



Version 6



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While every attempt was made to clarify in the documentation the differences between how Maya operates on the IRIX and Linux platforms, you may encounter subtle differences.



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About

Surface shading



Image by Danny Mousses

In the real world, what an object is made of is one of two main factors that determine the appearance of its surface (the other is light). This is because when light hits the objects, some of the light is absorbed and some of it is reflected. The smoother the object, the shinier it is; the rougher the object, the more matte it is.

In Maya, the appearance of a surface is defined by how it's *shaded*. Surface shading is a combination of the basic material of an object and any textures that are applied to it.

In Maya, *materials* (also called *shaders*) define an object's substance. Some of the most basic attributes of materials include color, transparency, and shine. For more information on materials in Maya, see "Maya materials" on page 23.

Factors beyond basic color, transparency, and shine that determine the appearance of an object's surface (such as more complex color, transparency, shine, surface relief, reflection, or atmosphere) are defined by textures. For more information on textures, see "Maya textures" on page 25.

Surface texture

In visual arts, a texture is any kind of surface detail, both visual and tactile. In Maya, you create surface detail with textures connected to the material of objects as texture maps. (Materials define a the basic substance of an object; see "Surface shading" on page 15 for more details.)

For more information on texture maps, see "Texture mapping" on page 30.

About > Color

Factors beyond basic color, transparency, and shine (see below) that determine the appearance of an object's surface include:

- Surface relief. See "Surface relief" on page 247 for more information.
- Whether or not the surface casts or catches reflections. See "Reflection" on page 283 for more information. (Objects typcially reflect backgrounds or environments; see "Backgrounds" on page 261 for more informaion.)
- Atmosphere. See "Fog, smoke, dust, and silt" on page 291 for more information.

You can also bake illumination and color to a texture that you can later apply to objects in a scene. See "Baking illumination and color" on page 299.

Color

You can work with color in Maya in so many different ways. Here are some of the most common:

- Change the basic color of an object by adjusting the color attribute of a material applied to the object. To find out more about material node attributes, see "Render node attributes" on page 20.
- Apply a texture as a color map to the material's color attribute.
 - For more information about texture mapping, see "Texture mapping" on page 30.
 - To map a 2D or 3D texture, see "Map and position textures" on page 76.
- Use a Ramp Shader for extra control over the way color changes with light and view angle. You can simulate a variety of exotic materials and tweak traditional shading in subtle ways. For a description of the Ramp Shader, see "Ramp Shader" on page 129.
- Expand, enhance, or manipulate colors in applied textures using the Color utilities. For example, you can blend colors, adjust contrast, and convert HSV to RGB. For a description of each of the color utilities and what you can use them for, see "Color utilities" on page 363.

Transparency

You can work with the transparency of an object in the following ways:

• Change the transparency level of an object adjusting the transparency attribute of a material applied to the object. To find out more about material node attributes, see "Render node attributes" on page 20.

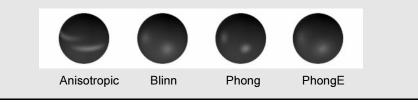
About > Specular highlight (shine)

- Apply a texture as a transparency map to the material's transparency attribute to designate which areas of an object are opaque, transparent or semi-transparent.
 - For more information about texture mapping, see "Texture mapping" on page 30.
 - To map a 2D or 3D texture, see "Map and position textures" on page 76.

Specular highlight (shine)

You can work with the shininess of objects in your scene in the following ways:

- Change the intensity and size of the specular highlights of an object by adjusting the Specular Shading attributes of a material applied to the object. To find out more about material node attributes, see "Render node attributes" on page 20 and "Common surface material Specular Shading attributes" on page 121.
- Apply a texture as a specularity map to the material's Specular Color attribute to designate which areas of an object shine (and the color of the highlights).
 - For more information about texture mapping, see "Texture mapping" on page 30.
 - To map a 2D or 3D texture, see "Map and position textures" on page 76.
- Note Only materials with specular attributes (Anisotropic, Blinn, Phong, and PhongE) have surface highlights. The *specular highlight* is the white shiny glow on the material.



What are specular highlights?

Some surfaces are shinier than others (for example a wet fish has a shinier surface than a dry leaf). Depending on how shiny a surface is, it reflects light in different ways.

About > What are specular highlights?

Shiny objects reflect light directly; matte objects diffuse light. Specular highlights show the places on the object where the light sources are reflected at consistent angles; reflections on an object show, among other things, light bounced from surrounding objects.

Specular highlights depend directly on the view (camera), not the position of the light, like diffuse shading does.

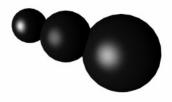
Tip The Blinn material is recommended for shiny surfaces in animations. Highlights on other specular materials, like Phong and PhongE, may flicker when animated.

Highlights



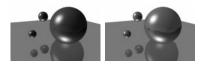
The size of a specular highlight on a surface makes the surface look either flat or shiny.

Highlight color



You can control the color of highlights on surfaces.

Reflections



You can control the degree of reflectivity as well as other surface properties like refracted color.

About > Shading networks

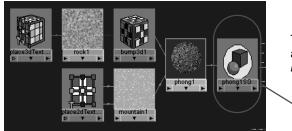
Shading networks

Shading networks

A *shading network* is a collection of connected rendering nodes that defines how colors and textures contribute (usually with lights) to the final look of surfaces (materials). A shading network typically consists of any number of connected rendering nodes plugged into a shading group node. (For more information about render nodes, see "Render nodes" on page 20.)

A good portion of your time building shading networks is spent connecting node attributes to each other and adjusting node attributes to describe what a surface should look like and how it should be positioned.

To build shading networks, see "Build shading networks" on page 55.



The *shading network* is a a collection of connected *nodes*.

Shading group node

Shading group node

Shading networks are designed as a data flow network, where data streams from the left side of the network toward a final shaded result that emerges from the right node. The right most node (which is not always visible by default; click the Input and Output Connections button in the Hypershade to see it) is the Shading Group for that particular network.

The Shading Group is a collection of materials, textures, and lights that efficiently describe all the necessary attributes required to shade or render an image affect the final render of the surface.

