Tutorials: Hair & Cloth

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Hair and Cloth Tutorials



The following tutorials explain how to use Hair and Cloth on your models to accomplish specific results. The Hair tutorials show you how to apply different types of hair and fur, while the Cloth tutorials demonstrate the basic workflow to create pieces of clothing, then explain how to tailor them to your model.

Features Covered in This Section

- Adding the Hair and Fur modifier.
- Using a sub-object level to control hair placement.
- Modifying hair settings, including material properties.
- Rendering hair.
- Using the Garment Maker.
- Applying the Cloth modifier.
- Locking points on the cloth.
- Adding space warps and collision objects to the cloth.
- Running a Cloth simulation.
- Adjusting fabric properties.

Hair

The tutorials included in this section walk you through a variety of methods for using Hair.



Features Covered in This Section

- Adding the Hair And Fur modifier.
- Using a sub-object level to control hair placement.
- Modifying hair settings, including material properties.
- Rendering hair.

Creating a Centurion Helmet

In this tutorial, you will use the Hair And Fur modifier to grow hair onto selected objects. You will then learn how to define hair properties, such as thickness and frizz levels, then render the result.



In this tutorial, you will learn how to:

- Use the Hair And Fur modifier.
- Adjust hair properties.
- Use spline objects to comb the hair.
- Apply hair presets to objects.
- Style hair using a brush gizmo.

Skill level: Intermediate

Time to complete: 45 minutes

Adding Hair to the Helmet

Add the Hair And Fur modifier to the helmet:

- 1 Con the Quick Access toolbar, click the Open File button and open *helmet_hair_start.max* from your *dynamics_and_effects**hair_and_cloth**hair* folder. This scene contains two mesh objects named *Head* and *Helmet*.
- **2** Select the *Helmet* object, and then go to the Modify panel and apply the Hair And Fur modifier. Hair And Fur is a world-space modifier (WSM).



Hair emanates from the entire helmet.

3 The hair should grow only on selected portions of the helmet, so on the Selection rollout, click Polygon to go to the Polygon sub-object level.

- **4** Turn on Ignore Backfacing.
- **5** Select the polygons in the groove at the top of the helmet.

This step is easiest to do in the Top viewport: click the Back face of the ViewCube and make sure that you have selected all these polygons. Clcik the Top face of the ViewCube to restore the original Top view.



Selecting the crest polygons

TIP You can use Ctrl+click (or drag) to add or remove polygons from the selection, and Alt+click (or drag) to remove them.

6 Update Selection On the Selection rollout, click Update Selection.

The hairs now emanate only from the selected polygons.



Hairs growing from the crest only.

Modify the Hair general parameters:

1 Scroll down to the General Parameters rollout.



- 2 Change the hair count to **10000**.
- **3** Reduce Hair Segments to **4**. This value is the number of segments created along the length of each hair. Shorter hair needs fewer segments; longer hair needs more segments. Lowering the number of segments also reduces the amount of time it takes to render the scene.
- 4 Change the Rand(om) Scale value to 0.0.For this example, the helmet hair is all the same length, without any random scaling.
- **5** Set the Root Thick and Tip Thick values both to **2.0** so that the hairs are the same thickness along their entire length.

Next you will change the frizz and material properties of the hair.

Modify the Frizz and Material Properties of the helmet crest:

1 Open the Frizz Parameters rollout.

- Frizz Parameters
Frizz Root 15.5 • Frizz Tip 130.0 • Frizz X Freq. 14.0 • Frizz Y Freq. 14.0 • Frizz Z Freq. 14.0 • Frizz Anim. 0.0 •
Anim. Speed (0.0

- Set the Frizz Root and Frizz Tip values to **10.0**.
- Open the Material Parameters rollout.



- **4** Select a bright, saturated red for the Tip Color and black for the Root color.
- **5** Reduce both Hue Variation and Value Variation to **5.0**.

Because this hair is dyed, its color and texture are more uniform than natural hair. We want to add a bit of variety, but not much.

6 Leave the Mutant % value at **0.0**.

Mutant hairs are randomly selected and receive the color assigned. Mutant hairs are present in natural hair; as we age, we have more and more mutant gray or white hairs. However, the foot soldier's helmet plume

will not age (it is made of dyed horsehair), so you will leave the mutant hairs out for now.

Render your scene to view the hair:

The Hair And Fur modifier requires at least one spotlight in the scene to render shadows.

1 From the right-click quad menu, choose Unhide All to unhide the lights in the scene.

Two omni lights for general lighting and one spotlight for the Hair And Fur modifier appear. The spotlight is set to render shadows.

A Hair And Fur render effect is necessary to render hair, but this is added automatically when you first apply the Hair And Fur modifier to an object in the scene. Also, by default the render effect is automatically set to use all spotlights in the scene to illuminate the hair, so no further lighting adjustment is required.

You can now render your scene.

2 With the Perspective viewport active, render your scene (press F9).

NOTE You can render hair only in a Perspective or Camera viewport.

Your centurion helmet should look something like this:



Rendered image of the helmet

Recombing the Helmet Crest of Hair

In this lesson you'll learn how to style the hair using the Recomb From Splines tool.

1 Continue from the previous lesson or open *recomb_helmet.max*.



On the main toolbar, right-click the Snaps Toggle button so that the splines begin at the roots of the hair.

3 Right-click the Snaps Toggle button to open the Grid And Snaps Settings dialog, and on the Snaps panel, turn off Grid Points and turn on Face.

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+ [Vertex		Endpoint	
	Edge/Segment		Midpoint	
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Clear All				

- **4** Go to the Create > Shapes panel and choose Splines > Line. On the Creation Method rollout, make sure the Initial Type and Drag Type are both set to Smooth.
- **5** In the Left viewport, starting at the front of the helmet, draw Line splines away from the head as illustrated below. Hair requires that all the splines are part of the same object, so after you draw the first spline, turn off the Start New Shape check box on the Object Type rollout.



Spline object to use for recombing

- **6** Select the Line object to make sure all the splines are part of the same object. If they are not, select the first line, go to the Modify panel, and at the Spline sub-object level, use Attach to attach the other lines.
- 7 Select the Helmet object, and on the Tools rollout, click Recomb From Splines. In a viewport, click the spline object.



The hair now follows the shape of the splines.

■ Render the Perspective viewport to view the new hair.



Hair recombed by splines

Adding Facial Hair to the Centurion

Now that you have the helmet ready to go, you'll add hair to the centurion's face.

- 1 Continue from the previous lesson, or open the file *recomb_helmet_splines.max*.
- **2** Apply the Hair And Fur modifier to the head.
- **3** Go to the Polygon sub-object level. Make sure Ignore Backfacing is turned on, and select the polygons at the base of the chin.

The Orbit tool can help you locate the polygons you need. Once you've made the sub-object selection, Shift+Z will undo the viewport changes.

4 Click Update Selection.



Hair as a goatee, with chin polygons selected

Use preset hair values:

1 On the Tools rollout, click Load in the Presets group.



The Hair And Fur Presets dialog appears.



- **2** Double-click the "clumpy-wet-brown" preset to apply it to the polygons.
- **3** Adjust the Perspective viewport so it shows a better view of the chin, and then render it.

You now have fine, spiky hair growing from the chin.



The goatee before styling

Style the goatee:

1 Open the Styling rollout and click Style Hair to turn it on.

A green brush gizmo appears in the viewports. In the active viewport, the brush appears as a circle, but it is actually a cylindrical region, as you can see in inactive viewports.

Orange guide hairs also appear in the viewports, among the actual hairs. When you style hair, you are styling the guides. There are fewer guides than hairs, so this method saves performance time.

TIP If you turn off Toggle Hair in the Styling rollout's Utilities group, the Guides can be easier to see in the viewports.

