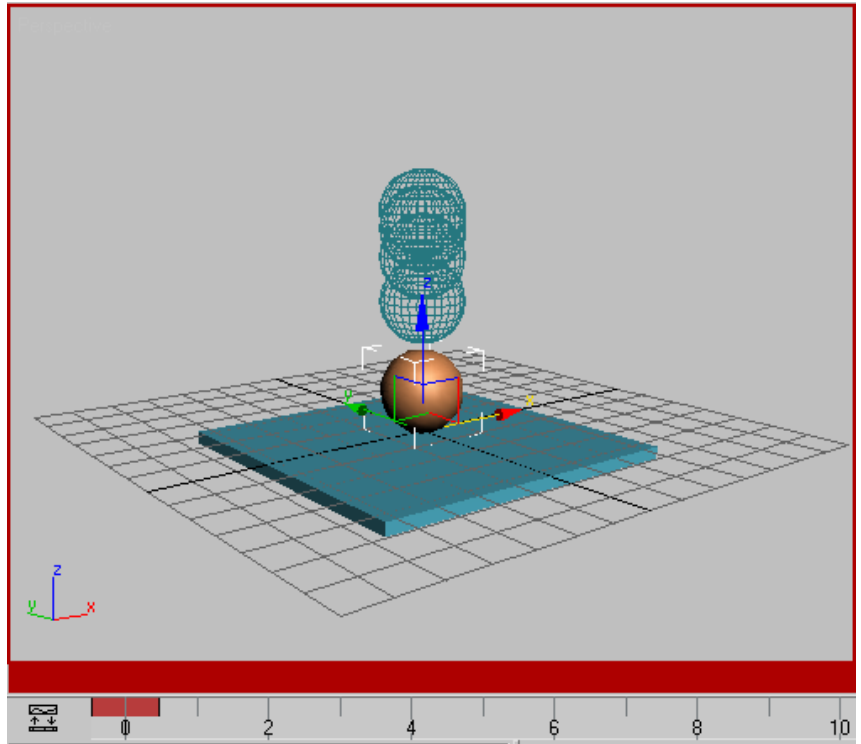


**Shift** key allows for manipulation of individual handles.

You'll change one more setting to make this tool more useful.

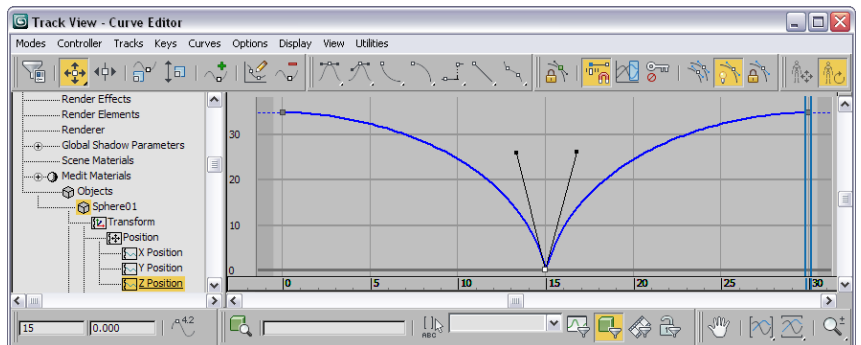
### Using Interactive Update:

- 1 On the Track View Settings menu turn on Interactive Update. Now move the time slider to frame 15, then manipulate the tangency handle while observing the effect in the ghosting. You can clearly see the changes as you work.
- 2 Set the tangency handle so the in-betweens are mostly drawn toward the raised position (see the illustration that follows). With interactive update on, you can do this with very fine control.




Interactive update and ghosting

- 3 Move the time slider to frame 30, then adjust the right tangency handle so it approximately matches the left one.



By manipulating this handle you can get different effects. The upward movement of the ball as it bounces off the table will determine the perception of the weight of the ball. The ball will appear to be bouncy, like a tennis ball, if the two handles are similar. The ball will appear to hang in space if enough of the in-betweens are drawn close to the topmost position.

- 4  Turn off Views > Show Ghosting and then play the animation. Concentrate on the movement of the ball. Adjust the curve handles some more while the animation plays. Observe the effect.  
The ball leaves the table as quickly as it hit it, then begins to slow down as it rises.
- 5 Play the animation, and then stop.  
The ball has bounce now. It looks like there is gravity at work here.  
When you see something you like in the viewport, it's a reminder that you should save your work. It's easy to forget while you're being creative.
- 6 Save your work as **mybounce.max**.

You've made the ball bounce once. In the next section, you'll learn to repeat the bouncing of the ball using Out-of-Range types in Track View.

## Adding Parameter Curve Out-of-Range Types

You can repeat a series of keys over and over in a variety of ways, without having to make copies of them and position them along the time line. In this lesson, you'll add Parameter Curve Out-Of-Range Types to the ball's position keys. Out-Of-Range Types let you choose how you want the animation to repeat beyond the range of the current keys. They have the advantage that when you change one set of keys, the changes are reflected throughout the animation

Most of the tools in Track View are available both from menu choices and from toolbars. This feature is also on the Controllers menu.


### Repeat keyframed motion:

- 1 Continue from the previous lesson, or open *bounce\_repeat.max*. This is a 3ds Max Design scene with the ball bouncing once.




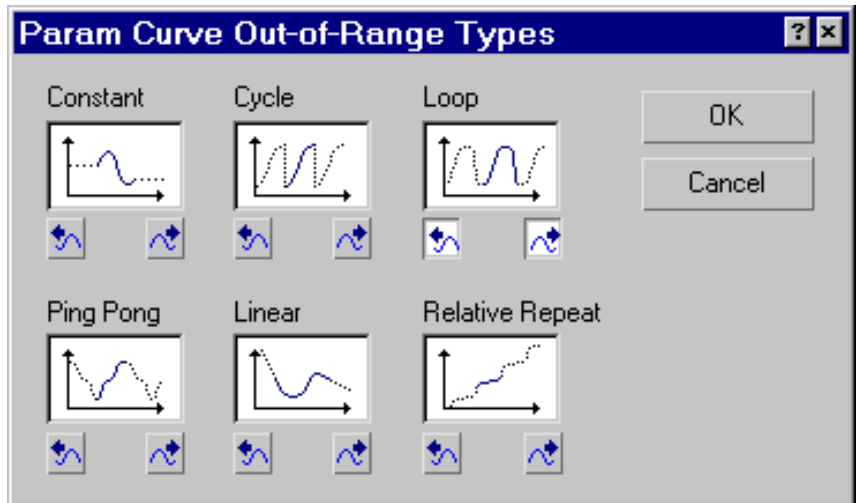
- 2 If the Curve Editor isn't displayed already, select the ball in any viewport, right-click, and choose Curve Editor from the quad menu.
- 3 In the Controller window, make sure that only the Z Position track is selected.

Before you repeat the keyframes, you'll extend the length of the animation.

- 4  Click Time Configuration. This button is beneath the Go To End button in the animation playback controls at the bottom-right corner of the interface (not Track View).
- 5 Change the Animation End Time to **120**.

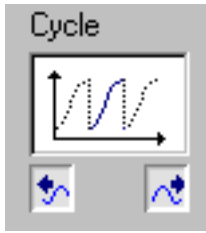
This adds 90 blank frames onto the existing 30 frames. It doesn't stretch the 30 frames over 120. The ball will still be bouncing once between frames 1 and 30.


- 6  Now, back in Track View, click the Parameter Curve Out-Of-Range Types button on the toolbar.

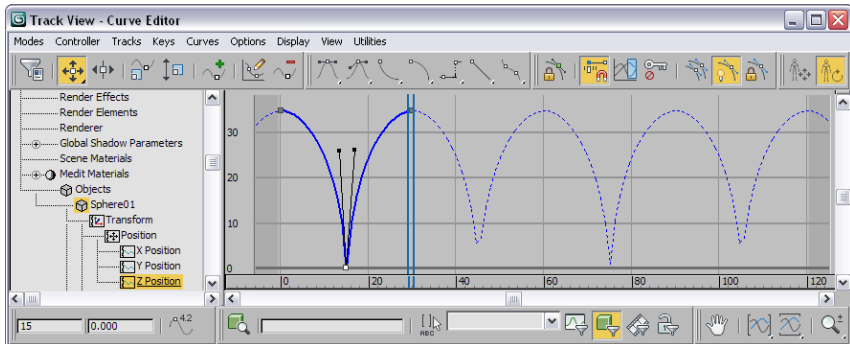


Parameter curve out-of-range type choices

- 7 Click both boxes under the Cycle graph to choose Cycle for In and Out. Click OK.



- 8  Click Zoom Horizontal Extents on the Navigation: Track View toolbar at the lower right corner of the Track View window. The Keys window zooms back so the entire time segment is visible. The Parameter Out-of-Range curves are displayed as dotted lines.



### Parameter Out-of-Range curve

There are no keys beyond frame 30. Any change made to the original keys will be reflected in the looping.

---

**TIP** You can create keys for the out-of-range curves by choosing Utilities > Track View Utilities > Create Out of Range Keys.

---

- 9 Play the animation.  
The ball bounces over and over.
- 10 Save your work as **mybounce\_repeat.max**  
Next, you will learn to link the ball to a dummy object and then use the dummy to animate the position of the ball. This allows you to keep the bouncing independent from the position, and makes it easier to control the animation.

# Animating with Dummy Objects

In this lesson, you will link the bouncing ball to a helper object. Then you can animate the helper so that the ball bounces across the top of some text. This animation technique is useful because you can control the ball's bouncing and its traveling motion independently.