All of the nodes connected upstream (that is, farther to the left of the node) of the shading group contribute to the final look of surfaces in the scene. Adjusting any node's attributes or connections causes a downstream (that is, farther to the right) reaction that can be seen in the final rendered image. To learn more about these input and output connections, see "Show node connections" on page 62.

For a description of the Shading Group node's attributes, see "Shading group node" on page 163.

About > Shader network libraries

Shader network libraries

Maya ships with a library of shader networks. To install the shader library, if it is not installed by default, see the *Installation and Licensing* guide. To view and work with shader network libraries, see "Work with shader libraries" on page 70.

Maya also ships with a number of mental ray shading networks (mental ray for Maya must be loaded to see them in the Hypershade). To create and load mental ray for Maya shading networks, see "Work with mental ray shaders" on page 83

Render nodes

Render nodes are the individual components you interconnect to use as building blocks to produce all rendering effects. Like all other nodes in Maya, you can animate or map render nodes to other nodes' parameters. For more information on Maya nodes, see *"Nodes and attributes"* in the *Basics* guide.

Texture nodes, placement nodes, and material nodes along with their input and output connections (attributes) define all aspects of the final rendered images, from surfaces to lights and shadows.

- To learn more about material nodes, see "Surface, displacement, volumetric materials" on page 23.
- To learn more about texture nodes, see "Texture nodes" on page 164.
- To learn more about placement nodes, see "2D and 3D texture positioning" on page 33.

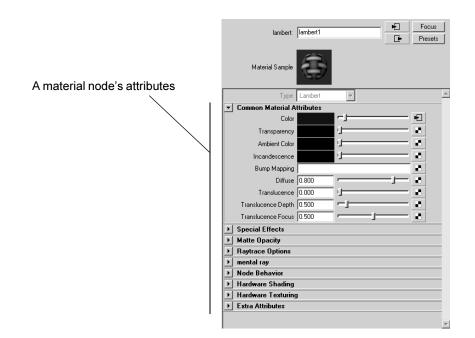
You can connect nodes to create the effects you want. You can also share nodes to create visual relationships, and to make rendering more efficient. For example, two objects can share a single texture so that both objects appear the same, but less memory and/or processing is required.

You can see and work with rendering nodes and shading networks in the Hypershade. To learn more about the Hypershade, see "Hypershade" on page 99.

Render node attributes

A node attribute describes one aspect of the node. So, when you adjust an attribute of a node, you adjust one aspect of its description. For example, you can change the color attribute from red to blue. Or, you can change an opaque object to transparent by adjusting the transparency attribute.

About > Render node connections



Although you can interactively adjust some attributes, typically you verify and enter precise numerical values using the Attribute Editor or display and adjust node attributes in the Attribute Spreadsheet or the Channel Box. (Only some attributes are displayed in the Channel Box. All attributes are displayed in Attribute Editor and Attribute Spreadsheet. To find out more about general editors such as the Attributes Editor and the Attribute spreadsheet, see "Attribute Editor" on page 189 in the Basics guide.)

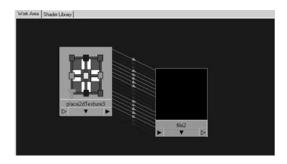
To adjust render node attributes, see "Adjust node attributes" on page 67.

Render node connections

Connections between node attributes are shown by colored arrowed lines in the Hypershade. The connection lines between nodes indicate what type of data flows through the connection. Depending on the types of nodes and connections used, different information is passed. That is, values may be of color, distance, position, angle or object ID.

Note mental ray for Maya expects only certain connections to be made to the message attribute in the Attribute Editor. See "mental ray shader connections" on page 37 for more details.

About > Render node connections



Some information can come as a single value (for example, OutAlpha is a single value) or as triple (for example, an RGB value or an XYZ value). Triple connections are represented by green connection lines. Single, double, triple, data, and array data each have an assigned default color.

You can customize the colors and their meanings. To change default connection line colors, see "Change default connection line colors" on page 59.

To connect render nodes, see "Connect nodes" on page 62.

Tip When you point to one of the lines that connects two nodes by their attributes, and information appears about the connection. To show and hide node connections, see "Show node connections" on page 62.

The Connection Editor

Each node has a default attribute and a list of commonly connected attributes that lets you make node connections interactively (dragging and dropping in Hypershade). The Connection Editor, however, is the best tool for fine-tuning a shading network and for making non-default connections.

Note Some utility nodes can connect to a material's attributes only through The Connection Editor.

The Connection Editor shows node network information in a side-by-side layout so that you can view two connected nodes in a node network. You can quickly and easily traverse from node to node and show a node's outputs or inputs to easily facilitate connections, which means you can make connections in either direction in a node network.

About > Surface, displacement, volumetric materials

To connect nodes with the Connection Editor, see "Connect render nodes using the Connection Editor" on page 65.

Maya materials

Surface, displacement, volumetric materials

Though 3D surfaces in Maya respond to light similarly to those in the real world, there are important differences in the way that surfaces and lights interact in computer graphics software. Material nodes are a type of render node (see "Render nodes" on page 20) that, when applied to an object, let you define how the object's surface appears when rendered.

See also "Surface shading" on page 15.

In Maya, material nodes define how surfaces react to light. (The term shader is often used to describe the role played by a material node, especially in mental ray for Maya.) Maya contains several types of material nodes that help you simulate the real-world qualities or behaviors of surfaces to light: Surface material nodes, Displacement material nodes, and Volumetric material (atmosphere) nodes.

You can set a material's attributes, such as color, specularity, reflectivity, transparency, and surface detail of scene elements to create a wide variety of realistic images. For a detailed description of Maya's materials, their attributes, and guidelines on how to change them, see "Material nodes (Maya software)" on page 116.

Note When you first create an object, Maya's assigns a special version of the Lambert material (a surface material) by default.

Surface material

Surface materials represent the types of surfaces onto which you can map textures. Attributes such as shininess, matte, reflectivity, glossiness, etc., vary among the different types of materials in Maya. For example, if the texture requires a shiny surface, such as chrome, use a Phong material rather than something like a Lambert.

For a detailed description of a surface material's attributes, see "Surface materials" on page 116.