2 Make sure that the brush is large enough to encompass the goatee. If you need to change its size, you can use the slider in the Styling group (below

the Ignore Back Hairs toggle), or you can hold down Shift+Ctrl and drag the mouse.

Click the Translate button to turn it on, position it over the goatee, and drag to straighten the hairs so they point away from the chin.
The Front and Left viewports are the easiest to use for this adjustment.



Goatee translated downward and away from the chin

- 4 Click the Clump button to turn it on. In the Front viewport, place the brush over the goatee and then drag toward the right to move the guide hairs together until they come to a point (see the following illustration).
- 5 If required, repeat the two preceding steps until you get a result you like.
- **6** When you are happy with the results, render the Perspective viewport.



The goatee after translating and clumping

The hair still frizzes out a bit too much at the tips.

Fix the frizz value:

■ Go back and change the Frizz Tip value to **0.0**. Render the scene again to view the changes.



The goatee with tip frizz removed

Summary

This tutorial demonstrated how to apply Hair to a model, and showed you a few ways in which you can style hair.

Styling Hair with a Spline Emitter

Some hairstyles, particularly longer ones, lend themselves more naturally to spline interpolation than surface growth. Spline-based hair gives you explicit control inside 3ds Max over a finite set of guide hairs. When you create hair with a spline object as the growth source, Hair creates a guide from each spline in the object. It then uses these guides as cross-sections to create hair growth. Essentially, you're creating a three-dimensional "sheet" of hair in the shape of the spline cross-sections.



For success with spline-based hair, keep in mind these important requirements

- Hair growth is interpolated between each pair of successive splines. The best way to ensure that splines are in the proper order is to create the splines that serve as the hair outline as separate objects, and then attach them all together in the correct order.
- Interpolation between pairs of splines is linear, so use as many splines necessary to create a rounded look for your hair.
- The first vertex in each spline serves as the hair root, so when you create the splines, start at the base of each hair.

In this tutorial, you'll create two different spline objects, both comprising a number of Line splines, to create a woman's hairdo. The hairdo will have bangs in the front, with a flip on the sides and long, straight hair in the back.

In this tutorial, you will learn how to:

- Create spline objects on which to base hair growth
- Use vertices to give hair its shape

- Fine-tune hair characteristics
- Apply hair presets to objects

Skill level: Intermediate

Time to complete: 1 hour

Generate the Hair

Set up the lesson:

1 Con the Quick Access toolbar, click the Open File button and open spline_emitter_start.max, from your *dynamics_and_effects**hair_and_cloth**hair* folder.

The scene consists of a simple head mesh and three shadow-casting spot lights that are hidden at this time. Instead of using the mesh as a hair emitter, you'll create a spline-based outline for the hair.

2 Select the head in the scene and right-click it. From the quad menu that appears, choose Freeze Selection.



- 3 On the main toolbar, right-click the Snaps Toggle button to open the Grid And Snap Settings dialog.
- **4** Turn off any other options and turn on Face.
- 5 In the Grid And Snap Settings > Options panel, turn on Snap To Frozen Objects.

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_ General				
Snap Preview Radius	: 30 🔹 (pixels)			
Snap Radius:	20 🛊 (pixels)			
Angle:	5.0 单 (deg)			
Percent:	10.0 💲 (%)			
🔽 Snap to frozen objects				
Translation				
🔲 🔲 Use Axis Constraints 🔽 Display rubber band				
🔲 Use Axis Center As Start Snap Point				

6 Click the close button in the upper-right corner to exit the dialog, and then click the Snaps Toggle button to turn on snapping to faces.

Create the spline cage for the hair:

In this section, you'll create the splines for the hair. In that respect, you must consider the design of the hairdo and the parting of the hair. The red line in the following illustration shows where the hair part will be. You will use it as a base line for the hair splines as they flow on either side of the head.



The hair part line

- 1 Go to the Create > Shapes panel and choose Splines > Line. Make sure Initial Type and Drag Type are both set to Smooth.
- **2** In the Perspective viewport, position the mouse at the front of the parting line seen above, and then click to start the spline. Move the mouse partway down the left side of the head and click again. Move it farther down and slightly back, click again, and then move it down and closer to the front to create a nice flowing curve. Right-click to end.

The four-vertex spline is not smooth enough to follow the contours of the head. You will make the necessary adjustments later but for now, press F3 to view the scene in wireframe mode.

IMPORTANT Before you create additional splines, make sure that Start New Shape (on the Object Type rollout) is turned on. Each spline should be its own object until you attach the splines later.



3 Continue adding splines. Start the next one a little further back from the first. Likewise for the third and fourth. Continue around the back, always placing the spline base points along the parting line of the hair. use the following image as a reference.



Adjust the spline cage



1

Go to the Display panel. In the Hide rollout, turn on Hide Frozen Objects. This setting hides the head object from the scene.



2 Select the first spline you created: *Line01*, and then go to the Modify panel.

- **3** From the Geometry rollout, click the Attach button.
- **4** Attach the splines sequentially, moving clockwise around the head. The sequential order of splines in the spline cage is important for the hair modifier to work properly.

NOTE The names of the individual splines are not important to this step. What is important is the order in which you attach them.

- **5** Go back to the Display panel and turn off Hide Frozen Objects.
- 6 With the spline cage selected, go to the Modify panel and rename the object **Hair**.
- **7** Go to the Vertex sub-object level. Looking at the top of the head, select all the first vertices representing the hair roots.



8 Press Ctrl+l to invert the selection.



9 From the main toolbar, choose the Select and Uniform Scale tool and set the scale pivot to Use Selection Center

10 Scale the selection up so that the splines flow more naturally around the head.



11 Adjust the individual vertices so they fit the shape of the head nicely, floating just above the mesh. Make the necessary adjustments to follow the design of the hairdo you have set yourself to achieve. If necessary, click Refine to add vertices to the splines, and then shape the spline cage with more detail.



Generate the hair:

- 1 Continue working on your file or open the file *spline_emitter_hair.max*
- **2** With the *Hair* object selected, apply a Hair And Fur (WSM) modifier.



Hair And Fur modifier applied to splines

Adjust the hair settings:

The settings described in the following steps were arrived at through experimentation. You might find other settings that work better for your hair, so feel free to experiment yourself, and revise the suggested values.

- 1 Open the General Parameters rollout and set these values:
 - Hair Count =1200
 - Hair Segments =25
 - Hair Passes =4
 - Root Thick =6.0
 - Tip Thick **=4.0**

These settings control the number of hairs, their curvature, and their size.

- **2** Open the Material Parameters rollout and set these values:
 - Occluded Amb. =0.0
 - Tip Color = dark brown**RGB (34,28,13)**
 - Tip Color = dark brown**RGB (29,24,11)**
 - Hue Variation =15

These settings control the material properties of the hair, such as color and shininess.

- **3** Open the Frizz Parameters rollout and set this value:
 - Frizz Root =80

This setting adds a certain amount of noise to the root of the hair, making it look denser and more natural.

- 4 Open the Multi Strand Parameters rollout and set these values:
 - Count **=5**
 - Root Splay =**0.85**
 - Randomize =15

These parameters add a certain amount of clumping to the rendered hair.

Render the hair:

■ Render the hair in the Perspective viewport.



The final result

If you have time, try rendering the hair from various angles.


The same hair, rendered in a partial profile



The same hair, rendered nearly from the back

To see our final results, open the scene *spline_emitter_final.max*. Your results might differ significantly; there are many variables in projects like this.

Also if you have time, try adjusting spline vertices to further style the hair. Notice that as you adjust the splines, the display hairs in the viewports are updated interactively.

Working with Hair Presets

Presets let you save or load the various hair settings.

Set up the scene:

■ Continue working on your file or open the file *spline_emitter_final.max*.

Save your work:

Now that you have adjusted the hair parameters, you will save a hair preset for later recall.