## Set up the lesson:


- 1 Open the scene file *bounce\_dummy.max*.

This file is similar to the bouncing ball created in the last lesson. The only difference is that it has a text object prepared for you in the scene and it has a longer active time segment.

---



**TIP** If you want to keep using your own bouncing ball, you can merge the text object in the *bounce\_dummy.max* file by going to the Application menu and choosing Import > Merge.

---

- 2  If you didn't open *bounce\_dummy.max*., you'll need to extend the active time segment to 240 frames. Click the Time Configuration button and then in the Animation group change End Time to **240**.

## Create a dummy object:

- 1 Go to frame 0.
- 2 Click the Top viewport to activate it, then zoom in on the ball and the box.

- 3   On the Create panel, click the helpers button, then on the Object Type rollout click Dummy.

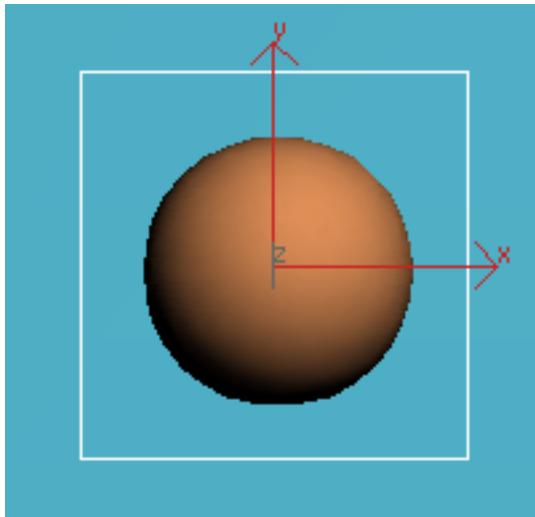
- 4 In the Top viewport, move the cursor over the ball.

---

**TIP** Move the Layers and Extras toolbars away from the Top viewport

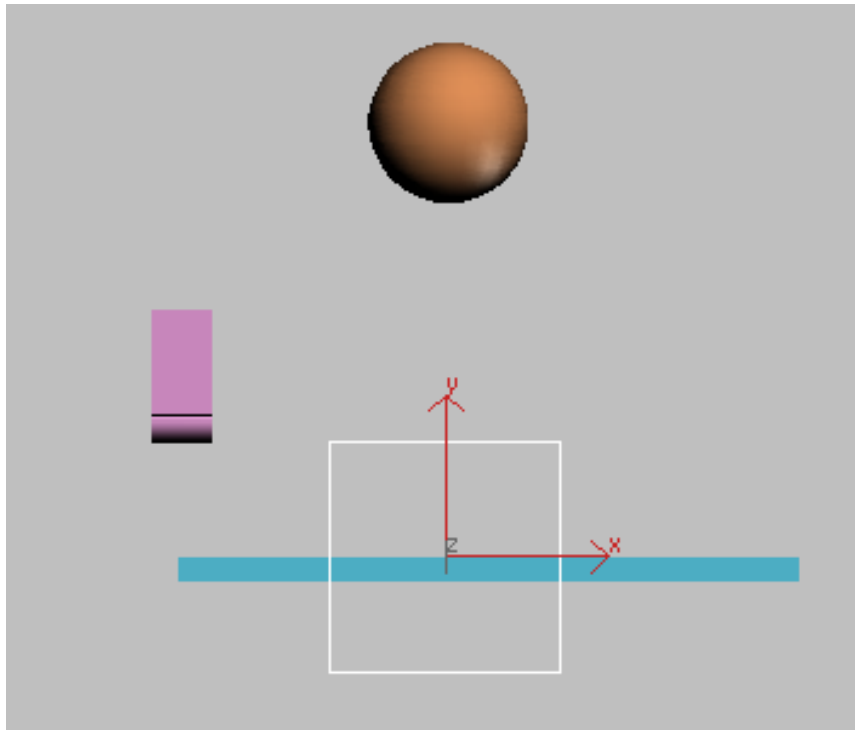
---

- 5 Press the mouse button and drag outwards to create a dummy object.



**Make the dummy in the Top viewport.**

If you look in the Front viewport, you'll see that while the ball is up in the air, the dummy is positioned at the same level as the box.



#### Dummy created below the ball

Next you will align the dummy so that it is centered over the ball when viewed from the top.




- 6 On the toolbar, click Align. Then in the Top viewport, click the ball.

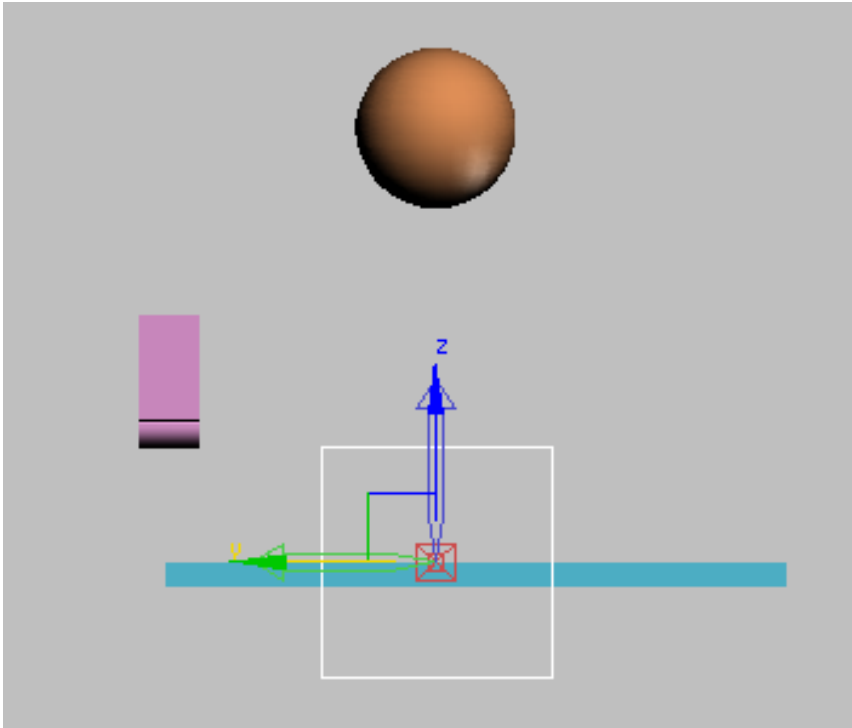
The Align Selection dialog is displayed.

- 7 On the Align Selection dialog, turn on X Position and Y Position, but leave Z turned off. Click OK.

You'll see the dummy shift position so it is aligned to the ball.


Next, you'll align the dummy's pivot point with its base, and you will position the dummy so that it sits on top of the box. The idea is to set up the dummy so that its pivot point will match where the ball bounces. Then placing the dummy on any frame in time will ensure the correct alignment.

-  8 Select the dummy object, and go to the Hierarchy panel. Instead of moving the pivot, you will move the object using Affect Object Only. This moves the object but leaves the pivot unmoved.
- 9 On the Adjust Pivot rollout, click Affect Object Only to turn it on. The pivot icon is displayed in the viewport.



**Pivot point tripod display**

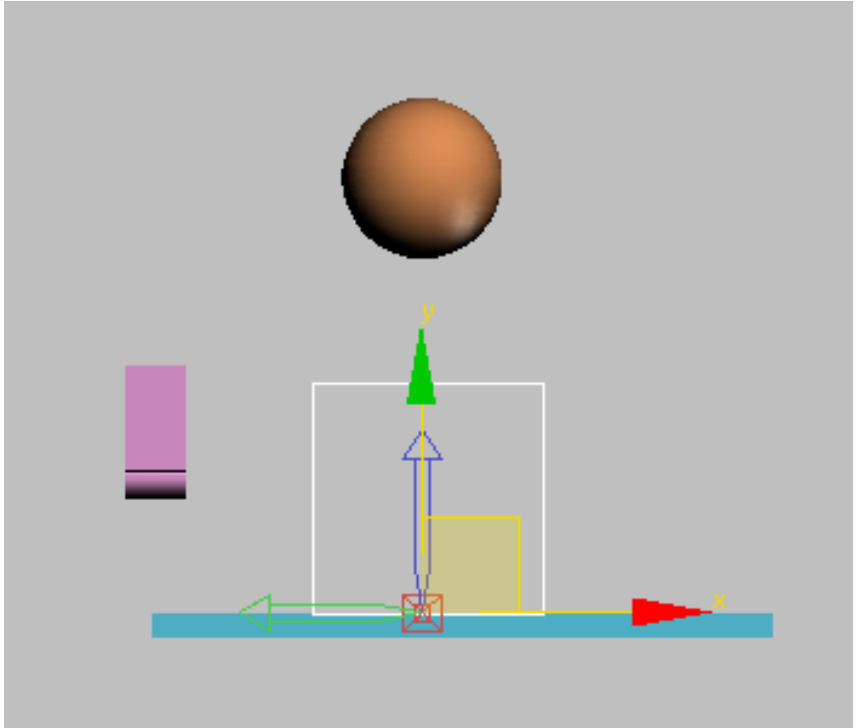
Now you can move the object to change its relationship with the pivot point.

-  10 Turn on Select And Move, and raise the dummy cube so its base is level with the pivot tripod. Use the Transform gizmo so the dummy only moves up.

You don't want to move in any other axis, since the dummy is already centered properly in the other axes.

---

**TIP** You can increase the size of the transform gizmo by pressing the = key repeatedly until the gizmo is the size you want.