Displacement material

The displacement material lets you use an image to specify surface relief on objects in your scene. To find out more about surface relief, see "Surface relief" on page 247.

About > Volumetric material (atmosphere)

Volumetric material (atmosphere)

In the real world, when you photograph an object, it is usually within an atmosphere (air) and is surrounded by other objects (background).

Volumetric materials describe the physical appearance of phenomena which occupy a volume of space (for example, fog, smoke, dust or other fine particles). You can raytrace volumetric materials and produce effects such as displaying light fog through mirror reflections and refractions.

For a description of volumetric materials see "Volumetric materials" on page 147.

To use volumetric materials, see "Simulate fog, smoke, or dust" on page 292.

Layered shaders

You can layer shaders when you want to use more than one material for an object. Layered shaders let you create the appearance of variations in the material qualities of the surface by combining two or more material nodes that each have their own qualities. Layered shaders render more slowly than other materials, so consider using Layered textures instead to achieve similar results.

To use a layered shader, see "Layer shaders" on page 73.

For a description of the Layered Shader node's attributes, see "Layered Shader" on page 127.

Layered textures with the Layered Shader node

The Layered Shader has an attribute called compositing flag that causes the shader type to layer materials or layer textures. You can use this to layer textures with the Layered Shader node. However, using the Layered Texture node is recommended because you can set many more options. See "Layered textures" on page 26 for more information.

If you choose the texture option for the compositing flag, you must plug the whole network into a material (for example, Phong or Blinn).

For a description of this flag, see the Layered Shader node's attributes in "Layered Shader" on page 127.

About > Double-sided shaded surfaces

Double-sided shaded surfaces

Double-sided shading lets you shade a surface with one material on one side and a different material on the other side. This is the only way you can apply more than one material to a NURBS surface. You use both the Condition and Sampler info utility to create this effect. For more information on these utility nodes, see "General utilities" on page 339.

To create double-sided shaded surfaces, see "Create double-sided shaded surfaces" on page 73.

Maya textures

2D and 3D textures

Texture nodes are a type of render node that, when mapped to the material of an object, let you define how the object's surface appears when rendered. For more info on render nodes, see "Render nodes" on page 20.

Texture node(s) (with the material node(s)) feed into the Shading Group node, which tells the renderer how to shade the surface. For more information on Maya's Shading Group node, see "Shading group node" on page 19.

Texture nodes are procedural textures generated by Maya or bitmap images imported into Maya (see "Procedural textures" on page 26) that you can use as texture maps for material attributes. Texture maps on various attributes such as color, bump, and specularity affect the appearance of the material. For more information about texture maps, see "Texture mapping" on page 30.

2D textures

2D textures wrap around an object, like gift wrapping, or stick to a flat surface, like wall paper.

- For a detailed description of Maya's 2D textures, see "2D textures" on page 164.
- To map a 2D texture see, "Map a 2D or 3D texture" on page 76.
- To position a mapped 2D texture on an object see, "Position 2D textures and labels" on page 77.

3D textures

3D textures project through objects, like veins in marble or wood.

About > Environment textures

With a 3D texture, objects appear to be carved out of a substance, such as rock or wood. You can scale, rotate and move 3D textures interactively in a modeling view to achieve the desired results.

- For a detailed description of Maya's 3D textures, see "3D textures" on page 188.
- To map a 3D texture see, "Map a 2D or 3D texture" on page 76.
- To position a mapped 3D texture on an object see, "Position 3D textures" on page 78.

Environment textures

Environment textures are commonly used either as backgrounds for objects in your scene or as reflection maps.

For more information on simulating reflections with environment maps, see "Reflection" on page 283.

For a detailed description of Maya's Environment textures, see "Environment textures" on page 207.

Layered textures

There are two ways to layer textures in Maya: using the Layered Shader with the texture compositing flag (see "Layered shaders" on page 24), or with the Layered Texture Node.

Though the workflow for using the Layered Texture node is similar to the Layered Shader, using the Layered Texture node is recommended because you can set many blend modes.

To use the Layered Texture Node to layer textures, see "Use a layered texture" on page 80.

Procedural textures

Procedural textures are generated by Maya. In fact, all of Maya's 2D textures (except for file and movie) and 3D textures are procedural textures.

Procedural textures are 2D or 3D plots of mathematical functions (called procedures) that have no limitation in resolution (size). You can adjust attributes for different aspects of a procedural texture to create different looks. 2D procedural textures operate much like 2D file textures in that they attach themselves to the UV coordinates of the geometry. 3D procedural textures ignore UV coordinates.

About > File textures

File textures

File textures are bitmaps scanned from photographs, taken with a digital camera, or painted in a 2D or 3D paint package that you bring into Maya to use as a bitmap. File textures filter better than most procedural textures and can result in better image quality.

Note You can render an entire branch of a shading network to use the illumination, shadow, shading, and textures as a file texture (texture map) for the following reasons:

- To reduce rendering time of particularly complex networks or if mental ray's high-profile global illumination features are involved.
- To obtain lighting effects that would be difficult to achieve in other ways.

For more information see "Baking illumination and color" on page 299.

HDR images as file textures (mental ray for Maya)

mental ray for Maya supports High-Dynamic Range (HDR) images as file textures.

For more information about HDR images, see "High Dynamic Range Imaging (HDRI)" on page 29 in the Lighting guide.

Considerations for creating file textures

Animated file textures

To use a sequence of image files to create an animated file texture, the file extensions must be separated from the basename and/or the extension by dots. For examples, see "Image Name" on page 169.

About > Considerations for creating file textures

Note Using "." to delineate animated file texture names, may cause the wrong frame to be used for texture mapping.

Maya parsable, animated file textures should be of the form XXX.ext.###, where XXX is the filename, ext is an optional file extension (sgi, tif, iff, and so on), and ### is the frame number.

It is also possible to use file textures of the form XXX.###.ext. We do not support XXX###.ext (without the "." between XXX and ###), nor XXX.YYY.###.ext (but XXX_YYY.###.ext is fine).

File textures for hardware rendering

Textures greater than 2048 x 2048 or 4096 x 4096 typically aren't supported by existing hardware. Larger textures (in one or both dimensions) use a lot of memory and take longer to render because the hardware renderer must spend more time reducing their size.

