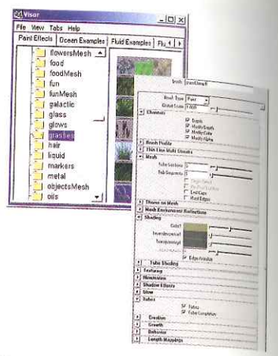
Paint Effects

Paint Effects offers a wide variety of brushes that let you add real-time effects to a scene. With this toolset, you can work on either a 2D canvas or in a typical 3D scene. This makes it possible to create either bitmap images or integrated brush strokes that can be viewed and animated in 3D. Paint Effects offers a vast library of pre-sets that make it easy to add effects to your scene with a few brush strokes. As you learn more, you can also enhance the existing brushes and even add your own to the library.

Paint Effects Basics

Paint Effects offers 3D artists a number of pre-set brushes ranging from a simple pen stroke to a complex brush, such as an animated tree blowing in the wind. The Attribute Editor for Paint Effects has some 274 attributes. With these attributes, you can create a number of effects brushes ranging from an oil or watercolor brush to many animated 3D brushes such as lightning, fire, hair, and plants.



You can access all the Paint Effects pre-set brushes through the Visor. Attributes are accessed through the Template Brush window.

Visor
From the Visor, you can access a palette of pre-set brushes. When you select a brush option, the attributes for that brush are transferred to the Template Brush.

Paint Scene
You can use any brush to paint on any object. When you paint in a scene, your brush works in 3D space. Painting in a scene also gives you the option to have your brush animated.

Template Brush
The Template Brush stores the attribute settings for your next brush stroke. You can edit a pre-set brush by selecting it in the Visor and then changing the various attributes in the Template Brush window.

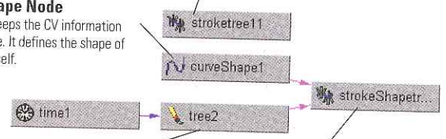
Paint Canvas
In Canvas mode, you can use any brush to paint on a 2D canvas. You can then save the image out to an image file to use as a texture map.

Paint Effects Dependencies

When you select a brush and draw a Paint Effects stroke in a 3D scene, you are actually creating a curve that provides information as to where the brush will be placed in the scene. Once the curve is drawn, Paint Effects creates a stroke Shape node. This node takes shape information from the curveShape node and applies the brush properties from the Template Brush to it.

Transform Node
This node contains the actual transform information for the curve. With this node, you can modify or keyframe any animation or scale the size of your curve.

CurveShape Node
This node keeps the CV information for the curve. It defines the shape of the curve itself.



Brush Node
This node takes all of the attribute information from the current Template Brush. To change attributes of a brush once it is already painted, you change the attributes contained in this node.

StrokeShape Node
The strokeShape node contains information such as pressure mapping, sample density smoothing, and surface offset.

Painting in Canvas Mode

Paint Effects can be used to paint 2D images or textures using any of the preset brushes, or ones you have customized yourself. You can also add blurs or smears to existing paint on the canvas using preset brushes.

Image Size
You can specify the size of your canvas by selecting Canvas > Set Size.

Background Color
You can change the background color of the canvas while in canvas mode by selecting Canvas > Clear - ❐

Wrap Image
Turning on the wrap image feature gives you the ability to create a tileable texture.

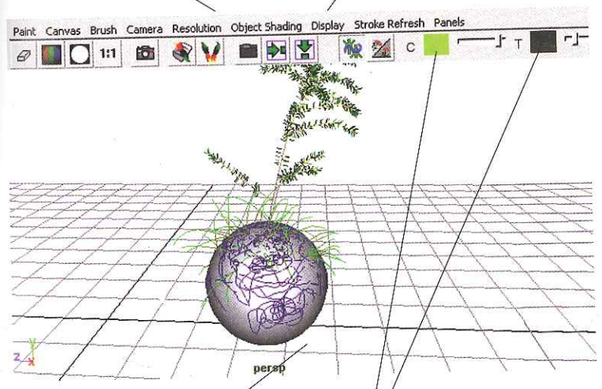
Display Alpha
You have the option to create a mask channel with any brush stroke.

Painting in Scene Mode

When you paint in Scene mode, you paint in 3D space. In Scene mode, you can paint directly on objects, or in front or behind them. Many of the strokes that you paint in scene mode use the actual lights in the scene. Scene mode also lets you animate any brush. As in Canvas mode, you also have the option to apply a blur or smears to any brush in 3D.