- 1 With the *Hair* object selected, go to the Modify panel and expand the Tools rollout.
- **2** In the Presets group, click the Save button.
- **3** In the dialog that appears, name the preset **Brown_Hair** and then click OK.

Load a new preset:

1 In the Tools rollout > Presets group, click the Load button.

The Hair And Fur Presets dialog appears. The preset you just saved is displayed in a thumbnail called *Brown_Hair.shp*.



2 Double-click the *platnumBlond.shp* thumbnail to load that Preset.

3 Render the Perspective view to see the results. The character now has light blond hair, but the parameters need adjustment.



Platinum blond hair: default preset settings

Presets are a good way to load hair settings, but often you must adjust the preset parameters to get the effect you are aiming for. In this case, it looks like the hair ought to be finer and straighter than the default settings show.

Adjust the preset settings:

- 1 Change the hair settings as follows:
 - General Parameters > Hair Segments =30
 - General Parameters > Root Thick =4.0
 - General Parameters > Tip Thick **=3.0**
 - Frizz Parameters > Frizz Root =50
 - Frizz Parameters > Frizz Tip =0
 - Multi Strand Parameters > Multi Strand Count =4
 - Multi Strand Parameters > Root Splay =0.2
- **2** To test the results, render the Perspective view again.



Blond hair after adjusting the preset settings

Feel free to experiment with other settings.

Summary

This tutorial showed one way of using a spline cage to generate and style hair, and how to load hair presets.

Working with Surface Lock

One of the useful tools Hair offers is the ability to lock hairs to a surface. This feature allows you to create features such as a braid as easily as you can model one.



In this tutorial, you will learn how to:

- Align hair to an object.
- Lock hair guides to the object surface.

Skill level: Beginner Time to complete: 10 minutes

Surface Lock

Set up the lesson:

1 Con the Quick Access toolbar, click the Open File button, open *morph_braid_start.max* from your *dynamics_and_effects**hair_and_cloth**hair* folder.

This scene contains three cylinders combined into a single object named *Braid surface*. The scene uses a Morpher and a PathDeform modifier to animate the three strands being braided together. In the start scene, these modifiers are initially turned off. The cylinder geometry is not renderable: its only purpose is to deform the hair.

2 Select Braid surface and note the hair settings.

When locking hair to a surface, you are actually locking the guides to the surface, so it's a good idea to use low values for the parameters that spread hair away from the guides; for example, Random Scale and Frizz. For realistic hair, set these values a little higher than 0. To improve deformation, try using a higher-than-usual Hair Segments value.

Set the sub-objects that grow hair:

You'll grow hair from the tops of the cylinders and then drape it down around the surface.

■ At the Polygon sub-object level of the Hair And Fur modifier, select the top polygons of each cylinder as shown, and then click Update Selection.



Top segments of the hair braid selected

Align the hair to the braid model:

■ On the Tools rollout, click Recomb From Splines and then pick the *Spline Guides* object.



The hair aligns to the direction and length of these splines.

You could easily create these splines from edges of the geometry, drawing them by hand. Or you could just create the same hairstyle using the styling tools and skip the splines altogether.

The next step is to lock the hair to the surface of the cylinders, which you do in the Styling rollout.

Lock the hair guides:

- 1 Change from the Polygon to the Guides sub-object level. This also activates the controls on the Styling rollout.
- **2** Open the Styling rollout.

By default, all the guide vertices are selected, so you don't need to select any.



3 Click the Lock button to turn it on. Now the hair guide vertices are locked to the *Braid surface* object.

NOTE In other situations, it might be desirable to lock only specific parts of the hair to a surface; for example, to wrap hair around curlers, or tuck hairlocks behind the ears.

4 Click Finish Styling to turn off this button . This also exits the Guides sub-object level.

Set up rendering and render the result:

1 In the modifier stack, turn on the Morpher and Path Deform modifiers.

NOTE For animation, the braid mesh can be skinned to a bone chain, instead of posed with Path Deform.

- **2** Go to frame 20.
- **3** Render the Camera01 viewport.

The completed braid

If you have time, you can also look at the scene *morph_braid_finished.max*. This scene contains two additional Hair And Fur modifiers, which model layered growth effects.

Rendering of braid with layered hair

Summary

This tutorial demonstrated the Surface Lock feature as a way to animate hair.

Cloth

The tutorials included in this section walk you through a variety of methods for using Cloth.



Laura by Georges Walser

Features Covered in This Section

- Using the Garment Maker
- Applying the Cloth modifier
- Locking points on the cloth

- Adding space warps and collision objects to the cloth
- Running a Cloth simulation
- Adjusting fabric properties

Creating a Billowing Flag

This quick start tutorial introduces you to some of the basic concepts you'll need when using Cloth. It is meant simply to provide an overview to the Cloth modifier. Do not worry if you don't understand the entire process, as the "why" will be explained in the later tutorials.



In this tutorial, you will learn how to:

- Use the Garment Maker modifier to convert a 2D spline into a 3D mesh object.
- Use the Cloth modifier to apply cloth properties to the object
- Simulate wind effects on a cloth object using Wind space warp.

Skill level: Intermediate

Time to complete: 20 minutes

Creating a Flag

Create a cloth flag from a spline object:

- 1 Con the Quick Access toolbar, click the Open File button and open *quickstart.max* from your *dynamics_and_effects**hair_and_cloth**cloth* folder. This scene contains a rectangular spline object named *Flag* and a cylinder named *FlagPole*.
- **2** Select the rectangle shape named *Flag* and apply the Garment Maker modifier to it.

Modifier stack with Garment Maker modifier applied to the Editable Spline object Flag



The resulting Flag object is now a 3D mesh.

This modifier turns the 2D spline into a 3D mesh that you can use as cloth.

The corners of the new mesh get "rounded" because the flag spline was not set up correctly.

3 Delete the Garment Maker modifier.

The spline object reverts to its original status.

- **4** Access the Vertex sub-object level and then select all four vertices of the spline (press Ctrl+A).
- **5** On the Geometry rollout, click Break.



Flag with vertices broken

This causes the segments within the spline to become independent, as shown above. This preserves the corners when you apply Garment Maker. Whenever you have a spline that changes appearance after the application of Garment Maker, check the vertices and break the ones that cause this kind of issue.

6 Exit the sub-object level and then reapply the Garment Maker modifier.

Front	
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Flag with Garment Maker applied

Apply and set up the Cloth modifier:

1 With the *Flag* object still selected, apply the Cloth modifier to it.

2 On the Object rollout, click the Object Properties button.

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This opens the Object Properties dialog.

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	U Bend 0.0 ◆ Thickness 0.0 ◆ V Bend 0.0 ◆ Repulsion 0.0 ◆ U B-Curve 0.0 ◆ Air Res. 0.0 ◆ U B-Curve 0.0 ◆ Dyn. Fric. 0.0 ◆ U B-Curve 0.0 ◆ Dyn. Fric. 0.0 ◆ U Stretch 0.0 ◆ Static 0.0 ◆ U Stretch 0.0 ◆ Self Fric. 0.0 ◆ U Compress 0.0 ◆ Seam Force 0.0 ◆ V Compress 0.0 ◆ Seam Force 0.0 ◆ V Compress 0.0 ◆ Seam Force 0.0 ◆ V Compress 0.0 ◆ U Scale 0.0 ◆ Density 0.0 ◆ Depth 0.0 ◆ Damping 0.1 ◆ Offset 0.0 ◆ Based on: default Layer 1 ◆ ● Inherit Velocity Anisotropic (unlock U,V) <t< th=""></t<>				
K Cancel	Pressure (Inside Enclosed Cloth Volume) Pressure 0.0 Pressure 0.0 Damping 0.0 Cap Holes				

First, you'll tell Cloth which objects should be part of the cloth simulation. Currently only *Flag* is present in the left-hand column of the Object Properties dialog; the *FlagPole* object should be part of the simulation as well. **3** On the Object Properties dialog click the Add Objects button, select *FlagPole*, and then click Add.