= key used to grow the transform gizmo

---

**11** Turn off Affect Object Only.

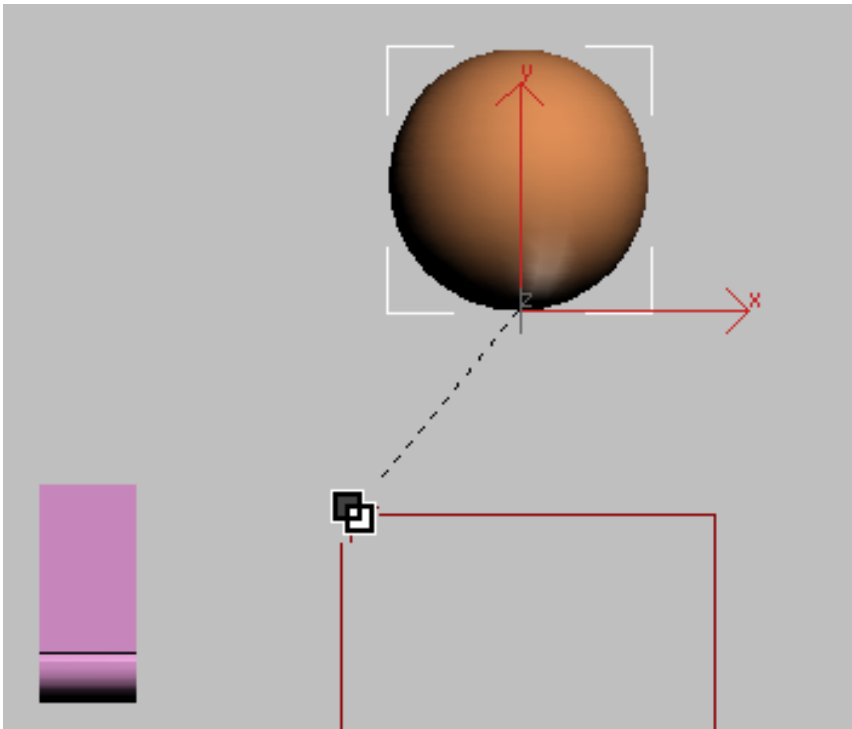
Now you will link the ball to the dummy. The dummy will become the parent to the bouncing ball.

**Link the ball to the dummy:**

**1** In the Front viewport, zoom in so you can see the dummy and the ball.



- 2 On the main toolbar, turn on Select And Link.
- 3 Move the cursor over the ball, then press and hold the mouse button. The cursor changes to two interlinked boxes.
- 4 Move the mouse to the dummy. A rubber-band line follows the cursor. When the cursor passes over the dummy, it changes again. One box is white, showing you this object (the dummy) will be the parent of the first object (the ball). When the cursor has changed, release the mouse button.



**Link the ball to the dummy**

You just linked the ball to the dummy.

You can also create linkages in Schematic View. For something this simple, it's easier to link directly in the viewport.

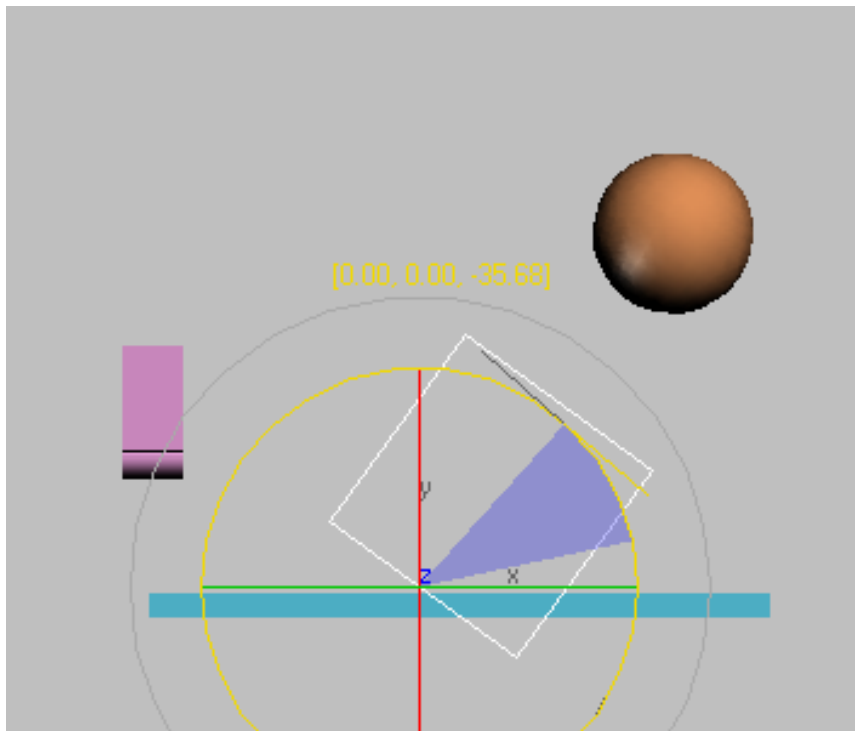


When you've created a linkage, it's a good idea to test it out to make sure that you did what you think you did.

**Verify that you've created the hierarchy:**



- 1 On the toolbar, turn on Select Object.
- 2 Press H to open the Select From Scene dialog. Choose Display > Show Children to make sure this option is active (a check should appear next to it), and then Display > Expand All.  
The *Sphere01* object should appear indented below *Dummy01* in the object list.
- 3 Test the linkage by transforming the parent object. Rotate the dummy in the viewport. The ball should rotate as well.
- 4 Undo the transform after you've tested your linkage.



Testing the linkage

Now you're ready to animate the dummy. You'll use simple Auto Key animation first, so you can understand the process.

### Animate the dummy:

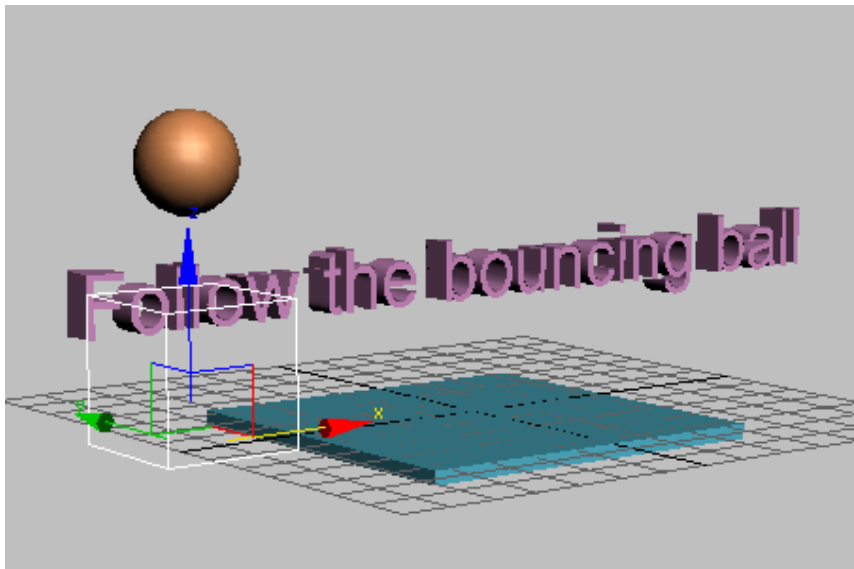
- 1 Grab the divider lines between the viewports and drag them so the perspective viewport is wide screen.

- 2  Turn on Auto Key




- 3 On the main toolbar, turn on Select And Move.

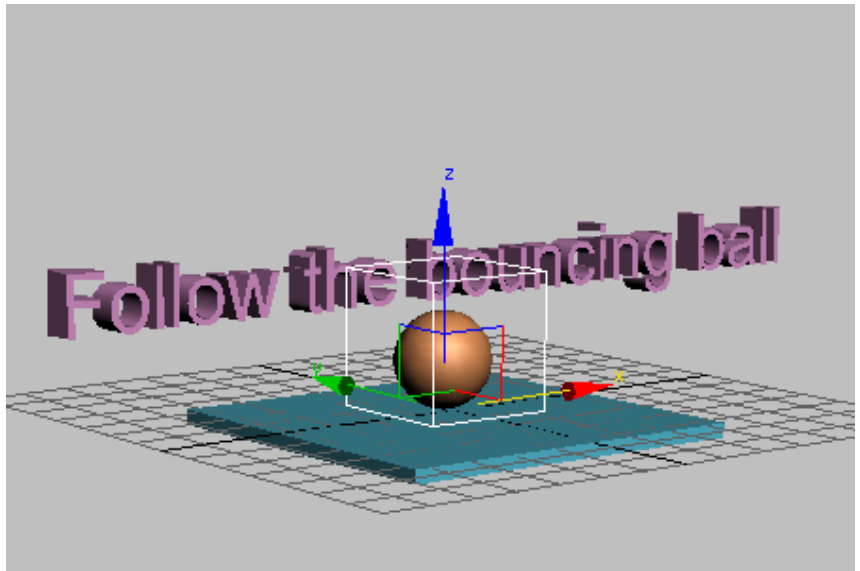
- 4 At frame 1, move the dummy so it is to the left of the box in the Perspective viewport.



Dummy at frame 1

- 5  Use the time slider to move to frame 15, or type 15 in the Go To Frame field.