Resolution
This sets how much of your brush detail will be shown in your work window. A higher setting will give you the highest display resolution of your brush stroke, but it will also take longer to refresh your screen. Rendering Paint Effects will be at full resolution regardless of this setting.

Shading
This option allows you to preview your strokes in either wireframe, shaded, or textured modes. A higher setting will take longer to refresh.

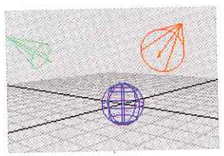


Brush Stroke
When you paint in a scene, you create a curve that has attached brush information.

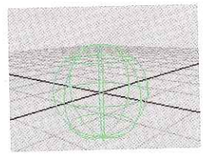
Color and Transparency
The color and transparency for the brush can be set using the sliders in the Preview window toolbar and in the Template Brush Editor.

How to Paint on an Object

To paint on an object in Scene mode, you must select the object and make it paintable. You can use this application to paint objects like hair on a character or paint trees on a sculpted surface.

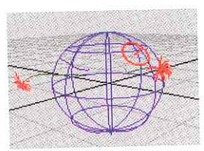


Step 1: Add Lights to Your Scene
Create and aim some lights on the object in your scene.



Step 2: Select Your Object
Select the object you want to paint on.

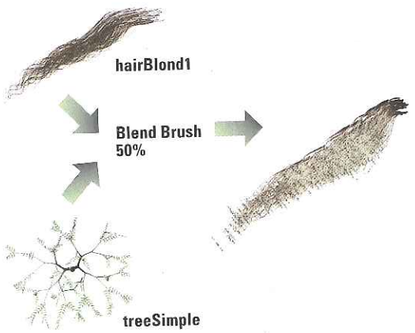
Step 3: Make Object Paintable
Select Paint Effects > Make Paintable.



Step 4: Select a Brush and Paint
Select a brush from the Visor and paint on your object.

Blending

Blending takes the shape or color attributes of a brush and combines those elements into your current brush. Selecting a brush in the Visor makes it your Template Brush. Right-click over another preset in the Visor and you are given the option to blend either shape, color, or the entire brush in varying percentages to your Template Brush.

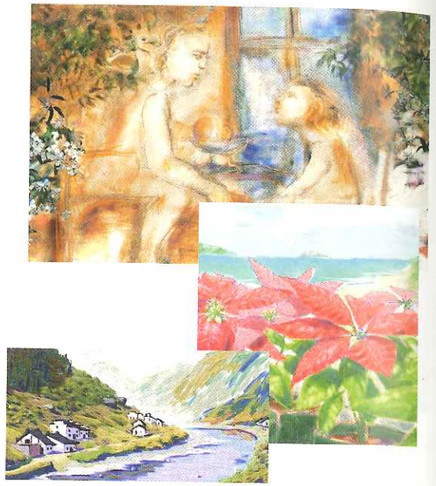


Brushes

The power of painting with Paint Effects is that brushes contain a large number of attributes that make it possible to achieve almost any required effect. In a 3D scene, these attributes are stored with the brush stroke and can be edited after painting. Therefore, it is a good idea to learn the role each of the attributes plays in the look of a typical brush stroke. As you learn about the attributes, you will have more control over your own strokes.

Basic Brush Attributes

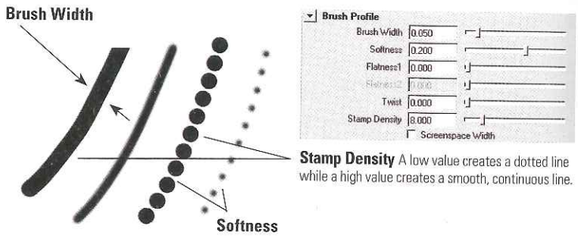
Paint Effects works by creating a series of dots along a curve. When you paint with a brush, the closer the dots are together, the smoother your brush stroke will look. Using the Attribute Editor, you can control the size, color, and spacing of these dots. This method lets you create many different effects. In the Attribute Editor, there is a setting called Global Scale. This setting scales all the attributes proportionately to your scene. If you paint a stroke that is too big, simply use a lower value for Global Scale.



Paint Effects allows you to create 2D images using a variety of pre-set brushes. You also have the option to smudge, blur, or add water to your images to create interesting effects.

Brush Profile

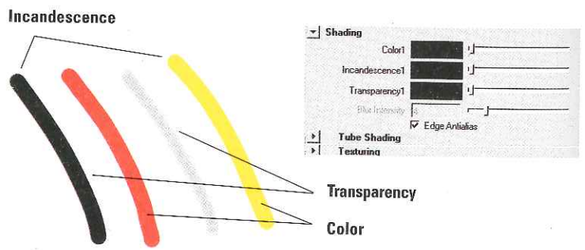
When you paint, you are basically creating round dots along a curve. By opening the Brush Profile attributes in the Attribute Editor, you can set how many of these dots are created and how far apart they are spaced. By setting Stamp Density, Brush Width, and Softness you can choose between a dotted line with harsh edges or a soft flowing brush stroke.