This adds the *FlagPole* object to the simulation.

Next you'll set which objects are to act as cloth and which objects the cloth will interact or collide with.

4 In the list on the left side of the Object Properties dialog, click *Flag*, and then click the Cloth radio button.

This tells the simulation that *Flag* is to be a cloth object.

5 In the list on the left side of the Object Properties dialog, click *FlagPole*, and then click the Collision Object radio button.

This tells the simulation that *FlagPole* is a collision object with which the cloth object can interact.

6 Click OK to close the Object Properties dialog.

Run the simulation:

Before you simulate, it's a good idea to check the cloth scale to make sure that you get the results you might expect. To do so, you'll measure the flag as it relates to the cloth simulation. Cloth works in real-world units to create its simulation, so it's important to make it a habit to check the size of your objects.

- 1 Go to the Create panel and click the Helpers button.
- **2** Click Tape, and then in the Front viewport drag out a Tape helper to determine the width of the flag.

You'll find that it is approximately 165 3ds Max units in width. Currently, Cloth is set (in the Simulations Parameters rollout) to 2.54 cm/unit, which equals 1 inch per unit (2.54 cm=1 inch). So at 165 inches wide, the flag is 13.75 feet wide, which is a big flag. That's not unrealistically large, but it is big, which is something to keep in mind because it affects the cloth behavior.

3 On the Cloth Object rollout, click Simulate. Let the simulation calculate for a few frames. After about 35 frames, press the ESC key to stop the simulation.

The flag falls to the ground because it is not attached to the flagpole in any way. To attach the flag to the flagpole, you will need to access the Cloth Group sub-object level and create a group of vertices to attach to the flagpole.

4 Click Erase Simulation.

If you don't erase the simulation after pressing ESC, when you click Simulate again, the simulation simply resumes from the point where it was interrupted.

Attach the flag to the pole:

- Go to the Group sub-object level of the Cloth modifier. The flag vertices become visible.
- 2 In the Front viewport, select the column of vertices on the *Flag* object nearest the flagpole, as shown below.



Vertex selection for FlagPole binding

3 On the Group rollout click the Make Group button, and then name the group **FlagPoleSelection**. Click OK to close the dialog.

Now that you've made and named a group, you need to assign it to the flagpole.

4 On the Group rollout click the SimNode button, and then pick *FlagPole* by either selecting it in the viewport or by pressing the H key and using the Pick Object dialog.

Alternatively, you could attach the flag to the flagpole using the Surface constraint, but that method locks each vertex to the triangle on the chosen object whose *center* is closest to the vertex. In the case of the flagpole, some of the vertices would be pulled toward the cylinder cap triangles to which they are closest, which might create unexpected results.

5 Exit the Group sub-object level.

Run and refine the simulation:

1 On the Object rollout click Simulate.

The flag drapes down and is held up by the flagpole, but it doesn't seem to drape very naturally. This is due to the size of the cloth. Remember that you determined that the flag is almost 14 feet wide, so you must now edit the cloth properties for the flag so that it behaves more realistically.

- 2 Click the Object Properties button, and then in the left-hand column of the floating dialog click *Flag*.
- **3** Change the Shear value to **350.0**.
- 4 Change the U Bend value to **50.0** (this also changes the V Bend value, which is locked to U Bend by default).

Altering these parameters forces the cloth to be less flexible, cause more realistic folds in the cloth drapes.

- **5** Close the Object Properties dialog, and then click Erase Simulation to remove the existing simulation data.
- **6** Click Simulate again to see the flag drape.

Add a wind force:

To make the simulation more realistic, you'll use a Wind space warp to make the flag flap in the breeze.

- 1 Go to Create panel > Space Warps > Forces and then add a Wind space warp In the Left viewport.
- 2 Rotate the space warp to point in the same direction as the flag, as shown below.



Wind space warp placement in the scene

3 With the Wind space warp selected, go to the Modify panel and change the Strength value to **10.0**.

Next you'll tell the Cloth simulation to take the wind into account by adding it as a force.

4 Select the *Flag* object and then on the Object rollout click the Cloth Forces button.

This opens the Forces dialog.

5 In the Forces In Scene column, click *Wind01* and then click the right-arrow button in the center to move it over to the Forces in Simulation column. Click OK to exit the dialog.

Forces		×
Forces in Scene	Forces in Simulation	ОК
Wind01		Cancel

6 Erase the simulation again and then click Simulate and let the new simulation run to completion.



Flag blowing after simulation is complete

Summary

This tutorial introduced you to applying the Cloth modifier and creating a cloth simulation. You can see how easy it is to create a simple cloth object with Cloth. Now that you've had a taste of how the system works, try using the major Cloth features in the Designing a Shirt tutorials to build a realistic shirt for a character model.

Designing a Shirt

In this tutorial, you will go through the process of building a shirt for a character from scratch.



In this tutorial, you will learn how to:

- Draw splines for the pattern.
- Apply the Garment Maker modifier to the pattern.
- Working with MultiSegment splines.
- Positioning the Garment Maker panels over the character.
- Create seams.

- Assign cloth and collision objects.
- Assign clothing properties.
- Run the local simulation to fit a garment.
- Use the Seam Strength and Seam Angle controls.

Skill level: Intermediate

Time to complete: 1.5 hours

Designing a Shirt, Part 1

Create the shirt pattern:

1 On the Quick Access toolbar, click the Open File button and open the file *tutorial_1.max* from your *dynamics_and_effects**hair_and_cloth**cloth* folder.

This scene contains a character for which you will make a shirt.

2 Select the character named *Jester*. In the Front viewport, rotate it –90 degrees on the X axis, so that the model faces up in the Top viewport.

Garment Maker requires that you create patterns in the Top viewport. Rotating the character will allow you to use it temporarily for fitting while creating the pattern. When you've finished creating the patterns, you will rotate it back.

Next you'll start to make a pattern for a shirt. First you'll create the panels that will make up the front and back of the shirt.

3 On the Create panel click Shapes > Line, and create a spline in the Top viewport that resembles the front of a shirt without sleeves. This will look something like a vest, as shown below.



Front of shirt in the Top viewport

Next you'll make the sleeve for the shirt. The sleeve is basically one long piece of fabric that wraps around the arm, with a seam at the bottom. The end of the sleeve that will attach to the shirt should be curved to better fit the shoulder area.

4 In the Top viewport, create a spline sleeve that fits the arm's length, and is about three to four times the arm's width.



Sleeve in the Top viewport

5 Copy the sleeve and front panel splines of the shirt so that you have a front and back plus two sleeves. Also, rotate the sleeve on the left so that it is properly oriented, as shown below.



Pattern panels copied and arranged

Next you'll combine all the pieces and set them up to be sewn together.

6 Select one of the pieces, then go to the Modify panel > Geometry rollout and click the Attach Mult. button. In the Attach Multiple dialog, click to select all the other Shape pieces, and then click Attach.

This combines all the editable splines into one Editable Spline object.

7 Name the attached object **Pattern**.

In order for Garment Maker to work, all of the panels that are created as part of a single piece of clothing must be part of the same object. That's why you attached all the splines. Next you'll break off different segments of the pattern so that these edges can be sewn together.

8 At the Vertex sub-object level, select all four corner vertices of both sleeves and then click Break.



Vertices selected for breaking

This will give you four separate splines to select and sew together instead of having only one spline. When you work with Garment Maker, you need to make sure that your shape contains separated splines to use as the seam edges.

9 Select the eight corner vertices on both the front and back pieces of the shirt, and click Break again.



Vertices selected for breaking

Now that the pattern is ready, you'll apply the Garment Maker modifier to make this 2D spline pattern into a 3D mesh.