In general, when rendering with file textures, take into consideration how much space the texture takes up in screen space. Try to keep textures as small as possible when rendering. This substantially decreases rendering time and memory usage and may result in better quality (fewer aliasing problems and texture crawling).

Tileable file texture images

Like any other texture, you map a file texture to an attribute of a material (shader). You can map file textures as a tileable (repeating) image where the opposing edges of the texture line up.

Procedural textures are tileable by default, but if you want to tile (repeat) file textures, you must make sure edges match properly to prevent seams. To make sure edges match properly, you can use an image editing package to offset the image, then touch up light or dark areas in the offset tile.

A tileable bitmap image is one that can be broken down into smaller pieces. Tileable images load faster and easier by the renderer, saving valuable rendering time. For more information on how to reduce the load on RAM during render time by converting your textures to Block Ordered Textures (tiles), see "Cache texture tiles using BOT (block ordered texture)" on page 139 in the Rendering guide.

About > Square vs. non-square bitmap images

Square vs. non-square bitmap images

You want your texture to fit your model perfectly, as though the texture has been painted on. You could measure the surface to which the texture is attached. However, because Maya is more efficient if it scales any nonsquare texture into a square texture, using a square image to begin with is recommended. If the object you are texturing in not square, for example, a lamp pole, place your texture in a black square.



Texture filtering

Texture filtering is an anti-aliasing technique used to refine file textures, reduce flickering, or to achieve special effects. The File texture's Filter attributes (see "File" on page 167) scale the size of the filter and let you specify the amount of blur in the texture map.

If a texture map image is too sharp, it may reveal aliasing (staircase) effects in the final rendered image. By default, Filter is set to a value of 1.0 to help prevent such aliasing effects.

The effect of Filter is related directly to eye space. As the object moves further away from the eye, the more the texture blurs.

Multi-pixel filter plug-ins

(For Maya software only.)

Multipixel filters process the entire rendered image to help eliminate artifacts, such as aliasing or jagged edges in rendered images, or roping or flicking in rendered animations. You can choose from a few different types of multipixel filters or you can create and use your own plug in.

To create and use your own plug-in, see "Create and load a plug-in multipixel filter" on page 101 in the Rendering guide.

About > Texture mapping

Mapping and positioning

Texture mapping

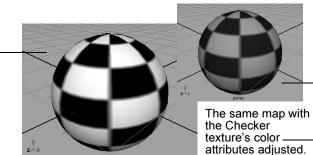
Maya has a number of textures that you can map onto objects. For more information on these textures, see "2D and 3D textures" on page 25.

To apply a texture to an object you map (connect) it to the attributes of an object's material. (Textures and materials are render nodes. Render node attributes describe how the node appears and behaves; for more information, see "Render nodes" on page 20.) The attributes to which the texture is connected determines how the texture is used and therefore how it affects the final results.

For example, if you connect Maya's 2D black and white Checker texture to the color attribute of an object's material, you have applied a color map; the checkered pattern determines which parts of the object appear black and which appear white (or other colors if you adjust the texture's color attributes).

To map a texture, see "Map and position textures" on page 76.

A Checker texture connected to the _____ Color attribute of a sphere's material. This is a color map.



If you connect the black and white Checker texture to the transparency attribute, you have applied a transparency map; the checkered pattern determines which parts of the object are opaque and which are transparent.

A Checker texture connected to the —— Transparency attribute of a sphere's material. This is a



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About > Commonly used texture maps

For a description of how textures stick to materials of objects, see "Mapping methods" on page 32.

Commonly used texture maps

To map a texture, see "Map and position textures" on page 76.

Color maps

By mapping a texture to the Color attribute of an object's material, you create a color map which describes the color of the object.

To learn more about how you can work with color in Maya, see "Color" on page 16.

Transparency maps

By mapping a texture to the Transparency attribute of an object's material, you create a transparency map which let you make parts of an object opaque, semi-transparent, or entirely transparent.

To learn more about how you can work with transparency in Maya, see "Transparency" on page 16.

Specularity maps

By mapping a texture to the Specularity attribute of an object's material, you create a specularity map which lets you describe how shine appears on objects (by controlling highlight).

To learn more about how you can work with highlight in Maya, see "Specular highlight (shine)" on page 17.

Reflection maps

By mapping a texture to the Reflection attribute of an object's material, you create a reflection map which lets you describe how an object reflects its surroundings.

To learn more about how you can work with reflection in Maya, see "Reflection" on page 283.

Bump maps

By mapping a texture to the Bump attribute of an object's material, you create a bump map which lets you add the illusion of surface bump detail to a surface.

To learn more about bump maps in Maya, see "Bump maps" on page 247.

About > Mapping methods

Displacement maps

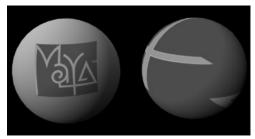
Displacement maps let you add true dimension to a surface at render time, a process which may reduce or eliminate the need for you to create complex models.

To learn more about how you can work with displacement maps, see "Displacement maps" on page 249.

Mapping methods

Normal mapping (default)

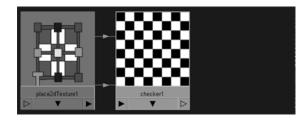
When you map a 2D texture, you can choose the mapping technique Maya uses to apply the texture to the object: normal, projection, or stencil. Mapping techniques determine the relationship between the texture and the surface. By default, textures are mapped as a normal map.



Normal mapping Projection mapping

The texture is mapped to the UV space of the surface and is sized and positioned depending on the UV parameterization of each surface. See the Polygonal Modeling guide for more details.

The shading network for a Normal 2D texture map is made up of the file texture node and the place2D texture node that defines the texture's placement.



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About > Projection mapping

Projection mapping

This mapping technique projects the texture through 3D space like a slide projector.

When you create a projected 2D texture, it behaves like a 3d texture (it has height, width, and depth).

The shading network for a Projection 2D texture map is made up of the file texture node and a Projection node that defines the texture's placement.