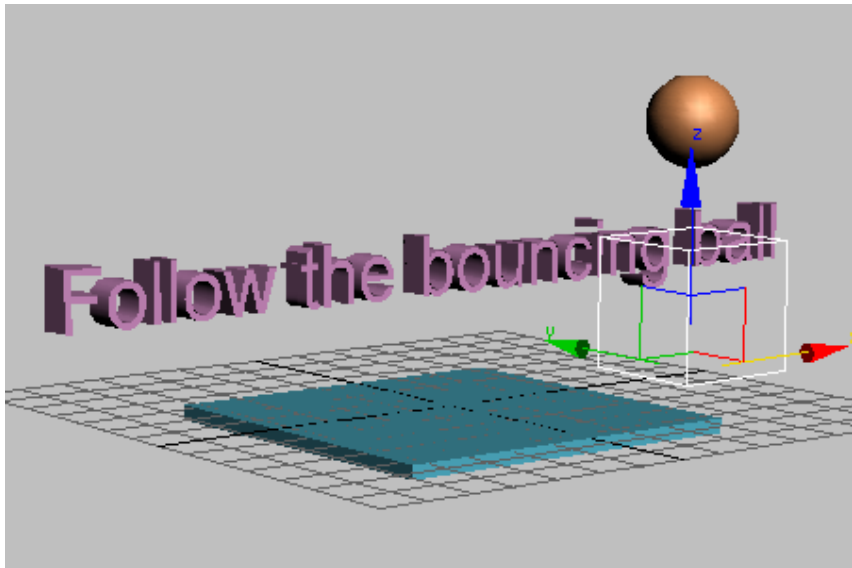
- 6 Move the dummy using the Transform gizmo so the ball is touching the box.



**Dummy at frame 15**

You just set two keys for the dummy, one at the start location at frame 1 and a second at frame 15.

- 7 Go to frame 30 and move the dummy again to the right of the box, so the ball continues to bounce away, rather than straight up in the air.



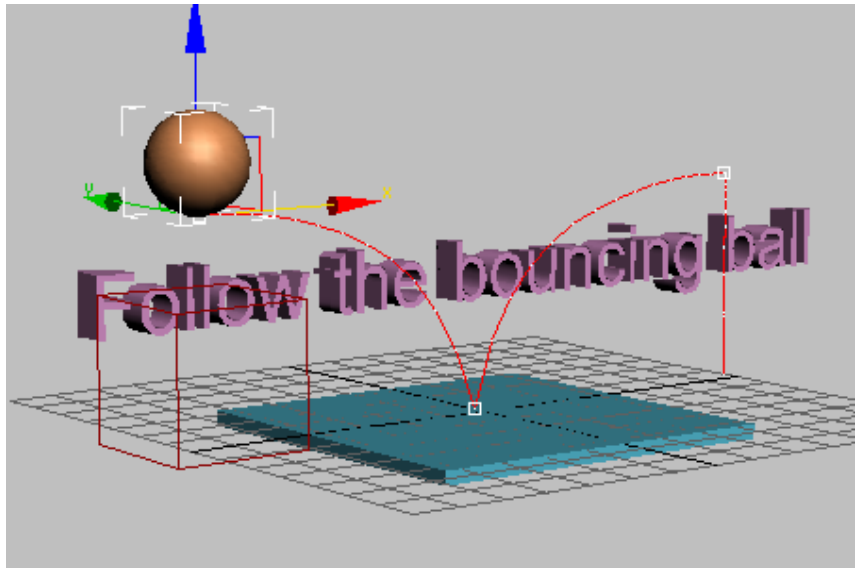
**Dummy at frame 30**

You've now set a third key at frame 30. If you play the animation, you'll see the ball bounce off the box as if it had been tossed.

You can display the trajectory of the ball to help visualize the animation. Here's how.



- 8** On the main toolbar, turn on Select Object.  
You can use any transform tool for this, but using Select Object ensures that you don't accidentally transform the object.
- 9** Select the ball, and then right-click it.
- 10** Choose Object Properties from the quad menu.
- 11** In the Object Properties dialog, in the Display Properties group, turn on Trajectory.



**Trajectory display for the ball**

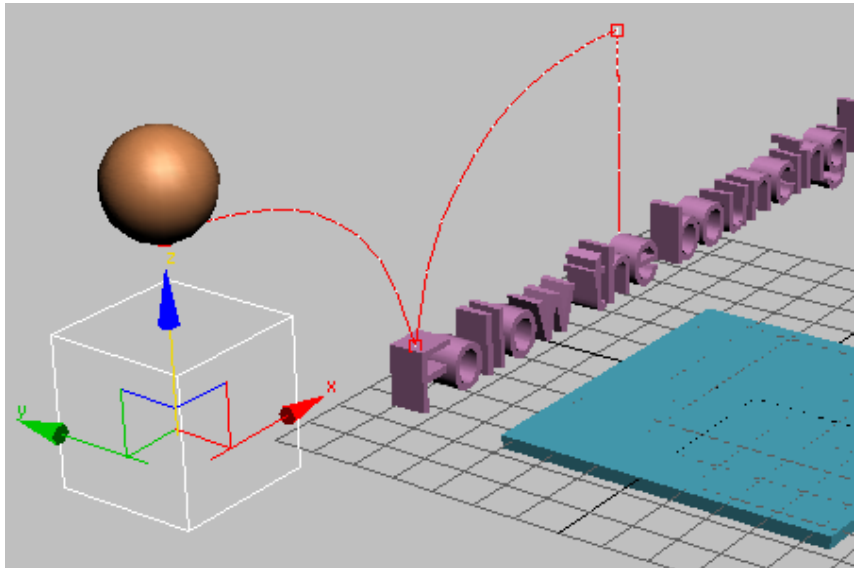
**12** Play the animation.

You see the ball bouncing onto the box and off, following the trajectory.

**Try Layout mode:**

If you turn off Auto Key and move the dummy, you will be moving the entire animation in space. When both Auto Key and Set Key are off, you are working in what is known as Layout mode. Here you will use Layout mode, so that instead of the ball bouncing on the block, the ball bounces off the letter F.

- 1 **Auto Key** Turn off Auto Key Mode.  
The red disappears in the time slider background and viewport outline.
- 2 Move the dummy object back toward the text.
- 3 Watch the position of the trajectory and move the dummy until the bounce point of the trajectory intersects the top of the letter F.




Layout Mode lets you move the animation in space.

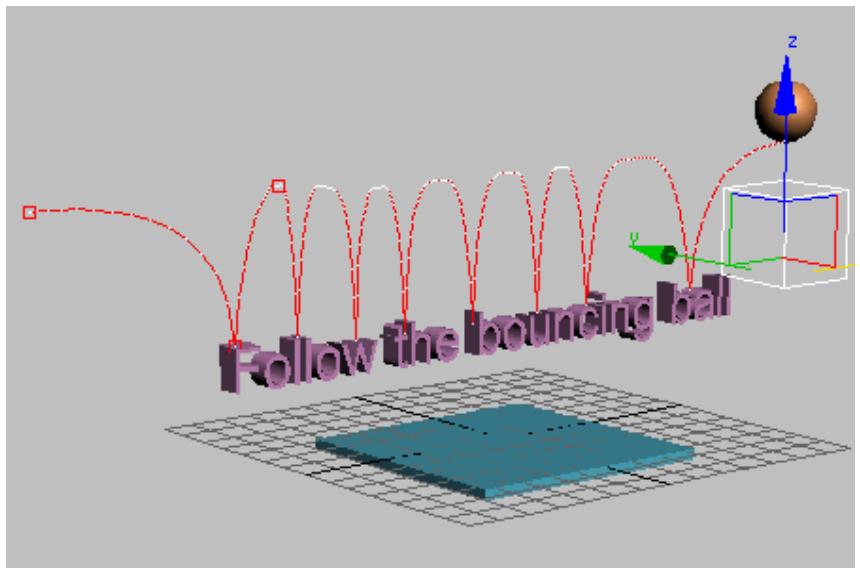
### Bounce the ball on the letters:

Now you'll repeat what you've learned to create the ball bouncing on the letters.

The ball bounces 8 times, making contact with the letters at frames 15, 45, 75, 105, 135, 165, 195, and 220.

- 1  Turn on Auto Key.
- 2 In the track bar, select the key at frame 30 and delete it.
- 3 Move the time slider to frame 45 (or enter **45** in the Current Frame field).
- 4 Position the dummy so the ball bounces on the double L's in the word "Follow".

- 5 Move the time slider, then the dummy so the ball bounces on the following letters at these frames.
- F at frame 15
  - ll at frame 45
  - w at frame 75
  - th at frame 105
  - b at frame 135
  - u at frame 165
  - c at frame 195
  - ba at frame 225





- 6 At frame 240, move the dummy so the ball move away from the letters.
- 7 Play the animation and observe the results.
- 8 Save your work as **mybounce\_text.max**. If you had any trouble, you can open the file *bounce\_text.max* to see the correct animation so far.
- Next you will learn to use a multiplier curve to affect the height of the bouncing ball.

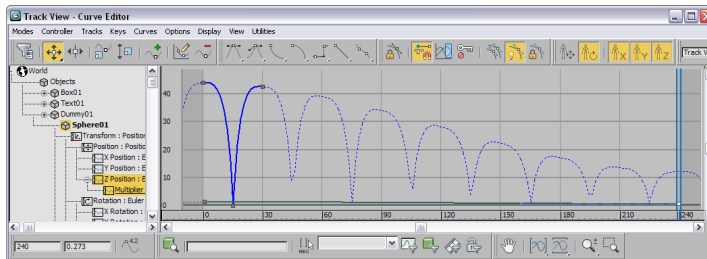
### Add a multiplier curve:

- 1 Select the ball in the viewport, right-click and choose Curve Editor. The Curve Editor window is displayed, if it wasn't already visible.
- 2 In the Controller window, click the Z Position track.
- 3 On the Curves menu, choose Apply Multiplier Curve. In the Controller window, click the plus icon. Click the Multiplier Curve to highlight it, and then hold down Ctrl and click the Z Position track. This way you have only these two curves displayed.