10 Exit the Vertex sub-object level, and with the Pattern spline selected, go to the Modify panel and apply the Garment Maker modifier.When you apply Garment Maker to the closed splines it fills them in with an irregular triangular mesh that is designed for cloth deformation.

Fit the shirt to the character model:

Now that you're done with the preliminary creation and sizing for the pattern, you'll rotate the Jester back into standing position.

1 In the Front viewport select the *Jester* object and rotate it 90 degrees around the X axis so the figure is standing vertically once again.

The next step is to position the panels of the pattern around the character.

- **2** Select *Pattern,* go to the Panels sub-object level of the Garment Maker modifier, and select the panel that makes up the front of the shirt.
- **3** Use all four viewports to move the panel into place so it lines up well with the front of the character.

You will need to rotate the panel 90 degrees in the X axis so it is vertical like the character. You will also need to move it forward so it is in front of the character. Refer to the following illustration.



Positioning of the front shirt panel

4 Still at the Panels sub-object level, select the panel that makes up the back of the shirt. Move and rotate this panel into place.

As with the front of the shirt, you need to rotate the back 90 degrees in the X axis so it is vertical. You also need to rotate it 180 degrees in the Z axis so it faces outward, away from the jester's body.

5 Move the sleeve panels into place above the arms.



Positioning of the back and arm shirt panels

You'll adjust a few parameters of the panels before adding the seams to the shirt's panels.

6 At the Panels sub-object level select one of the sleeve panels. In the Panels rollout Deformation group choose the Curved radio button option. Set the Curvature value to **-3.0** and choose the Y-Axis option. (Depending on the orientation of the sleeve object, you might need to set this value to **3.0**.)

This causes the sleeve panel to bend around the arm.

7 Using the Move and Rotate tools, reposition the panel to fit more closely around the arm.

If the sleeves are not wide enough to curve around the arm, go back to the Editable Spline level on the stack to make them a bit wider. To get Garment Maker to recognize this change, tweak the Density spinner up and down in the Garment Maker > Object rollout after editing the splines.

8 Repeat these steps to curve the other sleeve and position it to resemble the following illustration.



Sleeve panels with curvature

Make the shirt seams:

All the panels are in place, so next you'll make some seams for sewing them together. You can make seams at both the Curves and Seams sub-object levels. The Curves level is a good place to make seams quickly if you know exactly how they need to connect. However, this method can be a bit confusing at first. Therefore, you'll use the Seams level because it gives more visual feedback.

1 Go to the Seams sub-object level of the Garment Maker modifier. Select the edge on the front panel of the shirt above the left shoulder. It turns red to indicate it is selected.

2 Press and hold the Ctrl key, and then select the corresponding edge on the back panel of the shirt. On the Seams rollout click Create Seam.

If a dialog comes up that reads, "Seamed segments not within tolerance," increase the value for the Seam tolerance on the Seams rollout. You might also get a twisted seam. If this happens, click Reverse Seam on the Seams rollout.



Left: Twisted seam

Right: Correctly aligned seam

Most of the seams for clothing can be made as easily as this: Select two edges and then click Make Seam.

The exception to this is creating the seam between the sleeves and the arm holes. There are three seams involved here instead of two: the front half of the arm hole, the back half of the arm hole, and the sleeve edge itself. You must first make the arm holes on the front and the back of the shirt into one segment. You will do this by making a "MultiSegment" seam.

3 Select both segments for the arm hole on the front and the back of the shirt. It is important that you select the segments on the same side of the body on which you just made a shoulder seam. When both edges are selected, click Make MultiSegment on the Seams rollout.



Segments selected for making MultiSegment

Now, if you deselect and select either the back or front segment, both will be selected or deselected because Garment Maker now considers them to be one segment.

4 Select the MultiSegment you just made, and then select the sleeve edge. Click Create Seam to attach the sleeve.



Seam attaching sleeve to body

5 Create the seams for the rest of the segments on that side of the body. Don't forget the underside of the sleeve.



Seams for left side of body

6 Use the same method to create the seams for the other side of the body.

Remember to create the shoulder seam first and then make the MultiSegment seam. When dealing with MultiSegment seams, the order of creation is important. If you attempt to create seams in the wrong order, you might get a "Seamline topology is wrong" error, and the seams will not be created. When dealing with MultiSegment seams, create the minimum number of seams necessary to make the MultiSegment seam match the topology of the other piece to that you are going to connect. In this case, you have an arm seam that is open at the bottom, and a MultiSegment that is open at both the top and the bottom. By closing the top of this MultiSegment with a seam at the shoulder, you've created proper topology to make the MultiSegment seam.

To recap this first lesson, you created a pattern for a shirt from standard splines, applied Garment Maker, positioned them over the character and then created the seams that will be used to sew the panels together. In the next tutorial, you will see how to make the flat panels look more like a shirt.

Designing a Shirt, Part 2

In this next lesson, you'll take the patterns you built in the first tutorial, and you'll apply Cloth to begin the process of turning the panels into a shirt.
Apply cloth to the shirt:

1 Open *tutorial_2.max* from your *hair_and_cloth**cloth* folder.

This scene contains the Jester character and the shirt pattern with seams in place from the previous lesson. Now that all the seams are in place on the pattern, you will add the Cloth modifier to form the pieces into the shirt. The first task is to decide on the scale of the scene.

If you use the Measure utility, you can see that the Jester character is about 77 3ds Max units tall. One unit equals one inch, so this makes him 77 inches (6 feet, 5 inches) tall, including the hat, which seems reasonable. Since we want to use 1 3ds Max unit=1 inch, that means 1 unit=2.54cm, so the cm/unit setting in Cloth will be set to 2.54; this is the default.

2 Select the Shirt object, go to the Modify panel, and apply the Cloth modifier to it.

Since we want cm/unit=2.54, there is no need to change this value, but please keep in mind that it is very important to set this value correctly before attempting a simulation.

3 Click the Object Properties button.

The Object Properties button on the Object rollout opens the Object Properties dialog, where you add objects to the simulation and assign them different properties.

4 In the left column of the Object Properties dialog, click the *Shirt* entry, and then choose the Cloth radio button on the right.

This sets the shirt to be a cloth object in the simulation.

Take note of all the Cloth Properties parameters that can be adjusted when an object is set to be cloth. You can use these parameters to get the fabric type you want, or you can use a preset.

5 With *Shirt* still highlighted in the left column, choose Cotton from the Presets drop-down list.

This sets all of Cloth Properties to simulate cotton.

If you were to simulate now, the shirt would simply fall to the floor because it's the only object in the simulation currently. You'll add an object for the cloth to collide and interact with.

- **6** On the Object Properties dialog, click the Add Objects button. This opens a list of objects in the scene.
- 7 Click the *Jester*, and then click Add.

Object Properties	
Objects in Simulation	Inactive Property 1
Jester Shirt	Cloth Properties Cloth Properties Presets Load Save
	U Bend 5.0 Thickness 0.0 Repulsion 1.0 Repulsion 1.0 Repulsion 1.0 Air Res. 0.02 Dyn. Fric. 0.1 Dyn. Fric. 0.1 U B-Curve 0.0 Static 0.5 V B-Curve 0.0 Dyn. Fric. 0.1 U Stretch 50.0 Static 0.5 V Stretch So.0 Sean Force S000.0 V Compress So.0 Sean Force S000.0 V Scale 1.0 Shear So.0 V Scale 1.0 Depth 1.0 Depth Depth O Cling 0.0 Cling D.0 Edge Springs Use Cloth Depth/Offset Use Collision Obj Friction Deptiction Depti
	Keep Shape Bend % 100.0 • Stretch % 100.0 • Pressure (Inside Enclosed Cloth Volume) Pressure 0.0 • Track Volume Damping 0.0 • Cap Holes
<	Collision Object Collision Properties Depth 1.0 Dyn. Fric. 0.1 Collision Static 0.5 Collisions Cuts Cloth

When you add objects to the simulation, it is the same thing as instancing the Cloth modifier to those objects. Each object that is part of the Cloth simulation will have a Cloth modifier assigned to it. Be aware of this as you set up your own simulations.