Stamp Density A low value creates a dotted line while a high value creates a smooth, continuous line.

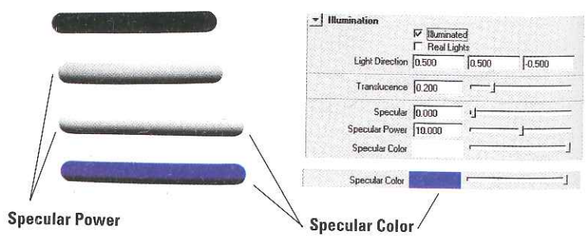
Shading

You can shade the Color, Incandescence, and Transparency of any Paint Effects stroke. In the Paint Effects window, you will find sliders that let you change these settings quickly. For more options, you can also open the Template Brush window to make changes. If you are working in 2D canvas mode, you can only make changes to brush settings before you paint with them.



Illumination

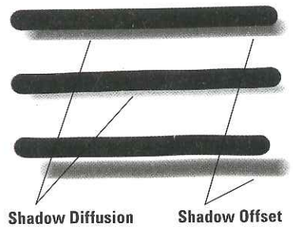
Every brush stroke can contain lighting information. In the Template Brush window you have the option to use real lights from the scene or you can choose to have the brush be self-lit by specifying the position of the specific light. In the Illumination section of the Template Brush window, you can also adjust specular qualities such as Specular, Specular Power, and Specular Color. By doing so, you can create a 3D feel to an otherwise 2D brush stroke.

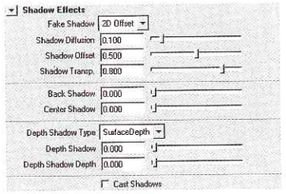


Shadow Effects

You have the option to add shadows to your paint stroke. When using Paint Effects, you can use either Fake or Real Shadows. Fake Shadows take less time to render and are usually sufficient for 2D textures or flat surfaces.

Real Shadows require you to select Cast Shadows from the Attribute Editor, and then turn on Depth Map shadows for the light you want to cast shadows. Real Shadows only work in Paint Scene mode and show up when you render.

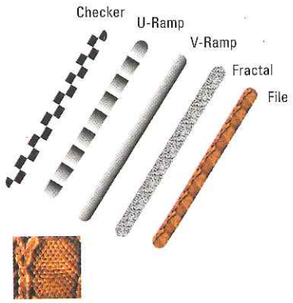




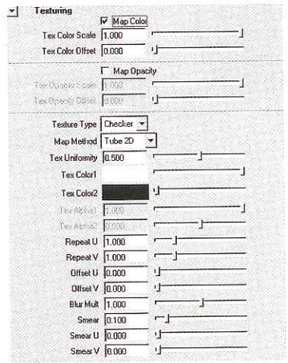
Texturing

You can add a texture to a Paint Effects brush using either a Checker, U or V Ramp, Fractal or File Texture. This is done by first enabling the Map Color box in the Template Brush window located in the Shading section, and then selecting what type of texture you want to map in the Texture Type box. You also have an option to choose which type of Mapping Method to use. You can map the texture to your stroke using either 2D or 3D methods.

When you enable the Map Color or Map Opacity, you will notice that as you map a texture to a stroke, there is a separate color channel for the texture and for the original shading color. The original shading color value is still used. When you map a texture to your stroke, the texture uses the colors in the texture color section. The texture then takes the original texture color and multiplies the texture color value by the color value. For example, if you have a stroke that has a Checker mapped to it, and your original color is black, you will not see the Checker effect because black equals 0. If you change the color to white (value = 1), you will see all colors in the texture section mapped to your stroke.



File Texture



Common Values

When you explore some of the many attributes that make up Paint Effects, you will see some recurring attributes:

Values 1 and 2

Certain values have a 1 or 2 beside them. These are values that affect strokes where tubes are enabled. The value 1 stands for the base of the tube, while 2 represents the tip of the tube.

Dropout

Dropout defines the proportion of the given attribute that is randomly "pruned" to give a more natural look. For example, a Twig Dropout setting of 0 will produce exactly the same amount of twigs each time it is created, where a setting of 1 will prune all twigs.