In the Controller window, the Multiplier curve is added beneath the Z position track. It's not very noticeable in the Keys window on the right. The scaling of the multiplier track is quite small, so the slightest change to a key could result in a large change in the animation. You can counteract this by zooming in on the multiplier track.

- 4  On the Navigation: Track View toolbar (at the lower right of the Keys window), click the Zoom Region button. Drag a zoom region window around the key at frame 240 on the multiplier track.
- 5 On the Options menu, turn on Interactive Update.

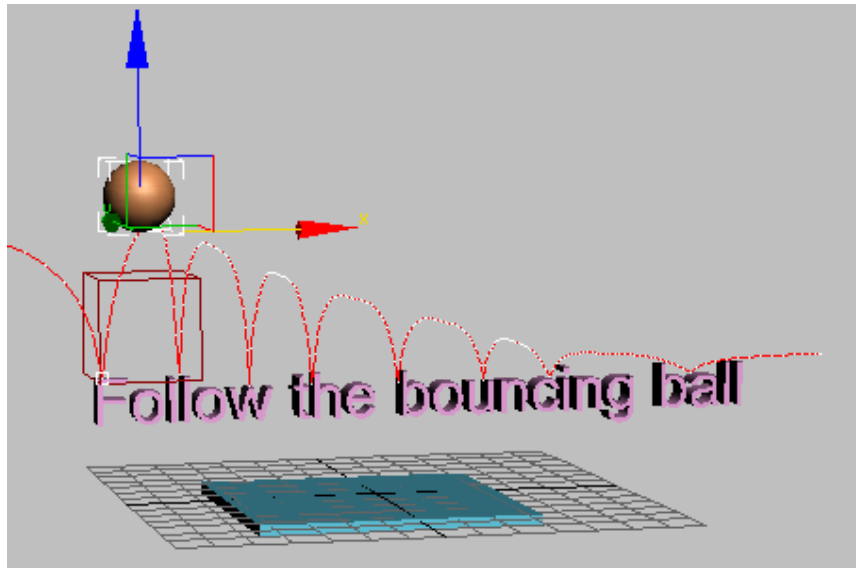
- 6  On the Track View toolbar click Move Keys to turn it on, then move the multiplier key downward, while observing the effect on the trajectory in the Perspective viewport.



Lowering the multiplier curve shows effect on Z position curve in Keys window

Don't move it below the horizontal zero value, or you will get some strange effects.






Multiplier curve shown on trajectory

---

**TIP** You can type in precision values on the Key Stats: Track View toolbar.

---

While working with Multiplier curves, if you're not sure you like the results, you can just turn them off. Select the Multiplier curve in the Controller window, then on the Curves menu choose On/Off.

- 7  Click Zoom Horizontal Extents on in the Navigation toolbar to see the entire curve again.

## Using the Dope Sheet Editor

Track View also has a mode called Dope Sheet, which lets you work with keys and ranges. In this lesson, you'll use the range function to make your animation go faster. You'll also use the Time tools to reverse your animation.

### Speed up the animation:

The bouncing ball doesn't have enough pep. To speed up the animation, you'll use Edit Ranges in Dope Sheet mode.

- 1 Continue from before or open *bounce\_multiplied.max*.
- 2 Select the dummy object in the viewport. Then, on the Graph Editors menu, choose Track View — Dope Sheet.



- 3 On the Keys: Dope Sheet toolbar, click Edit Ranges. By default, the Keys: Dope Sheet toolbar is on the top left.

The Keys window now displays the ranges for the animation.

- 4 In the Controller window, highlight the item label *Dummy01*. This way you will adjust the ranges of all the dummy's tracks at the same time.

Before making changes to the dummy, you want to make sure that you also are making changes to the bouncing ball as well. Since the bouncing ball is the child of the dummy, you'll use the Modify Child Keys button.



- 5 On the Display: Dope Sheet toolbar, click Modify Child Keys to turn it on.

Now the changes you make to the dummy range will also be applied to the bouncing ball.

- 6 Click the end of the Dummy range and drag it to the left to around frame 100.



Range bars used to speed up the animation

This compresses the animation for the dummy and the bouncing ball so it happens within 100 frames.

---

**TIP** You can raise the time ruler up from the bottom of the Keys window for greater precision.

---

**7** Play the animation.

The animation plays faster. The ball continues bouncing at the end of the animation. There are several different ways you could correct this. You could try to use an ease curve to stop the animation, or create keys from the out-of-range curve, and then delete the keys. Or you can set the active time segment to 100 frames.



**8** Click the Time Configuration button beneath the animation playback controls.

**9** Change the Animation End time to **100**.

**Reverse time:**

You can reverse the animation by using the Time tools available in Dope Sheet mode. It's easy to do.



**1** On the Keys Dope Sheet toolbar, click Edit Keys.

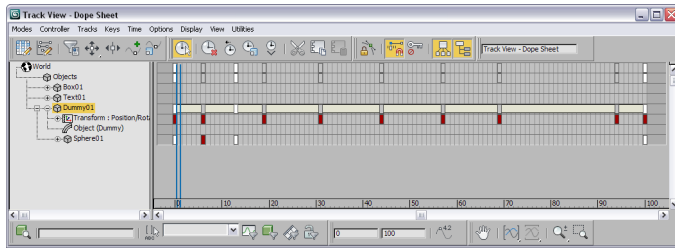
The range bars are replaced with keys.

**2** On the Time menu, choose Select.

When working with Time commands, you first select the time, then make changes to it.

**3** In the Keys window, on the Dummy track, drag from frame 1 to frame 100 to select the time.

The time is displayed as a light yellow band in the Dummy track.



Time displayed as light yellow band

#### 4 On the Time menu, choose Reverse

The animation plays backwards. The ball bounces from right to left instead of left to right, and the last bounce now happens on the letter F instead of the double L in ball.

---

**TIP** You can easily reverse the playback of an animation using controls found in the Time Configuration menu. But if you need to reverse the keys themselves, this is the technique to use.

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### Summary

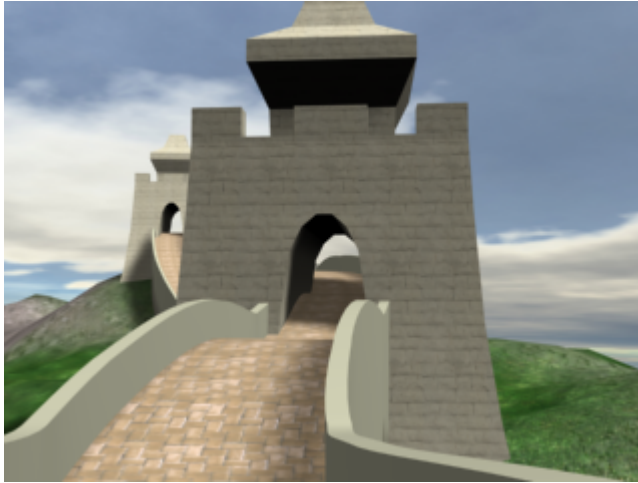
These Animation tutorials introduced you to the techniques of creating animation. You learned how to animate a bouncing ball using the Auto Key button and transforms, how to control in-betweens using key interpolation and ghosting, and how to loop animation using Track View controls. Finally, you've learned about animating with dummy objects, using the Dope Sheet editor and weighted list controllers.

## Working with the Walkthrough Assistant

Instead of manually manipulating the camera, you can make animating much easier by using the Walkthrough Assistant. The Walkthrough Assistant allows you to “fly” your camera to explore your virtual designs. Although the tool's name implies interior usage, the Walkthrough Assistant is actually suitable for both interior and exterior scenes.

In essence, it simplifies the tasks of creating a camera, constraining that camera to a path of your choice, and then makes it easy to edit and animate various aspects of the camera such as tilt, pan and lens values. All manipulation is

centralized in the same dialog so you do not have to browse through various panels to make changes to camera parameters.



In this tutorial, you will learn how to:

- Create a target camera
- Adjust camera head tilt and angle
- Use Set Key to animate a camera
- Render an animation to a sequence of still image files
- Create a movie file of your animation


Skill level: Beginner

Time to complete: 1+ hours (includes rendering time to create an animation)

## Camera Setup with Walkthrough Assistant

In this lesson you'll use the Walkthrough Assistant to animate a camera, simulating a walk or run along the Great Wall of China. The scene contains a camera path ready for constraining the camera, but you will first need to create a sufficient number of frames to hold your animation.

### Prepare the scene:

-  On the Quick Access toolbar, click the Open File button, navigate to the `\scenes\animation\walkthrough_asst\` folder, and open `great_wall_start.max`.


---

**TIP** If the Units Mismatch dialog displays, choose Adopt The File's Unit Scale and then click OK.

---

### Calculate the number of frames:


- 1 In the right viewport, select the blue spline that represents the camera path. Alternatively, press H to open the Select Objects dialog, and double-click Camera Path.

- 2  On the Utility panel, click the Measure tool.  
This tool reports the length of the camera path is roughly 900 feet.

---

**NOTE** For a comfortable walking pace, which is useful in architectural walkthroughs, you'll need about a second for every 3 feet of distance. For a jog or a fast run, you can go as far as 9 feet for a second. In NTSC format, that translates into 30 frames for every 9 feet of distance traveled, or 3000 frames for 900 feet.