Stencil mapping

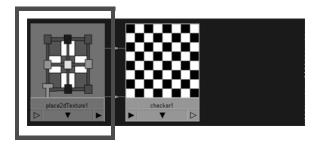
This technique lets you use either a mask file or a color key to remove part of the texture. If your label is not square, project the texture as a stencil to knock out the label using either a mask file or by color keying the texture. Then use the texture's Color Balance > Default Color to set or map the color behind the label.

The shading network for a Stencil 2D texture map is made up of the texture and a Stencil node that defines the masking, and two place2Dtexture nodes: one for the texture, and one for the stencil.

2D and 3D texture positioning

2D texture positioning

A 2D placement node in a shading network defines a texture's positioning and orientation within the UV space of the geometry.



The 2D placement can result directly from the surface's UV space or indirectly through a projection node (if the texture is projection mapped).

About > 3D texture positioning

You can scale (repeat), move (position) or rotate a place2Dtexture to change how the texture appears on the surface to which it is mapped. Other values, such as coverage and default color let you specify how much of the surface area is covered by the texture frame and the color of the border that surrounds the texture (which happens only if the coverage is set to less than 1), respectively.

- To position 2D textures, see "Position 2D textures and labels" on page 77.
- For a description of the place2dtexture node, see "Place 2d Texture" on page 220.
- To change the default operation of the place2dtexture from label mapping to surface placement (which adjusts the contents of the label instead), see "Texture placement vs. label mapping" on page 35.

Shared 2D texture node placement

Different textures can connect to one place2Dtexture node so that they are positioned identically. Edits to the place2dtexture node affect all of the textures to which it is connected. Sharing textures with color, bump, specularity, and other maps that need precise placement is recommended.

To learn about node connections, see "Render node connections" on page 21.

3D texture positioning

A 3D placement node defines a 3D texture or Environment texture's positioning and orientation in world space. 3D placement nodes make it easier to texture multiple surfaces as if they were one.

You can reposition 3D textures with numerical precision in the place3dtexture node's Attribute Editor, or you can use manipulators to reposition textures or labels interactively.

Maya provides two methods to place 3D textures on NURBS surfaces— Interactive Placement or Fit to group bbox (bounding box). Select the method most suitable for your needs. Sometimes using both methods different times works best.

When you create a 3D texture or project a texture onto an object (rather than apply it a normal or as a stencil), a cube-shaped icon appears in the scene that corresponds to the size, scale, and location of the texture on the surface. Especially for animated or deforming objects, you must maintain the correct positioning of the texture on the object. (If the object is animated, you could parent the 3D icon to the geometry, for example.)

To position 3D textures, see "Position 3D textures" on page 78.

About > Texture placement vs. label mapping

Texture placement vs. label mapping

By default, the Texture Placement tool is set for Label Mapping, which lets you stretch, shrink, move, and rotate the texture as if it were a label. You can change set the tool for Surface Placement, which lets you stretch, shrink, move, and rotate the texture as if it were wallpaper.

In both cases, wrap U and wrap V control the tiling of the texture in horizontal and vertical directions (based on the UV coordinates on the object).

To change the Texture Placement Tool, double-click the Texture Placement Tool icon in the toolbar, or select Texturing > NURBS Texture Placement Tool > \Box .

Surface placement

When you drag the manipulator handles, the attribute settings for Repeat UV, Offset, and Rotate UV change in the place2dTexture's Attribute Editor. This lets you stretch, shrink, move, and rotate the texture as if it were wallpaper.



As you middledrag the small boxes...

2d Texture Placement Attributes						
		Interactive Placement				
	Coverage	1.000	1.000			
Translate Frame		0.000	0.000			
Rotate Frame		0.000	J			
		Mirror		🔲 Stagger		
		— · · · · ·		-		
		🔽 Wrap U 🛛		🔽 Wrap V		
	Repeat UV		1.022	Vrap V	5	
			1.022 -0.014	Wrap V	9 9	
		2.765		Wrap V		
	Offset Rotate UV	2.765 -0.375		Wrap V		
	Offset Rotate UV	2.765 -0.375 0.000	-0.014			

... these attribute settings change

Label mapping

When you drag the manipulator handles, the attribute settings for Coverage, Translate Frame, and Rotate Frame change in the place2dTexture's Attribute Editor. This lets you stretch, shrink, move, and rotate the texture as if it were a label.

About > mental ray for Maya Shaders



As you middledrag the small boxes...

💌 2d '	exture Placement Attributes							
		Interactive Placement						
	Coverage	0.406	0.998					
	Translate Frame	0.188	0.000]				
	Rotate Frame	0.000	-1					
		Mirror		Stagger				
		🔽 Wrap U		🔽 Wrap V				
	Repeat UV	1.000	1.000]				
	Offset	0.000	0.000					
	Rotate UV	0.000	<u>ا</u> ا					
	Noise UV	0.000	0.000					
		🗖 Fast						

... these attribute settings change

mental ray for Maya shaders

mental ray for Maya Shaders

mental ray for Maya Shading nodes, such as materials, textures, and lights, allow you to expand the effects achievable when you render with mental ray for Maya.

mental ray for Maya shaders include the Maya Base shaders and Custom Shaders and Phenomena.

Maya base shaders

Maya comes with a collection of mental ray for Maya base shaders that you can assemble into a wide variety of shading networks. You can use the Maya base shaders exclusively or combine them with the standard Maya (or mental ray) shaders.

You use them the same way you do Maya materials, textures, lights, cameras, etc. You can achieve sophisticated photorealistic and non-photorealistic looks with them.

For a complete description of Maya base shaders, see "mental ray for Maya nodes" on page 224.

Custom shaders

Custom shaders are custom-coded mental ray shaders that let you create looks over and above those that can be achieved with the standard mental ray for Maya Base shaders. You (or third-party developers) can create them in C or C++ language, then process them into modes that you can see and use in Maya.

About > mental ray shader connections

A collection of custom shaders (one or more) make up a Custom Shader Library. Custom shaders are typically distributed in custom shader libraries. To see a particular custom shader in Maya, you must load the shader library that contains that custom shader. See "Load shaders" on page 86

Custom shader libraries

Custom shaders are distributed in custom shader libraries. To see a particular custom shader in Maya, you must load the shader library that contains that custom shader. A custom shader library consists of two files:

- a declaration file (for example, mayabase.mi) that contains descriptions of the interfaces of the shaders
- a library file (for example mayabase.so or mayabase.dll) that contains the actual implementations of the shaders.