Decay

This value defines the rate at which a factor diminishes for a given attribute.For example, setting a value of 1 for Split Size Decay creates branches the same size as the branch they are branched from. Setting a value less than one will produce them smaller than the original.

Rand

Sets the amount of randomization on a given attribute. The larger the Rand value, the higher the variation in values. For example, if Split Rand is 0, branching will occur at equal intervals along the tube. A higher value will cause the spacing to be more random.

Bias

Bias is used in conjunction with a random value for a given attribute. Setting a value for Bias will push or pull those random values towards the Bias values. For example, setting a positive value for Bias will create more wider tubes than thinner ones. A value of 0 will create just as many wide tubes as thin ones.

Mapping Methods

When you map a texture, Maya gives you the option to use different mapping methods.

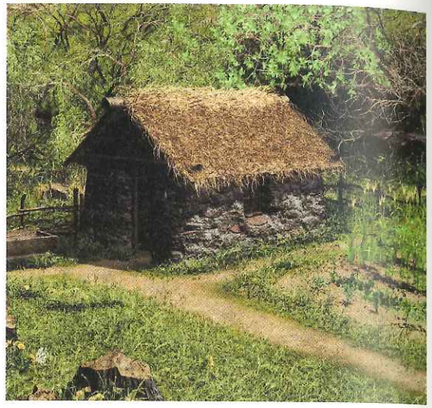
Full View
Full View Mapping maps your chosen texture across the entire screen view, and reveals it where you paint.

Tube2D Mapping
Tube2D Mapping maps your texture along the part of the stroke that is visible to the camera, projected as if the stroke were flat and oriented towards the camera.

3D Mapping
The 3D Mapping method wraps the file around the actual stroke in 3D space, as if the stroke were really a tube (or in this case, a snake).

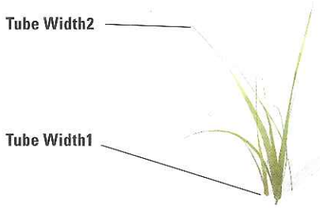
Tubes

A tube is an object that grows from a stroke path. To create vegetation, trees, hair, rain, and other unique 3D brush strokes, you must enable the Tubes option on a Paint Effects stroke. When you enable Tubes, a simple stroke sprouts a series of tubes. Enabling Tubes in the Attribute Editor allows you to create brushes that simulate vegetation or other organic growth. The attributes are named after the parts of a tree and are very similar in their function. However, the power of Paint Effects is that it allows you to pick which specific parts of the Tube you want to use; nothing stops you from using only some of these elements. The shape of the tube can then be shaded and lit using the same lighting as your scene.



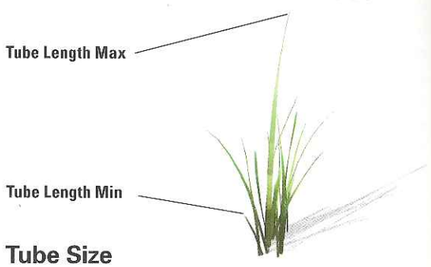
Tube Creation

As you paint a stroke, sample points are created along the stroke. The number of sample points on a stroke depends on the settings you make to the attributes in the strokeShape node. At each sample point, a new tube can be created and any existing tubes will grow a new segment. These segments can then become branches, twigs, leaves, flowers, or buds. By setting different attribute combinations, the tubes can grow into an infinite number of shapes and sizes.



Tube Shape

At the most basic level, the shape of a tube is determined by Tube Width 1 and 2 values, which set how thick the tube will be at the base and the tip, respectively. Other attributes that affect the shape of a tube are Twist, Flatness, Noise, Wiggle, and Curl.



Tube Size

The attributes Length Min and Length Max determine the minimum and maximum length that a tube can be. A brush with a big difference in these values will create a stroke with tubes that are quite varied in height.

Tube Density

Density is dependent on the **Tubes per Step** attribute. Increasing the value of this attribute creates more tubes at each sample point along the curve.

Tube Direction

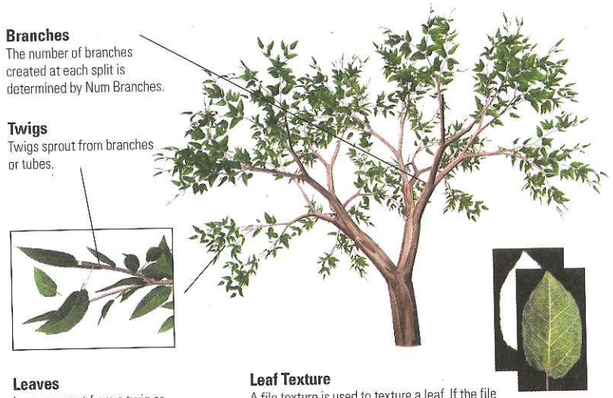
Tube Direction specifies whether the tubes use the Normals or path direction. If you use the Normals, you can then set the Elevation and **Azimuth**, which will determine the direction the tubes point. If you use **Path Direction**, the tubes will try to follow the path of the curve you paint.