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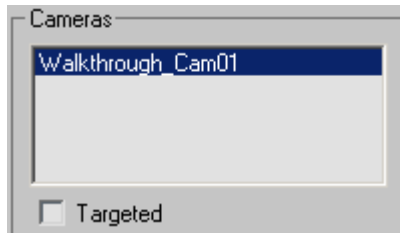
- 3  Click the Time configuration button next to the Current Frame Field.
- 4 In the Animation group in the Time Configuration dialog, change End Time to **3000** to increase the number for frames in the animation, and then click OK.  
This will provide sufficient frames for your walkthrough animation.  
The time slider frame indicator now displays 3000 frames.

### Creating a basic setup using Walkthrough Assistant:

- 1 From the Animation menu, choose Walkthrough Assistant.  
A modeless dialog displays.

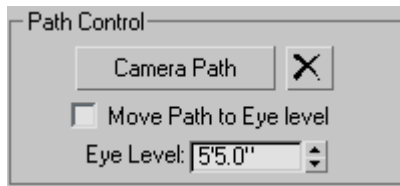
- 2 In the Camera Creation group in the Main Controls rollout, ensure the Free Camera option is chosen, and then click Create New Camera.

A new camera is created in the scene. The camera name, *Walkthrough\_Cam01*, displays in the Cameras group.



- 3 In the Path Control group, click Pick Path and then in the Right viewport click the blue spline named *Camera Path*.

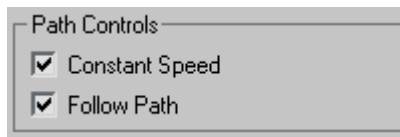
The Pick Path label changes to reflect the name of the selected spline. This constrains the Camera Position to the path. It also aligns it to follow the direction of the path.



---

**NOTE** By default, the camera will travel at a constant speed and will always point in the direction of travel. This is shown in the Advanced Controls rollout at the bottom of the dialog where both these options are enabled.

---



- 4 Right-click the lower-right Perspective viewport to activate it. In the Main Controls rollout, click the Set Viewport To Camera button to switch the viewport to the Camera view.

- 5  Click the Play Animation button to view the results in the Camera view.

The camera travels along the path but the motion seems unnatural, almost robotic. This is because the aim or target of the camera is controlled by the path constraint. It is far better to control the target manually, and choose the direction you want to look at any given time. As an analogy, as you walk in a straight line down a museum hallway, you would turn your head to look at the paintings on the wall instead of keeping your head pointed in the direction of your feet as you walk.

In the next lesson, you learn how to animate the camera using the Walkthrough Assistant.

## Animating Camera Rotation

Now that the camera is constrained to the path, you'll animate the camera rotation so that it is aimed in a more natural position at points of interest in the scene.

### Set up the lesson:

- Continue from the previous lesson or open the scene file *great\_wall\_head.max*.

---

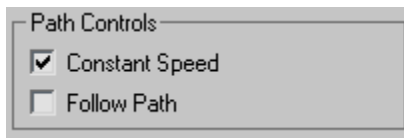
**TIP** If the Units Mismatch dialog displays, choose Adopt The File's Unit Scale and then click OK.

This is the same scene from the previous lesson. The camera is now in place but you will use Walkthrough Assistant to animate the Turn Head parameters.

---

### Turning off Follow Path:

- 1 If the Walkthrough Assistant dialog is not visible, go to the Animation menu and choose Walkthrough Assistant.
- 2 In the Advanced Controls rollout, in the Path Controls group, disable the Follow Path option. You will not need it because you will control the head rotation manually.



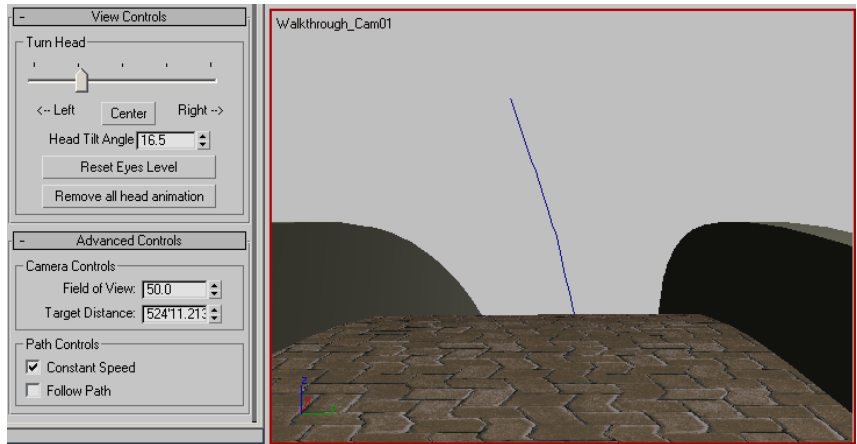


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**NOTE** Disabling the Follow Path option resets the camera orientation to its default value (positive Y). You will fix that as you start animating the head rotation from the Walkthrough Assistant dialog.

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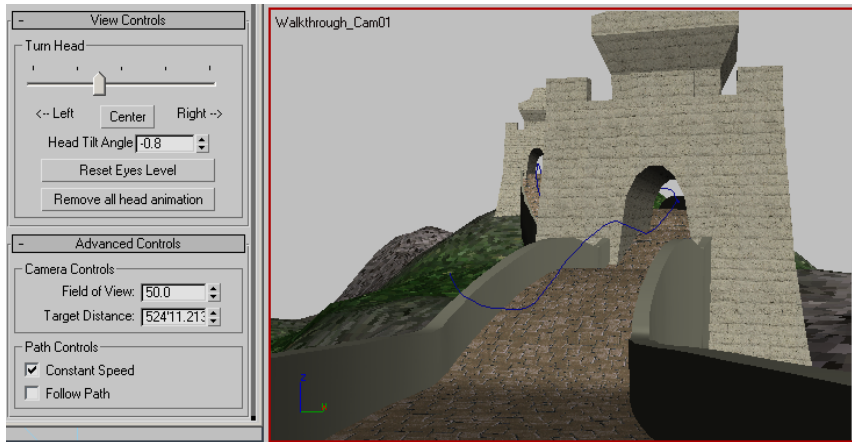
- 3 **Auto Key** Make sure you are at frame 1, then turn on the Auto Key button.
- 4 In the View Controls rollout, move the turn head slider to the left and adjust the Head Tilt Angle to **16.4** in order get a better viewing angle of the brick path in the Camera viewport.



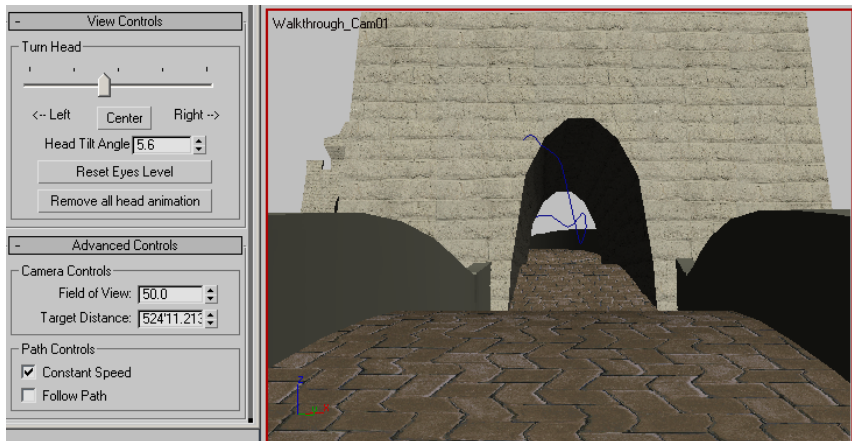
- 5 Scrub the time slider to frame 206. You are now at the other side of the hilltop. Adjust the Head Tilt Angle to approximately **-3.3** to level the camera head, then slide the Turn Head slider to the left to adjust the rotation.

The goal is to adjust the camera head rotation so that it looks towards the tower as if it has suddenly caught your attention.

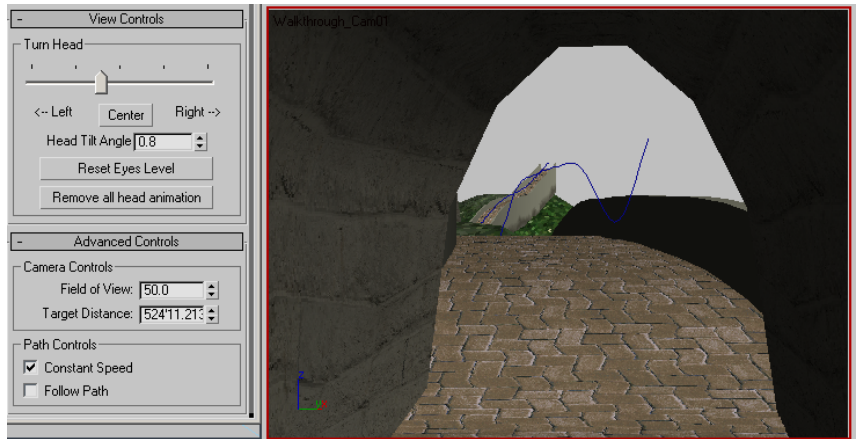
- 6 Scrub the time slider ahead to frame 408. Adjust the Head Tilt Angle to **-13.5** so that you are looking at the pavers in front of you.  
Although it's nice to look at the scenery, it's also important to create a walkthrough that "feels" comfortable; in other words, to make it so that the viewer doesn't feel off balance while doing the a virtual walkthrough of your scene.
- 7 Scrub the time slider to frame 615. Change the Head Tilt Angle to **-0.8** and turn the Turn Head slider a little to the right until the camera is looking at the tower again.