The Node Factory (see "The Node Factory" on page 39) creates the Mayatype nodes from your custom shader declarations. These nodes work just like regular Maya nodes: you can use them to build shading networks; you can save, load, and export them; you can write your own Attribute Editor templates; and you can provide icons, swatches, and help files. See the devkit fo rmore information and examples.

mental ray shader connections

The following mental ray shader parameter types are recognized as message attribute by Maya: light, geometry, color texture, scalar texture, vector texture, lightprofile, shader.

Though it is possible to connect any node to these attributes, you should make only those connections that Maya expects, otherwise a crash or rendering abort may occur. That is, if you drag a node to the message attribute in the Attribute editor, the message attribute of the source node will be connected to the attribute (for example node1.message > mrShaderNode.shader), but only the following connections are recognized and will work in Maya:

- light : light transform node. For example, pointLight1.message > dgs_material1.lights[0]
- geometry : geometry shader. For example, mib_geo_sphere1.message
 > mib_geo_instance1.object
- shader : mental ray shader. For example, mib_illum_phong1.message
 > mib_geo_instance.material

About > Phenomena

- color texture, scalar texture, vector texture: mentalrayTexture node.
 For example, mentalrayTexture1.message > mib_texture_lookup1.tex.
 The button next to a color/scalar/vector texture attribute in the shader's attribute editor will create a new mentalrayTexture node, and connect it to the attribute.
- lightprofile : mentalrayLightProfile node. For example, mentalrayLightProfile1.message -> mib_light_photometric.profile. The button next to a lightprofile attribute in the shader's attribute editor will create a new mentalrayLightProfile node, and connect it to the attribute.

Phenomena

Phenomena are mental ray for Maya components that look and behave like shaders but, unlike custom shaders, they require no programming knowledge of C or C++ code to create.

By exporting an assembled shading network (or portions of it) and designated attributes, you create a Phenomenon, a single node that you can then use just like a regular shader: you can build shading networks with them; save, load, and export them; write your own Attribute Editor templates; and provide icon, swatches, and help files. See the devkit for more information and examples.

Phenomena:

- Provide you with a simpler way of creating complex looks for objects other than creating custom shaders.
- Can be created during the earlier phases of production and then optimized or coded into custom shaders for later stages of the production.
- Let you restrict simplify the number and type of adjustable attributes made available to Maya artists. This provides you with a unified pallet and more control over the looks that can be achieved.

Previously generated phenomena

In order for the Node Factory to find and generate in Maya previously exported Phenomena, you need to:

• Export the file (for example, my_phenomenon.mi) to the directory specified in the environment variable: MI_CUSTOM_SHADER_PATH. The default value of this environment variable is: C:\Program Files\AliasWavefront\Maya6.0\mentalray\include.

About > The Node Factory

- Specify to the Node Factory to generate the node at every Maya startup. To do this, you must edit the maya.rayrc file, located (by default, for example) in C:\Program Files\AliasWavefront\Maya6.0\mentalray
- Add the following line: mi "{MAYABASE}/include/my_phenomenon.mi"

The Node Factory

The Node Factory is a special part of mental ray for Maya that creates Maya-type nodes from custom shader declarations and Phenomena declarations. (When you export an assembled shading network to be used a Phenomenon, the network is exported to the .mi declaration file.)

The Node Factory parses the declaration and packs it into a single node -- a shader or Phenomenon, depending on what you are creating.

To see each node type being created in the Script Editor, set option Var miFactoryVerbosity to 4 or higher.

Successfully created node types are available in Create Node window (Hypershade > Create Node window > Create mental ray nodes), either in the Miscellaneous section or one of the other sections (if the appropriate flag was set when you wrote the shader or exported the Phenomenon).

The Node Factory Parser

The Node Factory parser accepts any valid mental ray shader or Phenomenon declarations and special extensions. Messages are written to the Script Editor to inform you about parsing progress and any errors that have occurred.

Parsing error messages

The parser prints the name of the file it is processing. If an error occurs, the line number and a hint of what the parser actually expected are written.

Note The Factory Node parser does not understand the full mental ray syntax, so parsing errors frequently occur within Phenomenon declarations when unknown shader requirements or commands are encountered. The parser recovers from these errors without harm and proceeds.

About > Naming guidelines

Unrecoverable errors occur only if the syntax of parts of a shader or phenomenon declaration is wrong. The parser is unable to recognize, for example, commas in the parameter lists are missing. In such a case, the declaration is discarded.

Naming guidelines

- Attribute names and short names must be unique per node. For example, children of different compounds must not have the same name or short name.
- Node type names and IDs must be unique.

Syntax extensions for Maya specials

You can provide additional parameters for each attribute on a node, and the node itself. Because there are no counterparts for these parameters in mental ray's scene description language, the Factory parser has been extended beyond the standard mental ray syntax to recognize certain keywords that can be given on a per attribute or per shader or phenomenon basis.

Add additional attributes with keywords

You can provide additional parameters for each attribute on a node, and the node itself by including keywords in the .ni declaration file.

These keywords must be prefixed with #: so that the declaration files are still accepted by the standard mental ray parser; these keywords are ignored by the standard mental ray parser (but not the Node Factory parser) because they are recognized as comments. Special comments in wrong places or syntactically wrong #: comments cause parse errors, which are written to the Script Editor.

Where to put keywords and what to write

Such #: comments can appear in two places: after a shader parameter or phenomenon parameter or in the requirement section of a declaration.

• After a parameter, the following syntax is valid:

```
default scalar [scalar [scalar]]
max scalar [scalar [scalar]]
min scalar [scalar [scalar]]
shortname "string"
softmax scalar
softmin scalar
```

• In a declaration's requirement section, the following is syntactically correct:

nodeid integer

About > Add additional attributes with keywords

If none of these additional keywords are provided, the default is zero; the min/max and softmin/softmax are undefined; and the short name is uniquely assigned by counting attributes on nodes. Likewise unique node IDs are determined by counting nodes.