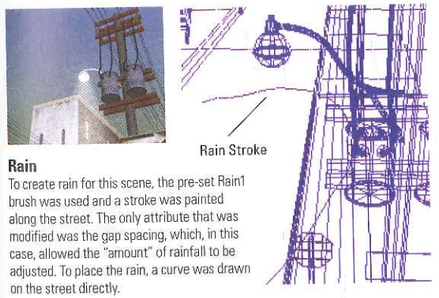
Growth

Growth is used to grow the tubes over time and have them sprout branches, twigs, leaves, flowers, and buds. Adjusting the attributes in each of these subsections allows you to simulate many natural, and some unnatural effects. Much like a shading network, it is a good idea to consider the various material qualities you want to achieve in advance. For example, if you understand how a plant looks and behaves, you will find it easier to translate these into the various Paint Effects growth attributes.

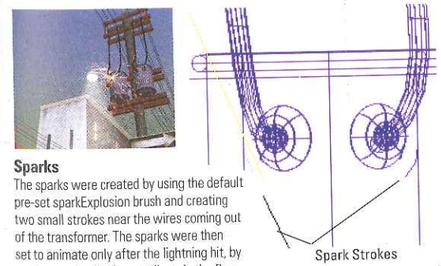
Working With Paint Effects Tubes

Through the use of tubes, you can create a large number of effects such as rain, lightning, sparks, and fire. In most cases, you will pick a pre-set brush and then modify the attributes to fit into the look of your scene. When you paint a stroke into your scene, you generally paint the stroke onto your target surface.

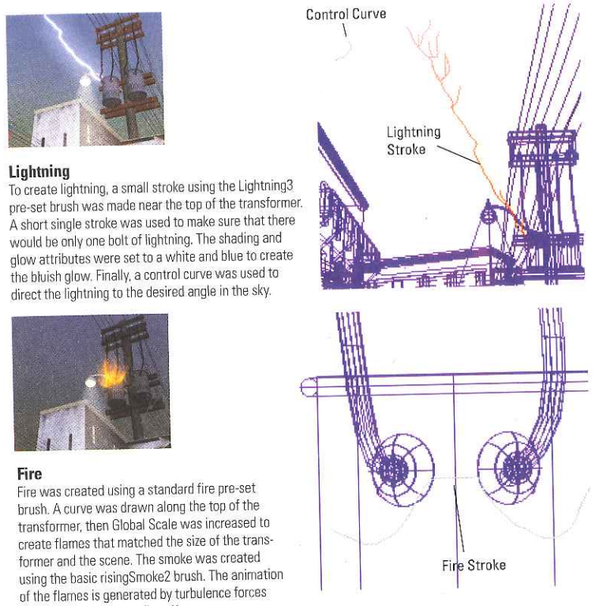




Rain
To create rain for this scene, the pre-set Rain1 brush was used and a stroke was painted along the street. The only attribute that was modified was the gap spacing, which, in this case, allowed the "amount" of rainfall to be adjusted. To place the rain, a curve was drawn on the street directly.



Sparks
The sparks were created by using the default pre-set sparkExplosion brush and creating two small strokes near the wires coming out of the transformer. The sparks were then set to animate only after the lightning hit, by turning on the clip time attribute in the flow animation section and by setting the time that the sparks were to occur.



Lightning
To create lightning, a small stroke using the Lightning3 pre-set brush was made near the top of the transformer. A short single stroke was used to make sure that there would be only one bolt of lightning. The shading and glow attributes were set to a white and blue to create the bluish glow. Finally, a control curve was used to direct the lightning to the desired angle in the sky.

Fire
Fire was created using a standard fire pre-set brush. A curve was drawn along the top of the transformer, then Global Scale was increased to create flames that matched the size of the transformer and the scene. The smoke was created using the basic risingSmoke2 brush. The animation of the flames is generated by turbulence forces that were built into the fire effects.