- **8** With *Jester* still highlighted in the left column, click the Collision Object radio button on the right near the bottom.
- **9** In the Collision Properties group, set the Offset parameter to **0.25**, which will keep the cloth a quarter of a 3ds Max unit away from the body (the default of 1.0 is a little large for this scene).
- **10** Click OK to close the Object Properties dialog and set the parameters. At this point, you have set the shirt to react like cloth, and the Jester's body to collide with it. You are now ready to convert the panels into a shirt. You do this with a *local simulation*.

Before you simulate sewing the garment together, you'll turn gravity off.

- **11** Scroll down to the Simulation Parameters rollout, and click the Gravity button so it is no longer highlighted and active.
- **12** In the Perspective viewport, zoom in a bit to get a closer look at the shirt, then still within the Cloth modifier, go to the Object rollout, and in the Simulation group, click Simulate Local. When the seams have pulled the shirt mostly together, press the ESC key to stop the simulation.



As you can see in the image above, the panels have pulled together and are draped over the Jester character. However, the seams have not come together to form a single garment and the green sewing springs are still visible. In order to get the seams to snap together completely, you will need to perform one more operation.

13 On the Simulation Parameters rollout, turn off Use Sewing Springs. The green lines disappear.

The sewing springs are a way for the Garment Maker modifier to tell the Cloth modifier where seams should be. But sometimes, as in this case, the spring tension isn't strong enough to pull the seams all the way together. Turning off the springs fixes this problem.

- **14** Turn Gravity back on, and then back on the Object rollout, click Simulate Local again.
- **15** Let the simulation run until you are satisfied with the fit, and then press the ESC key to stop it.

Now the shirt is complete. Next, you can animate the character and simulate the cloth over the animation. But before you animate your character, you're going to give the shirt a pocket to add some detail to it.

Now that the shirt is coming together, you'll give it some more detail by adding a pocket. This section will introduce you to the idea of attaching one cloth object to another as well.

The following concepts are covered in the next section:

- Garment Maker creation
- Creating and using groups
- Assigning separate cloth properties

Add a pocket:

1 Load *tutorial_3.max* from your \hair_and_cloth \cloth folder.

This scene contains the Jester character and the shirt simulated from the previous lesson. If the scene opens with the panels apart and the garment looking stretched out, there's an easy fix. Occasionally you will see a scene file with the panels not together and the triangles distorted. To fix this, just turn on Use Sewing Springs, click Reset State, and then use Simulate Local to rebuild the shirt as it was at the end of the previous tutorial.

Now that the shirt is in place, you will add a pocket to it to make it look like a fancy T-shirt.

You'll start by creating a pocket to add in the same way you made the shirt pattern.

- 2 In the Top viewport, select both *Shirt* and *Jester*, and rotate them –90 degrees in the X axis so the model is facing up.
- 3 In the Top viewport, zoom into the front of the jester's body, then draw out a pocket shape with the line tool using Create panel > Shapes > Line. Make the pocket an appropriate size for the shirt and name the object Pocket. Be sure to go to the Vertex sub-object level and break all the vertices.



Spline pocket in the Top viewport

- **4** With the Pocket object selected, apply the Garment Maker modifier to it.
- **5** Go to Panels sub-object level of the Garment Maker modifier, and then move the pocket into place just in front of the shirt. You might want to rotate the pocket a bit to more closely align it with the chest portion of the shirt. When you're done, exit the sub-object level.



Pocket positioned at the Panels sub-object level

Now that the pocket is in place, you will need to add it to the simulation.

- **6** Select all three objects (press CTRL+A), and rotate the model 90 degrees in the X axis so it is vertical again.
- **7** Select the shirt, and then click Object Properties. On the Object Properties dialog, click Add Objects to open a list of objects in the scene. Click *Pocket* and then click OK. With *Pocket* still selected in the left column, click the Cloth radio button on the right. Click OK to close the Object Properties dialog.

Before attaching the pocket to the shirt, it's advisable to make the mesh densities of the two objects similar. Right now, the mesh density of the pocket is higher than the shirt, which can cause crumpling at simulation time.

8 Select the *Pocket* object, and then access the Garment Maker modifier in the stack. A warning appears: click Yes to dismiss it.

9 On the Main Parameters rollout, change the Density value so the mesh density of the pocket more closely matches that of the shirt. A value of 1.0 should work.

Next you'll attach the pocket to the shirt. You can do this at the Group sub-object level of the Cloth modifier.

10 Select the *Pocket* object, and then go to the Group sub-object level of its Cloth modifier. This level lets you select vertices. Select the vertices at all edges of the pocket except the top edge, as shown below.



Pocket vertex selection

- **11** Click the Make Group button and name the group **PocketEdge**. You'll see a new group in the Group rollout list named "PocketEdge (unassigned)."
- **12** With this group still selected, click the Cloth button and pick the shirt by selecting it in the viewport or by pressing the H key and selecting it by name.

Now the Group should be named "PocketEdge (cloth to Shirt)." This lets you know that you have attached the group of vertices to the shirt object as a piece of cloth.

13 Return to the base level of the Cloth modifier, so you are no longer at the Group sub-object level. Make sure that Gravity is not active on the Simulation Parameters rollout.

- **14** Go to the Object rollout, and in the Simulation group, click Simulate Local to conform the pocket to the shirt.
- **15** This should take only a few frames, and you should also realize that this process will also further refine the shirt's fit itself, so don't let the simulation run too long.



Pocket conformed to the shirt

As you have seen, adding extra detail to a piece of clothing is not a very difficult process. Attaching one cloth object to another is simply a matter of creating a group of vertices and choosing the other cloth object to attach it to. In the next lesson you will expand on this knowledge to create a collar and cuffs for the shirt, as well as assign different material properties to them.

Next

Designing a Shirt, Part 3 on page 1621

Designing a Shirt, Part 3

Now that you've had a taste of adding detail to a garment, it's time to look at some of the more advanced attributes within Cloth. In this tutorial, you'll add a collar and cuffs to a simple shirt design, and change their seams to create creases within the garment.

Add a collar:

1 Load *tutorial_4.max* from your *hair_and_cloth**cloth* folder.

This scene contains a character and the shirt from the previous lesson. This shirt has some additions to it as shown in the following illustration. Two extra pieces have been added for the collar, and one extra piece per arm for a cuff. The cuff is a bit narrower than the sleeve.



Shirt layout with collar and cuffs added to the basic pattern

2 Select the shirt in the Top viewport, and on the Modify panel, turn on the Garment Maker modifier so the panels move into place.

The shirt is set up as in the previous lesson, with most of the seams created for the arms, back and front of the shirt. You'll adjust the curve of the cuffs and the collar, and apply seams to them.

3 Go to the Panels sub-object level of Garment Maker, and select one of the cuffs. In the Deformation group on the Panels rollout, choose Curved, and set the curve to **-5.0** around the Y-axis.

Now that the cuff is curved around the arm, you can add its seams.

4 Go to the Seams sub-object level of Garment Maker, and create a seam between the sleeve and the cuff. Then create the seams for under the sleeve and under the cuff. Create your seams in this order, or you might get topology dependency errors.



Seams for the underarm and cuff

Now that you have made the seams for the cuff, you will edit the seam, attaching it to the sleeve to get a cuff-like result. Where the cuff meets the sleeve, there should be a clear crease and a bunching of the sleeve.

5 At the Seams sub-object level, select the seam that joins the cuff and the sleeve. (In other words, click the green sewing springs that connect the cuff and the sleeve.) On the Seams rollout, set Crease Angle to **90.0** and Crease Strength to **100.0**.

This will make the seam try to maintain an angle of 90 degrees.