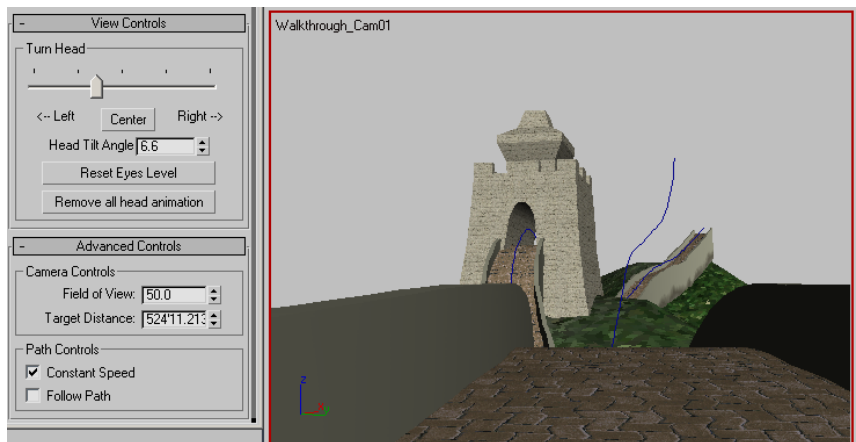
- 8 Scrub the time slider to frame 800. Change the Head Tilt Angle to about **5.6**. Move the Turn Head slider to the right until the tower opening is centered in the camera view.



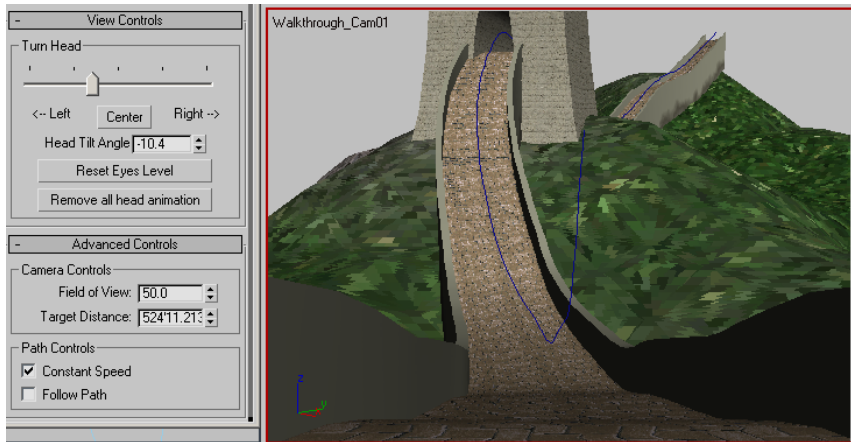
- 9 Scrub the time slider to frame 1050. Change the Head Tilt Angle to about **-0.8**. Move the Turn Head slider a little to the left so that the camera is tilted in anticipation of turning left after exiting the tower.



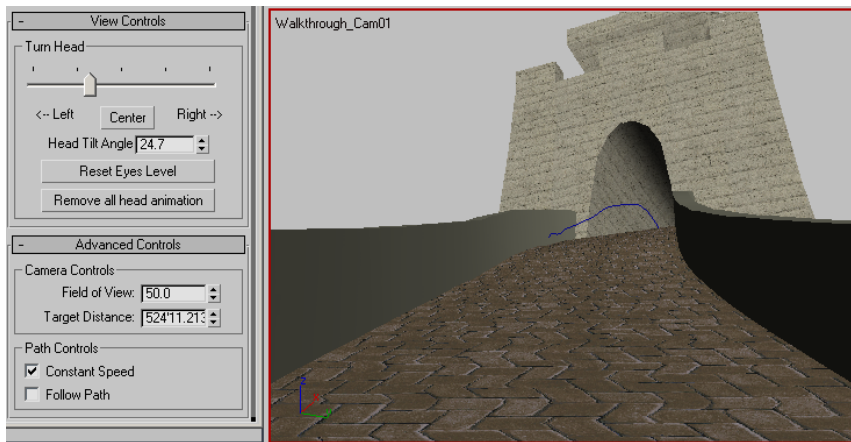
- 10 Scrub the time slider to frame 1150. Change the Head Tilt Angle to about **6.6**. Move the Turn Head slider slightly to the left so that you're looking the second tower in the distance.



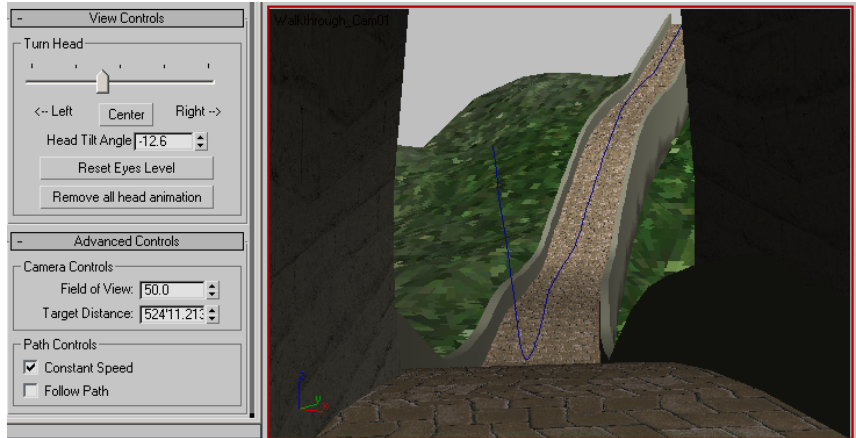
- 11 Scrub the time slider to frame 1280. This time change the Head Tilt Angle to about **-10.4** so that the camera head is tilted downwards to match the path's slope.



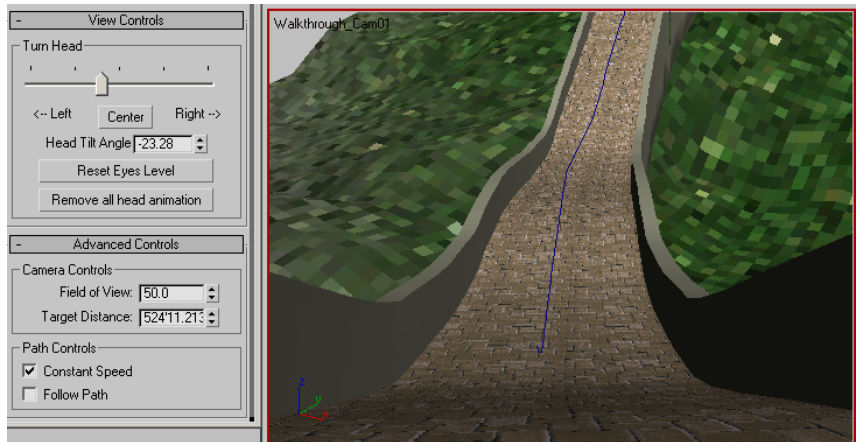
- 12 Scrub the time slider to frame 1420. Change the Head Tilt Angle to about **-11.9** to tilt the camera head further down.
- 13 Scrub the time slider to frame 1680. You're now looking up again towards the tower ahead of you. Adjust the Head Tilt Angle to about **24.7**. Slide the Turn Head slider a little to the left so that is aimed at the second tower.



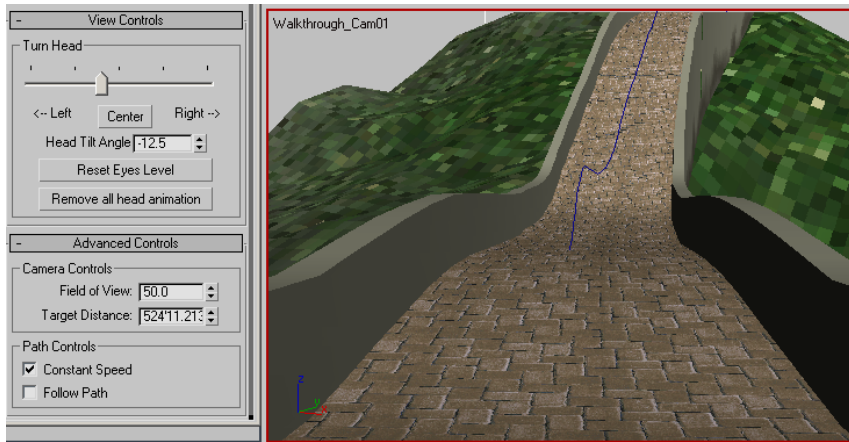
- 14 Scrub the time slider to frame 1860. Change the Head Tilt Angle to about **29.4**. Move the Turn Head slider slightly to the right so until you're looking at the second tower opening.
- 15 Scrub the time slider to frame 2030. Change the Head Tilt Angle to about **-12.6**.