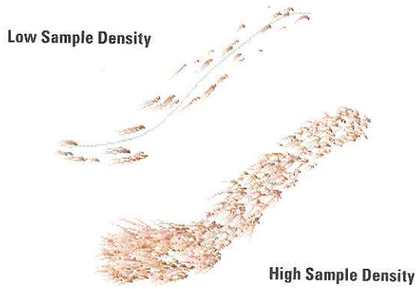
Brush Stroke

When you draw a brush stroke with a pressure-sensitive graphics tablet and pen, you modify parts of the stroke based on how hard you press as you paint. In Maya, this information is retained in the strokeShape node and offers another way of controlling how the brush information appears when rendered. In 3D scenes, you can turn curves into strokes and apply brush settings. You can also capture the brush attributes from any brush and create your own pre-set for later use.

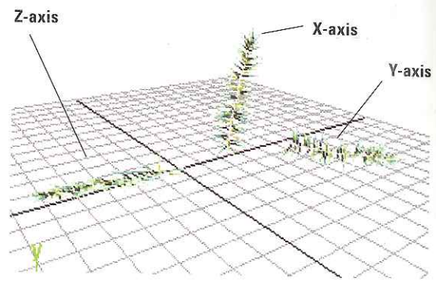
Stroke Attributes

Strokes are the curve that the Paint Effects brush is applied to. When you paint, you will notice that painting very slowly produces a result very different from painting quickly, since there are more sample points along the stroke. In this respect, your stroke acts much like a paint brush on a real canvas. Setting attributes in the strokeShape node affects the position and number of tubes that are contained on a particular curve.

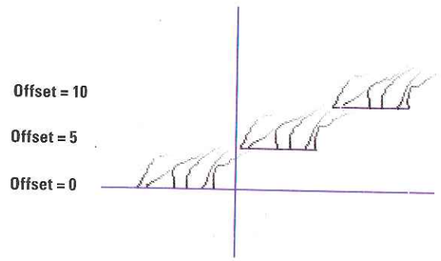
Painting Curves
The power wires in the above image were created not with geometry, but with curves that have the default template brush stroke applied.



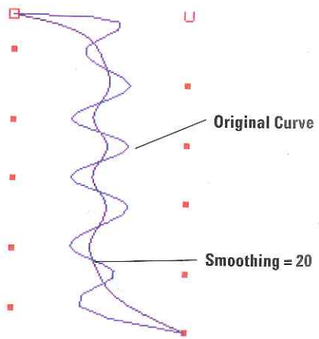
Sample Density
A sample point along a stroke either starts a tube or grows a tube by one segment. If you draw a stroke slowly or with heavy pressure, there will be many more sample points in a given length as opposed to a curve that was drawn quickly or with light pressure. Increasing the sample density on the stroke that was drawn quickly can help make the brush look more similar to the one that was drawn slowly.



Normal Direction
When you create a stroke on the ground plane, the Use Normal attribute is automatically turned on and set to the Up Vector. You can change this setting and have the Normals point in either X, Y, or Z directions. Any tubes contained on that stroke will grow in the selected direction. When you paint on an object, the **Use Normal** is turned off and the surface Normal of the geometry is applied instead.



Offset
The offset lets you set a value that will paint the brush at a distance away from the surface you are painting. For example, if you want to place some clouds in the sky, you could use a cloud brush with a high value for offset and paint on the ground plane. This will put your stroke on the surface, but your brush will actually paint the clouds away from the stroke.

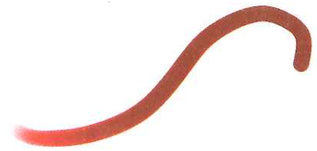


Smoothing
Smoothing allows you to dampen the values between CVs on a curve to create a smoother path for your stroke. With enough smoothing, it is possible to create a straight line out of even the most drastic curve.

Pressure Mapping

The strokeShape node also contains pressure mapping information. If you use a graphics pressure sensitive tablet, up to 3 brush-creation attributes can be mapped to the pressure used on the tablet as a stroke is drawn. You can access these settings by selecting **Paint Effects > Paint Effects Tool - option**.

Scale

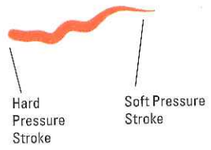


Transparency

Softness

Num Leaves

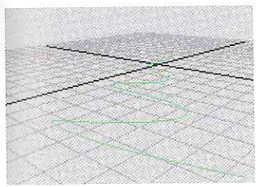
Tubes per Step



Combining Mappings
Pressure mapping becomes most effective when you combine different mappings to simulate an actual paint stroke. For example, the stroke to the left uses scale and transparency mappings. Pressing hard on the tablet gives you a thick dark stroke, while pressing lightly gives you a thin, wispy stroke.