6 Complete steps 3 to 5 for the other side of the body.

Now you'll look at the collar. It is best to make the seams for the collar first, and then change its curve afterward.

7 At the Seams sub-object level, create a seam between the back of the shirt and the bottom of the closest collar piece (the curved segment at the back of the shirt).



Seam from the back of the shirt to the bottom of the collar

8 Next, create a seam between the *tops* of the two collar pieces. If necessary, click the Reverse Seam button to straighten out the seam.

Next you'll bend the collar panels and move them into place.

- **9** At the Panels sub-object level, select the base of the collar and apply a curvature of **-3.0** around the X-axis. Select the other piece of the collar and apply a curvature of **-2.0** around the X-axis.
- **10** Select each of the collar places and move them into place around the neck and above the shoulders, as shown below.



Collar bent and positioned

Next, you'll edit the seam of the collar as you did the cuffs. This will let the folded part of the collar stand out a bit.

- 11 At the Seams sub-object level, select the seam between the top of the two collar pieces. Set Crease Angle to -75.0 and Crease Strength to 25.0. Now you are ready to add the Cloth modifier and run a simulation.
- **12** Apply the Cloth modifier to the shirt.
- **13** On the Object Properties dialog, set the shirt to be cloth, and choose the Cotton preset from the drop-down list.
- **14** Add the *Jester* to the simulation, and make the *Jester* a collision object. Close the Object Properties dialog by clicking OK.
- **15** On the Simulation Parameters rollout, turn off Gravity. Make sure that Use Sewing Springs is turned on. Then on the Object rollout, in the Simulation group, click Simulate Local to bring the panels together.

16 Stop the simulation and then, on the Simulation Parameters rollout, turn off Use Sewing Springs.

Turning off Use Sewing Springs tells Cloth to compute the seam angles and strength for the cuffs and collar.

17 Turn Gravity back on, and then Simulate Local again with Use Sewing Springs off to refine the garment position and fit.

If you don't get the right result the first time, you might want to turn Use Sewing Springs back on and Reset State. This will allow you to perform the local simulation again.



Simulated shirt with collar and cuffs

This lesson has provided you with additional ways to control how your fabric behaves and is joined together. In the next lesson you'll look at how you can further refine the look and behavior of your clothing by assigning different cloth properties to the panels of garments.

Apply various cloth settings to different parts of the shirt:

In the previous section, you looked at different controls that help define how your fabric behaves. In this section, you'll apply different cloth settings to various parts of the shirt to create a more convincing look.

The concepts that will be covered in this section are as follows:

- 1 Assigning separate Cloth properties for panels
- **2** Assigning different materials for panels
- **3** Assigning separate Cloth properties with a material
- 4 Load *tutorial_5.max* from your \hair_and_cloth \cloth folder. This scene contains a character and the shirt from the previous lesson. You'll add some different properties to the cloth panels themselves.
- **5** Select the shirt and then, on the Cloth modifier Object rollout, click Object Properties to open the Object Properties dialog. Highlight the *Shirt* entry in the left column, and then turn on Use Panel Properties. Click OK to exit the dialog.

This will let you set the cloth properties for the entire shirt on a panel-by-panel basis.

6 Go to the Panel sub-object level of the Cloth modifier (*not* the Garment Maker modifier!) and select one of the cuffs. It will turn red to indicate that it's selected.

You can change all of the parameters for how the fabric reacts here on the Panel rollout.

- 7 From the drop-down list in the Presets group, choose Generic Heavy. This sets the cuff to deform like a heavy or stiff piece of fabric.
- **8** Select the different panels of the collar and the other cuff and set them to the Generic Heavy preset.

IMPORTANT

Be sure to choose the preset even if it is already displayed in the list.

9 Select each of the other shirt panels, and set the preset to Cotton.This will make most of the shirt behave like cotton except for the collar and cuffs, which will be heavier and less flexible, as if they were starched.

Now it's time to rerun the simulation.

10 Exit the Panel sub-object level and go to the Simulation Parameters rollout of the Cloth modifier. Turn on Use Sewing Springs, then go to the Object rollout. In the Selected Object Manip group, click Reset State.

This resets the state of the shirt so you can run the local simulation again.

- **11** Run the local simulation again, first with Use Sewing Springs on for a bit, and then run the local simulation with Use Sewing Springs turned off. You might also use Simulate Local (Damped), which adds a heavy damping to the fabric as it simulates.
- **12** If you are not satisfied with the results, click Erase Simulation and then rerun the simulation until you like the positioning and drape of the shirt.

Fine-tune the fabric settings:

Now that you have different fabric properties for the cuffs and the collar, you'll set up some different materials and densities. If you look at the end of the cuff, you will see it seems a bit low-poly and chunky.



Slightly chunky-looking cuff

- 1 Select the shirt (if it isn't selected already), and then go down the modifier stack to the Garment Maker modifier. Click Yes to dismiss the warning that appears.
- **2** Go to the Panels sub-object level and select one of the cuffs. On the Panels rollout, change Density to **3.0** and set the Mat ID to **2**.
- 3 Repeat the previous step for the other cuff as well.Changing the material ID lets you apply a different material to the cuffs only.
- 4 Select each panel of the collar and change its Density to **2.0** and its Mat ID to **2**.
- **5** Go back to the Cloth modifier, click Reset State, then run the local simulation again to fit the shirt to the torso once more.

6 Open the Material Editor. Create a Multi/sub-object material with two sub-material slots. Change the two sub-materials to any colors you like, apply the material to the shirt, and then render.



Smooth cuffs with separate materials applied

Summary

This tutorial guided you through the steps of creating a shirt from multiple panels that are built from spline shapes.

Tailoring and Fine-Tuning

As you begin to create more complex clothing, you're most likely going to want to create the garments for your characters, then be able to go back and refine them to make them fit better. In essence, you'll be acting like a virtual tailor. This tutorial introduces you to the traditional sewing concept of darts, and how they can help you build better clothing.



In this tutorial, you will learn how to:

- Use darts with Garment Maker.
- Create seams for darts.
- Modify darts after simulation to get a better fit.

Skill level: Beginner

Time to complete: 15 minutes

Fitting a Dress

Fit a dress with darts:

1 On the Quick Access toolbar, click the Open File button and open the file *tutorial_6.max* from your *dynamics_and_effects**hair_and_cloth**cloth* folder.

This scene contains a character model and a pattern for a sun dress. This sun dress has darts in it to help it fit the character's body closely while still being a very simple pattern. The darts are simply lines in the pattern used by Garment Maker.

2 Select the SunDress object.

The darts in the pattern appear as thin diamonds.

3 Go to the Modify panel.

Most of the seams for the dress are already made. The ones you'll focus on are the darts.



Darts marked in red

4 Go to the Seams sub-object level of Garment Maker. Select the two seams of one of the darts and then click Create Seam.



Seam made for one dart (far right) and selected edges to create a seam for the next dart

- **5** Proceed around the dress making seams for each dart.
- 6 Apply the Cloth modifier to the dress.
- **7** On the Object rollout click Object Properties. Highlight the SunDress entry in the list on the left, click the Cloth radio button, and then choose the Cotton preset from the drop-down list.
- **8** Click the Add Object button and then add the Girl to the simulation. With the Girl entry highlighted click the Collision Object option. Click OK to exit the dialog.
- **9** On the Object rollout choose Simulate Local (Damped). Once your dress is partially formed to the figure, stop the simulation, turn off Use Sewing Springs in the Simulation rollout, and then simulate locally again for a bit.

The shoulder straps are floating too high above the shoulders, so you'll decrease the offset a bit.

- 10 Open the Object Properties dialog again and choose the Girl entry in the list at the left. In the Collision Properties group reduce the Offset value to 0.6. Click OK to close the dialog.
- 11 Click Simulate Local (Damped) to tighten up the dress.