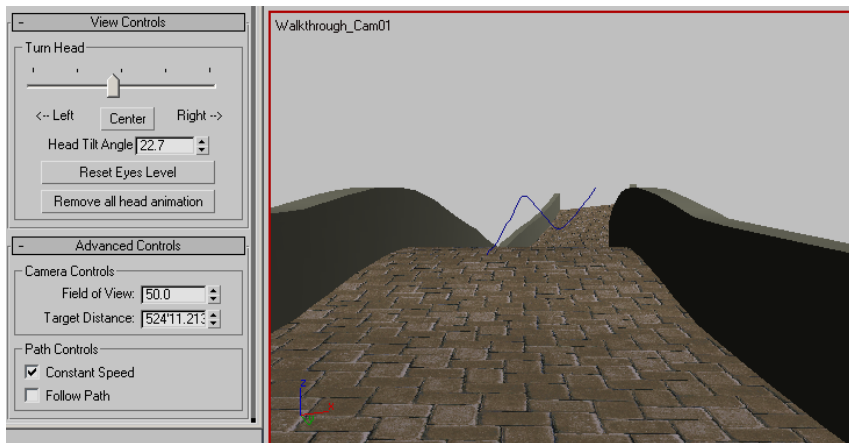
- 16 Scrub the time slider to frame 2125. At this point in the walkthrough, you are going down the hill again. Change the Head Tilt Angle to about **-23.3**. You want the camera head tilted downwards toward the path instead of the scenery because you want to feel as if you're watching your step.



- 17 Scrub the time slider to frame 2250. You are still looking at the path in front of you. Change the Head Tilt Angle to about **-12.5**. Adjust the Head turn and tilt to that purpose.



- 18** Scrub the time slider to frame 2550. You are now going up the path. Change the Head Tilt Angle to about **22.7**, and move the Turn Head slider slightly to the right so that you're looking towards the end of the pathway.



- 19** Turn off Auto Key mode.
- 20** Play the animation in the camera view to see the results. Notice that the camera motion is far more natural than it was in the previous lesson.

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**NOTE** The camera path will not be visible when rendered.

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- 21** Save your file as **great\_wall\_finish.max**.

## Summary

In this lesson, you have created a camera walkthrough animation using the Walkthrough Assistant. You have learned to calculate the number of frames needed for the animation and you have learned to automate the creation of the camera and how to constrain it to a path. Finally, you have learned how to manually animate the head turn and tilt of the camera to create realistic camera motion.

# Rendering Your Walkthrough Animation

There are some specific techniques to learn for rendering your animation into a movie file. You can render directly to a movie format such as AVI, or you can render a sequence of still image files to file formats such as TGA and then use the RAM Player to save them into a movie. The latter method is the recommended choice. It requires doing a few more steps than rendering directly to a movie format, but it gives you more control over the file size and quality of the output. In addition, if you have frames that artifacts or other errors, you can repair or remove them.

The next lesson will take some time to render. Depending on the speed of your computer, the rendering may take a few minutes to several hours.

### Set up the lesson:

- Open the scene file *great\_wall\_render.max*.

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**TIP** If the Units Mismatch dialog displays, choose Adopt The File's Unit Scale and then click OK.

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This file is similar to the one created in the previous lesson. A bobbing motion has been added to the camera to simulate the up-and-down effect of someone jogging along the path. Two omni lights have been added to create additional lighting but there are no settings for Global Illumination in order to decrease rendering time.

### Rendering an image sequence:

- 1 If the Camera viewport isn't active, right-click in it to activate it.



- 2 From the Rendering menu, choose Render Setup.

Next, you'll define the animation range and output size.

- 3 On the Common tab of the Render Setup dialog, in the Time Output group, choose Range. Set the range of frames from **1** to **3000**.
- 4 In the Output Size group, change the output resolution to 320x240.
- 5 In the Render Output group, click the Files button.  
The Render Output File dialog opens.
- 6 Navigate to a directory where there is enough disk space to save the rendered files. You can use the Create New Folder button to establish a new location, if necessary.  
Next you'll define the type of still image file to render.
- 7 In the Save As Type field, click the drop-down arrow and choose JPEG File (\*.jpg).

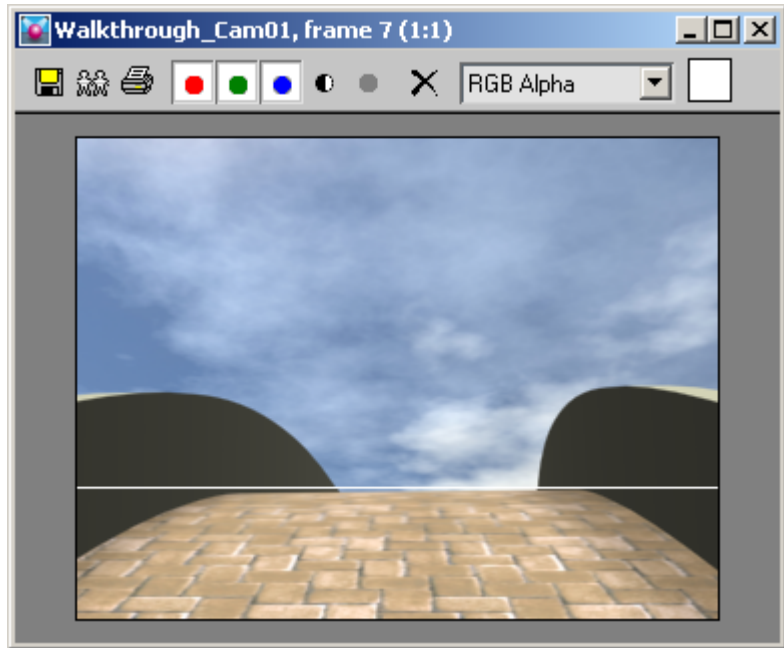
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**NOTE** In a production environment, you may want to use a high-quality, lossless format such as TGA or TIF, but for the purposes of this tutorial, you will use the JPG format to keep the size of the output files small.

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- 8 In the File name field, type **my\_jog.jpg**, then click Save.  
After you click Save, a format-specific dialog asks you to specify attribute and information settings. Accept the default values, and then click OK.  
When you render a still-image sequence, as in this case, the software automatically appends the first part of the file name with a four-digit frame number. So the first frame will be *my\_jog0000.jpg*, the second is named *my\_jog0001.jpg*, and so on.
- 9 Make sure Save File is turned on in the Render Output group. Also check that the Viewport field at the bottom of the Render Scene dialog is set to Walkthrough\_Cam01 (not Top, Front, or Left), then click Render.





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**NOTE** A sky background is rendered. The dome representing the sky is an object that is hidden in the scene. However, the renderer is set to take hidden geometry into account.

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- 10 The Rendering Progress dialog displays. Wait for a short while as the first frame is rendered. You will see the Last Frame Time, Elapsed Time, and Time Remaining values change after the first frame finishes.

Allow at least four frames to render.

At this point, you can work on something else while your animation is rendered.

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**TIP** You can also watch the rendering for errors or observe to see where you want to make changes. This is generally a good practice so that you can study the scene as it is rendered.

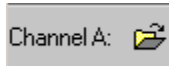
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After the rendering has completed, you will have 3000 JPG files in the folder you specified.

## Convert an image sequence into a movie:

The RAM Player loads still image sequences into memory and plays them so you can watch them as a movie. It actually lets you load two different sequences and then compare them visually, but you won't use that functionality here. You'll simply use the RAM Player to save the files into an AVI file.

- 1 From the Rendering menu, choose RAM Player.



- 2 On the RAM Player toolbar, click Open Channel A.
- 3 In the Open File Channel A dialog, navigate to the sequence of JPG image files. Highlight the name of the first file in the sequence and then ensure the Sequence option is turned on. Click Open.

The RAM Player will now load the image files in sequential order starting with the first file you selected. The Image File List dialog appears. Here you can use the Every Nth and Multiplier fields if you need to speed up or slow down your animation. If your animation is too slow, change Every Nth to 2 or 3. If your animation is too fast, increase the Multiplier.

- 4 Click OK.

The RAM Player Configuration dialog appears. Here you can observe and adjust your memory usage. There are also tools here to resize your animation, specify a range of frames to use, and split the alpha (transparency) information into a separate file.

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**NOTE** In order to use transparency, the image file specified has to be able to process an alpha channel. JPG files do not contain any transparency information the way TGA, TIF and PNG images often do.

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- 5 Increase the Memory Usage to its maximum for your system, and then click OK

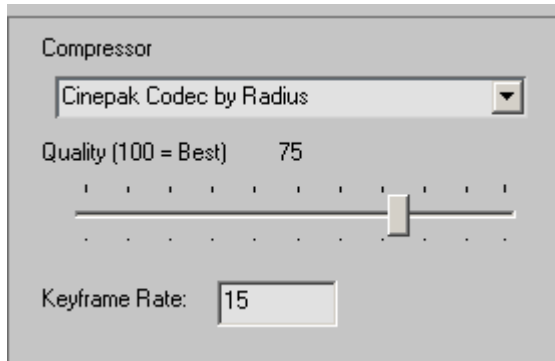
The RAM Player loads the rendered files into memory. In the Loading dialog, observe how much memory is being used and remains available.

If it looks like you are about to run out memory, click Stop Loading. If you have a low-memory system, reduce the number of frames to load and try again.



- 6 On the RAM Player toolbar, click the Play button and watch the movie play.

- 7  On the RAM Player toolbar, click the Save Channel A button. The Save File dialog appears.
- 8 Choose AVI as the file type, and name the animation **my\_jog.avi**. Click Save.  
The AVI File Compression Setup dialog appears. Here you can choose a codec (compression/decompression type) and adjust the quality of the file. Choose the default Cinepak Codec. To reduce file size, lower the quality to 75%.



- 9 Click OK to continue.

## Summary

You have learned how to render your animation to a sequence of still image files. This allows you better control for later correction of your animation. You also learned how to assemble a still image sequence into a movie file, such as AVI or QuickTime using the RAM Player.