How to Put a Brush on a Selected Stroke

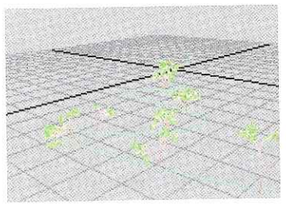
You can apply any brush to any curve or Paint Effects stroke in your scene. This is useful for using the same brush on multiple curves without having to paint each stroke.



Step 1: Select the Stroke
In your scene, select the stroke curve.

Step 2: Load to Template Brush
Open the Visor and select the desired brush to load it into the Template Brush.

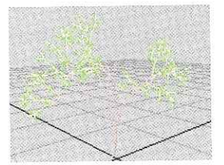
Step 3: Apply the Brush
In the Paint Effects menu, select **Paint Effects > Apply Settings to Selected Strokes**.



Step 4: Render Your Scene
Add lights to your scene and then render.

How to Create Your own Pre-set Brushes

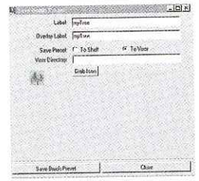
Once you have created a brush that you are happy with, you will want to save it so that you can use it in the future. Maya lets you customize your workspace by saving your brush to either the Visor or the Shelf.



Step 1: Edit Brush Attributes
Edit the brush attributes in the Attribute Editor or Channel Box to get a brush you like.

Step 2: Load to Template Brush
Select **Paint Effects > Get Settings** from Selected Stroke. This will load the brush into the Template Brush.

Step 3: Save Preset
With the brush loaded into the Template Brush, select **Paint Effects > Save Brush Presets**.



Step 4: Grab Icon
Switch to the Paint Effects preview window by pressing "8" on the keyboard. With your brush rendered, select **Grab Icon** and click+drag an area around the brush to create an icon.

Cloth

With Cloth, you can create realistic animated cloth within the Maya environment. Cloth gives you the ability to model garments for any animated 3D figure, apply dynamic effects, and simulate the cloth behavior.

If you are creating a simple piece of cloth like a sheet or tablecloth, you can create a polymesh or NURBS shape and make it a cloth object. Alternatively, attaching panels together for constructing a garment is similar to the way a tailor makes clothing.

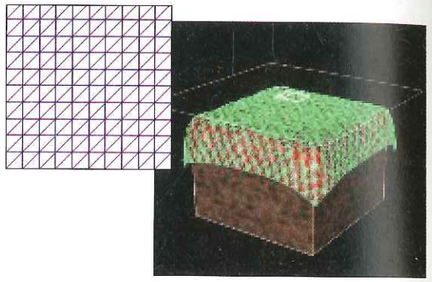
Cloth Animation

Cloth simulations are driven by dynamic solvers; there are no keyframes. A number of constraint types in Maya allow you to restrict the movement of your character's clothing. Collision constraints let your character's clothing move with the character's body.

Cloth objects

A cloth object is a piece of geometry simulated as cloth. You create cloth objects from polygonal shapes or NURBS shapes. The original shape is hidden and the tessellated cloth shape is displayed. The original shape and the cloth shape are grouped under the object's transform.

With NURBS objects and certain procedurally-generated polygonal objects, you can get artificial stress lines caused by the regular tessellation. If you change the topology of the polygonal object after simulating, you have to resimulate.

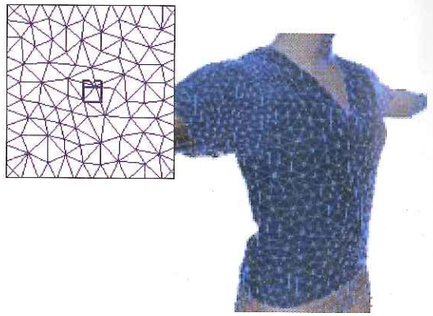


Garments

A garment is one or more panels that are seamed together to form a cloth. A panel is made up of two or more NURBS curves that are on the same plane and form a closed region.

When you create a garment from curves, Cloth creates a mesh with varying sizes of triangles that are randomly distributed. The mesh has no regularity or stress lines. This creates more natural folds.

In addition, if you change the resolution of a garment after simulating, Cloth can update the geometry without resimulating. However, you need to simulate for the cloth to move with the new resolution.



Collision Objects

In order for your cloth to drape over your model or an object, you need to make it a collision object. When you make an object a cloth collision object, Maya connects it to the cloth solver and adds three collision object attributes.

Polygonal objects, NURBS, and Subdivision Surfaces can all be used as collision objects. If your model is a NURBS object or a Subdivision Surface, Maya automatically converts it to polygons when you make it a collision object.