The resulting dress has some bunching on both sides under the chest. This bunching is what the darts are designed to minimize or eliminate. You should be able to get a better fit by repositioning the darts and making them a little larger.



Bunching on both sides of the dress

12 Go to the Line level at the bottom of the modifier stack (click Yes to dismiss the warning dialog), and then access the Vertex sub-object level. In the Top viewport, reposition the outside darts to be larger, and position them more toward the top of the dress as shown below.



Darts moved up and widened

13 Garment Maker doesn't register changes in the spline shape until the mesh is regenerated, so go to the Garment Maker modifier (again, click Yes to dismiss the warning), and then click the Mesh It And Preserve button. This button keeps the dress in place as Garment Maker adjusts to the new dart positioning.

If you clicked the Mesh It! button instead, the dress would revert to its pre-sewn configuration.

- 14 Go up to the Cloth modifier, turn on Simulation Rollout > Use Sewing Springs, and then on the Object rollout click Reset State.
- **15** Run the simulation locally again until you're satisfied.

You should get a much better fitting dress.



Results after manipulating the darts

Summary

This tutorial showed how to create darts, which are used to make a form-fitting garments.

Using Cloth with Bipeds

Cloth is a complex system, so it makes sense to learn how it functions in concert with another character-animation tool, namely, the 3ds Max Biped system.

In this tutorial, you will learn how to:

- Slow down the character's initial pose so the initial Cloth simulation can occur.
- Truncate a simulation
- Capture an initial state

Skill level: Beginner

Time to complete: 15 minutes

Clothe a Biped

To accomplish our task, we must slow down the character's pose. The idea here is that motion-capture data imported into both products will position a character at frame 0, which can cause problems for Cloth because it wants to simulate over at least 30 to 90 frames before motion begins, generally in a neutral pose.

Clothe an animated biped:

1 On the Quick Access toolbar, click the Open File button and open the file *tutorial_7.max* from your *dynamics_and_effects**hair_and_cloth**cloth* folder.

This scene has a biped standing in the "Da Vinci" pose.



Biped in Da Vinci pose

2 Select all the biped parts and then go to the Motion panel.



3

On the Copy/Paste rollout, click Copy Posture.

Now this posture is saved for you to get later.



- On the Motion Capture rollout, click Load Motion Capture File, and then load the file *backkick.bip* from the folder *sceneassets**animations*\. Click OK through the dialogs that follow, accepting the default settings.
- 5 Open Track View and choose Mode > Dope Sheet. Resize the Track View window until you can see all of the biped keys, then drag a rectangle to select all these keys. Drag the keys 30 frames to the right (while you drag, a tooltip shows an Offset value that you can watch).

This will give you 30 frames of transition between the copied pose and the first motion-capture frame.

6 Close the Track View - Dope Sheet window.



7

8

At frame 0, on the Motion Panel > Copy/Paste rollout, click Paste Posture.



On the Key Info rollout, click Set Key.

Now when you scrub the time slider your animation should show a smooth transition between the Da Vinci pose and the first frame of the motion capture.

- 9 Right-click a viewport and choose Unhide All to unhide the *Shirt* object.
- 10 Select the *Shirt* object and then go to the Modify panel. In the Cloth modifier's Object rollout > Simulation group, click Simulate to begin deforming the shirt. At frame 30, press ESC to halt the simulation (watch the progress dialog or the time slider).
- 11 At frame 30, in the Selected Object Manip group, click Set Initial State. This sets the initial state of the shirt to be in sync with the first frame of the motion capture. Because Cloth requires some pre-roll for the simulation, it provides you with the tools needed to copy the cloth at any stage back to frame 0.
- **12** Next, go to frame 0 and click Truncate Simulation. This removes the simulation after frame 0.
- 13 Save the scene as my_clothed_biped.max.

- 14 On the Quick Access toolbar, click the New Scene button, and on the New Scene options dialog, choose Keep Objects And Hierarchy. This removes all animation from the scene.
- **15** Import the motion capture file again. At frame 0, the cloth is in synch with the biped. From this point on, you can animate the cloth to follow the biped's motion.

This tutorial gave you a method for "staging" your Cloth simulation.

Summary

This tutorial showed how to clothe a Biped system using a shirt model created by Cloth.

Creating Pleats

In this final Cloth tutorial, you will learn more about creating specific pleats within a garment to make it look as if it's just been ironed and pressed.



In this tutorial, you will learn how to:

- Use a pattern with pleats in Garment Maker.
- Create seams for pleats.

Skill level: Intermediate

Time to complete: 20 minutes

Sewing, Seams, and Sections

Sew the skirt sections together:

1 On the Quick Access toolbar, click the Open File button and open the file *tutorial_8.max* from your *dynamics_and_effects**hair_and_cloth**cloth* folder.

This scene contains a mannequin figure and a pattern for a pleated skirt. This skirt has been broken into several sections for a pleated look when it gets sewn together.

2 Select the *Skirt* object.



Skirt pattern

This pattern object contains five sections that will have pleats between them. You'll connect the five sections to the five segments on the bottom of the waistband portion of the dress.

- **3** Apply the Garment Maker modifier to the *Skirt* object.

Garment Maker applied to the skirt panels

Next you'll position and rotate the pattern into place at the Panels sub-object level of Garment Maker.

- **4** Go to Panels sub-object level and then position and rotate the waistband portion of the pattern near the character's waist.
- 5 In the Panels rollout > Deformation group, choose Curved. Enter a Curvature value of -1.7 around the X-axis.

This bends the waistband portion of the skirt around the character's waist.

6 Move and rotate the skirt panels so they encircle the character, as shown below. Take your time and rotate the view around the character to get a better sense of where the panels are in relation to one another.



Panels rotated and placed around the character

Once the panels are in place you can make seams to attach each panel to the waistband.

7 At the Seams sub-object level of Garment Maker, select a segment on the bottom edge on the waistband and the corresponding edge on the top of a skirt panel.



Edges selected to make a seam

8 On the Seams rollout click Create Seam.

9 Attach the remaining panels to the waistband with additional seams.



Seams created attaching the waist band to the panels

- 10 Create a seam for the back of the waistband to close it off.Each adjacent pair of skirt panels needs a seam between them to keep them together and define a pleat.
- **11** Select the edges of the two back panels to create a seam between them and then click Create Seam.



Seam created between back panels of the skirt

12 With this seam still selected, go to the Seams rollout and change Crease Angle to 90.0 and Crease Strength to 25.0.

Setting Crease Angle to 90 makes the seam try to achieve a 90-degree angle during simulation. The Crease Strength setting defines how hard the seam will try to reach the set crease angle. All of this happens during simulation when Use Sewing Springs is off.

- 13 Repeat steps 11 and 12 with each pair of adjacent panels in the skirt.
- 14 Exit the sub-object level, then apply the Cloth modifier to the Skirt object.
- 15 On the Object rollout, click Object Properties.
- **16** In the Object Properties dialog, highlight the *Skirt* entry in the Objects In Simulation list, then choose the Cloth option to designate the skirt as a cloth object.
- **17** From the Presets drop-down list, choose Cotton.
- 18 Click the Add Objects button and add *Manny* to the simulation. Choose the Collision Object radio button to designate the mannequin as a collision object. Click OK to exit the dialog.

Now it's time to simulate and see how the dress looks.

- **19** On the Simulation Parameters rollout, turn Gravity off and make sure Use Sewing Springs is on. On the Object rollout, click Simulate Local (Damped) and let the sewing springs pull the skirt together for a few seconds. Press the ESC key to stop the simulation.
- **20** On the Simulation Parameters rollout, turn off Use Sewing Springs and turn on Gravity.
- **21** Run the local simulation again to snap the seams together and to define the pleats. When you are satisfied with how the skirt looks, press the ESC key to halt the simulation.



Skirt after simulation is complete

Summary

This tutorial showed how to use Cloth to create a skirt with pleats.