For attributes, not every keyword makes sense for every attribute type. The following is supported by Maya and thus by the Node Factory:

mental ray type	Maya type	default	min/ max	soft min/ max
boolean	boolean	0/1		
color	float3	3 scalars		
integer	long	1 integer	1 integer	1 integer
scalar	float	1 scalar	1 scalar	1 scalar
vector	float3	3 scalars	3 scalars	

Short names

Short names can be given to every attribute. The Factory appends R,G,B to color children names/short names and X,Y,Z to vector children names/ short names.

Example 1 (of 2):

```
declare shader
    vector
    "multiplyDivide" (
        integer
        "operation", #: default 1 min 0 max 2
        vector
        "input1", #: default 1. 1. 1.
        vector
        "input2"
        #: default 1. 1. 1.
        )
    #:
    #:
    #: nodeid 6894 # This is the node ID for binary Maya files.
    #:
    version 1
end declare
```

Example 2 (of 2):

declare shader					
struct	{				
	color	"outColor",	#:	shortname	"oc"
	scalar	"outAlpha"	#:	shortname	"oa"

About > Add additional attributes with keywords

```
} "ramp" (
              array struct "colorEntryList" {
                     scalar "position",
                       #: default 1.
                     color "color"
                            #: default 0.8 0.8 0.8
                     },
                     #: shortname "cel" # compound's short name
              scalar
                     "uWave",
                     #: shortname "uw"
                     #: default 0.5
                     #: softmin 1E-5 softmax 1
                     #: min 1.0E-05 max 1
                        "vWave",
              scalar
                          "noise",
"noiseFreq",
              scalar
              scalar
                           "hueNoise",
              scalar
             "satNoise",
scalar "valNoise",
scalar "hueNoiseFreq",
scalar "satNoiseFreq",
scalar "valNoiseFreq",
                           "satNoise",
              # Inherited from Texture2d
              vector "uvCoord",
                  #: shortname "uv"
              vector "uvFilterSize",
                           "filter",
              scalar
                           "filterOffset",
              scalar
                           "invert",
              boolean
                  #: default 0
              boolean "alphaIsLuminance",
                     #: default 1
              color
                            "colorGain",
                     #: default 1.0 0.8 0.8
                     #: min 0.1 0.1 0.1 max 0.5 0.5 0.5
              color
                        "colorOffset",
              scalar
                            "alphaGain",
                     #: shortname "ag"
              scalar
                            "alphaOffset",
                     #: shortname "ao"
                         "defaultColor"
              color
              )
       #:
       #: nodeid 6895 # Node ID for binary Maya files
       #:
       apply texture
       version2
end declare
```

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About > The Factory parser syntax vs. the mental ray parser syntax

The Factory parser syntax vs. the mental ray parser syntax

Details about what the Factory parser does not accept, but mental ray's parser does:

- Missing zeros before the dot in a scalar value are not supported. Instead of .5 you should write 0.5. Missing zeros after the decimal dot are supported, so 5. is OK.
- There must be no comma after the last parameter in the input parameter list of a shader declaration. mental ray accepts

The Factory parser reports a syntax error at the comma.

Hooks

The Factory creates Maya nodes from mental ray shader declarations. Once created, each such node represents a custom mental ray shader (a shader definition, to be precise). It can conveniently be used with various Maya scene entities.

Message attribute

The following mental ray shader parameter types are registered as message attribute by node factory : light, geometry, color texture, scalar texture, vector texture, lightprofile, shader.

Though it is possible to connect any node to these attributes (if you drag a node to the message attr in the Attribute editor, the message attribute of the source node is connected to the attribute. For example node1.message -> mrShaderNode.shader), you should make a proper connection. Otherwise, it may lead to crash or rendering abort.

The following are expected to be connected to each mental ray shader parameter type.

- light : light transform node. For example, pointLight1.message -> dgs_material1.lights[0]
- geometry : geometry shader. For example, mib_geo_sphere1.message -> mib_geo_instance1.object
- shader : mental ray shader. For example, mib_illum_phong1.message -> mib_geo_instance.material

About > The Factory parser syntax vs. the mental ray parser syntax

- color texture, scalar texture, vector texture: mentalrayTexture node. For example, mentalrayTexture1.message -> mib_texture_lookup1.tex The button next to a color/scalar/vector texture attribute in the shader's attribute editor will create a new mentalrayTexture node, and connect it to the attribute.
- lightprofile : mentalrayLightProfile node. For example, mentalrayLightProfile1.message -> mib_light_photometric.profile The button next to a lightprofile attribute in the shader's attribute editor will create a new mentalrayLightProfile node, and connect it to the attribute.

Materials

Custom materials may be specified in the shading group node. In the Attribute Editor, go to the mental ray section of the shading engine created along with this shader. Turn on Suppress all Maya shaders and connect the desired custom shaders to the corresponding attributes. The shading engine is now going to be exported as a mental ray material. You may still assign it to Maya objects in the usual ways.

Lights

You may specify a custom light shader in the mental ray section of any Maya point, spot or directional light. Turn on Suppress all Maya shaders and connect your light shader. On export, this overrides the default Maya shader while other properties of the light (orientation, spot cone angle, etc.) are preserved.

Cameras

Provide your own output, volume, lens, and environment shaders in the AE mental ray section of any camera shape node. Currently you cannot specify more than one output shader.

Transforms

It is possible to override a shape node attached to a transform with a custom geometry shader. Just turn on Enable geometry shader in the mental ray tab of Maya's transform nodes. Ideally, the transform node should have a single shape child.

Textures

The mental ray texture node should be used. mental ray Texture can be created from the Attribute Editor of a shader with "color texture, scalar texture, vector texture" parameter, and will be connected to the shader.

About > Custom mental ray text

Custom mental ray text

mental images .mi files are created with the mental images scene description language, which can be either an ASCII or binary file.

In mental ray for Maya, you can write and insert a text-only integration of custom mental ray shaders within Maya. It allows creation of special-purpose Maya nodes that hold customized mental images (mi) text.

You can assign these nodes to certain Maya scene entities with the help of the Custom Text Editor and special custom text controls.