Dress-up Pose

It is recommended to start the cloth simulation from a dress-up pose. This will eliminate any self-collision of the garment worn by the character, and minimize wrinkling in the initial fitting of the garment.

To create a character animation, you should move your character from the dress-up pose to the position it will be in at the start of the animation. You may want to add some frames to the start of your scene to accommodate this transition, or, the cloth might not react as expected.

Draping and fitting

After you create the garment, you drape it and fit it to the character. To drape the garment on the model, you specify the model as a collision object and use the cloth solver to drape the garment over the model.

Fitting involves modifying the original garment to accommodate peculiarities of the character on which it is draped. You can influence how the cloth settles on the character using constraints and dynamic fields. For example, you can pull out wrinkles or pin portions of the garment to specific places on the character. You can assign different properties to the panels and set various attributes of the cloth to change the physical behavior of the cloth.

Once the garment has settled, you can save this initial position of the garment and begin animating.

Simulate Cloth

Once you have your cloth ready to drape over your character, you can start the simulation. The simulation is performed by the cloth solver, which assembles information on all the garments, cloth objects, bodies they interact with, and any fields or constraints applied to the cloth.

Cloth Cache

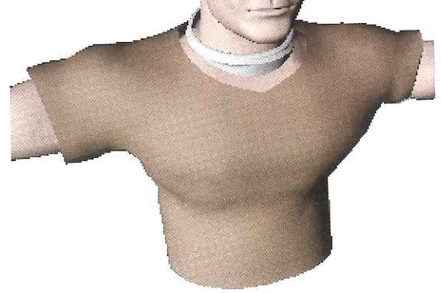
When you simulate cloth by playing through the Time Slider, Cloth creates a cache file to store all the positions of the vertices of the cloth. The cache lets you quickly preview the results of the cloth simulation without having to render to a flipbook. This offers many benefits, including scrubbing back and forth in the Time Slider and re-using a cache so you don't have to solve at render time.

Cloth Constraints

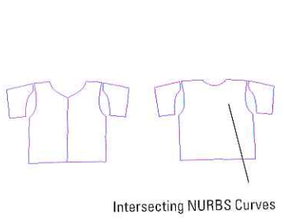
Sometimes you may want to constrain certain parts of your clothing to your character so they don't fall off. You can do this using constraints. For example, you can use constraints to make sure the pants of your character stay on, or to keep straps in a dress attached to the shoulders. In addition, you can use constraints to pin clothing together or attach items such as buttons or pockets.

Dynamic Fields

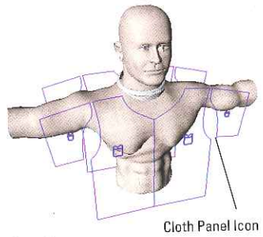
Because Cloth is fully integrated with Maya, you can use Maya's dynamic fields to affect the motion of your cloth. You create the field the same way you create a field in Maya. You connect the field to cloth using a type of constraint known as a field constraint. You can connect field constraints to cloth vertices or panel curves.



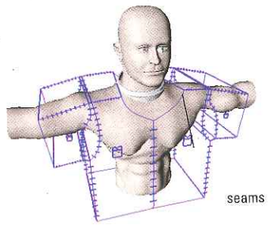
The model with the final cloth shape after the simulation.



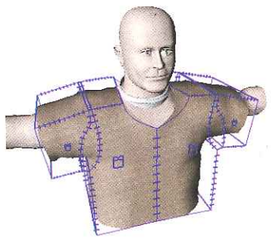
Step 1
The cloth object begins as a series of intersecting NURBS curves that form the front and back shape of the shirt.



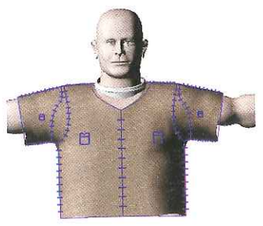
Step 2
Panels are defined for the different regions of the shirt by selecting **Cloth > Create Panel**.



Step 3
Next, one panel is defined by using **Cloth > Create Garment**. Seams are created where each panel overlaps. This creates a "cage" around the model and a polygonal "cloth mesh."



Step 4
The body geometry is made into a collision object by selecting **Cloth > Create Collision Object**. At this point, no dynamic interaction has occurred between the cloth object (shirt) and the collision object (body). Therefore, the cloth appears very loose.



Step 5
Select **Simulation > Start Simulation** to perform the cloth simulation. Maya applies gravity to the cloth. Based on the cloth properties set by the user, the cloth collides, interacts, and settles to take shape around the body.