The mi file generated with mental ray for Maya can contain customized versions of: camera output statements including lens, volume, and environment shaders, light shaders, material shaders, texture or utility shaders, and object definitions. Furthermore, text can be generated that is written at certain stages of the export.

To work with mental "Work with Custom mental ray text" on page 91.

Customize Scene Entities

The mental ray for Maya plug-in provides a proprietary type of node, the mentalrayText node. It comes with a simple user interface that allows editing ASCII text. For more information, see "Work with Custom mental ray text" on page 91.

You can connect these nodes to other nodes in the scene in certain situations using the Custom Text Editor.

The mentalrayText node assignment to Maya nodes is done on a mi Text in the Extra Attributes section. mental ray for Maya checks for this new attribute when traversing the scene and shader graphs. If it has been found, the contents of the connected mentalrayText is written without further checks.

Warning

The translation of such entities has been disabled by default for interactive preview rendering due to several unpredictable issues. It is enabled for the .mi file export to create customized scene files for external rendering.

Dependent on the text mode attribute, the custom text is appended, prefixed, or completely replaces existing text in the generated mi text.

About > CustomText Editor control group support

The Maya renderer ignores these extra attributes and can render the scene safely as usual. On the other hand, the changed scene may not render any more with mental ray because of broken dependencies between lights, objects, and materials. See "General Notes" on page 48.

The scene needs to be saved as a Maya Binary (mb) file in order for the text nodes and its connections to be preserved.

CustomText Editor control group support

The Custom Text Editor contains two rows of drop-down lists and buttons that are dimmed by default.

When selecting objects or shaders in Maya the Custom Text Editor is updated according to the selected entity and enables the appropriate control if the current selection allows creation and assignment of custom mi text.

The two control groups support:

custom shader text

It is enabled when selecting any light, any camera, any shading group, except the initial variants, any shader, except Maya's default lambert1 and particleCloud1.

custom object text

It is enabled when a mesh or NURBS shape is selected. If a direct transform of a shape is selected, the underlying shape is automatically determined and used.

Custom Text Variables

The custom text can make use of special placeholder characters or strings that are recognized during translation. They are replaced by actual values on export. Right now, there is just one such variable supported: the at sign (@) is a placeholder for the current frame number.

What happens when assigning text to entities

When creating a custom text node and assigning it to the selected node in the scene the Attribute Editor is updated.

The option menu lists all the available text nodes that were previously created. By selecting a new entry in this option menu the text assignment of the current scene entity is replaced with this newly chosen text node. Saving the scene to a Maya file also stores all the existing text nodes, both connected and unconnected. Custom text nodes have to be deleted by standard Maya methods, as the Custom Text Editor doesn't provide a way to do it.

About > Types of text assignments

Types of text assignments

Camera Output and Shaders

The text node assigned to a camera adapts the first output statement that usually is created by the plug-in. Thus, customized image files and framebuffers can be created. Furthermore lens, volume and environment shaders can be added. The other camera parameters are unaffected and is still written according to the settings set in Maya.

Light Shaders

The text node assigned to a light affects the original light shader output. The light parameters remain unchanged and are written as usual. Using alternatives to standard Maya light shaders break illumination of Maya materials, since they depend on special light dependency nodes.

Material Shaders

A custom text node assigned to a shading group affects the export of mental ray materials. If text is applied in replace mode the connected surface, volume, and displace shaders won't be exported at all. Otherwise, those shaders are written as usual, including their own dependent nodes.

The custom text editor prefixes the name of the currently selected entity with *&out;material* to inform about its intended use.

Other Shaders

Text nodes can also be assigned to any other shading node that is supported in the translation process. The editor enables the controls in case such a supported node was selected, and prefixes the type of the node to the name of the selected entity. This relates to all texture and utility nodes. Using this feature, graphs of custom text nodes can be created and exported. mental ray for Maya ensures proper export of the graph, where leaf nodes get exported before dependent nodes, even if they contain custom text. This way, custom text itself can contain references to nodes down the graph. There is one limitation: custom text is expected to not use any shaders that return structures. In connections they are always written just with their node name, not appended with names of output plugs like, for instance, .outColor, as usual in Maya.

Object Definitions

Custom text assigned to shape nodes affects the complete object definition except the object's name and its flags. In text replacement mode, the flags are written according to the settings in Maya, but can further be adapted in the custom text. Also, the exported object is tagged by default, thus the custom object definition should use a material tag number instead of a material name.

About > General Notes

The actual material is assigned in the instance statement, which gives a list of materials, one for every tag number. This way, different instances of the same object, and even polygons out of a mesh object, can get different materials.

General Notes

- Unfortunately, the custom text functionality does not prevent you from creating invalid mi scenes that don't render any more or produce unexpected results. Therefore, great care should be taken to avoid undesired custom text.
- Text is printed in the mi file without any further indentation. This is required for certain mi commands that are expected to start at the first column of a line.
- The \$include statement can be used anywhere in custom text to take the actual mi text from external files (this statement has to start in the first column of the line), but note that the actual inclusion is resolved at render time on the render host.
- The original names of the Maya entities stay untouched and cannot be changed with custom mi text.
- Placing comments around the text (starting with #) makes the identification of the custom parts in the mi file much easier.
- When a custom text node has been assigned to a Maya node, the newly created attribute mi text appears in the Extra Attributes section of that object's Attribute Editor. Clicking the button in the text field displays the appropriate text field.
- When using references to light in custom shader text, the Maya light names should be used.

Limitations

The non-deletable default lambert1, particleCloud1, initialShadingGroup, and initialParticleSE nodes deny storage of the extra text assignment if the scene is saved to a Maya file and later restored because they are handled in a non-standard way. The text nodes are stored, but the connection to these nodes are lost and has to be repeated. Any other Maya surface node saves and restores as expected.

The custom text nodes support limited animation. When exporting an animation, the regular node attributes are checked for changes from frame to frame, and the node gets incrementally exported in every subsequent frame. This happens even if custom text is attached.

No checks for the correctness of the mi syntax and the use of valid name references in the custom text can be made.

About > Custom vertex data

A custom text node that contains empty text and is not going to be appended but is connected to an entity removes the output of the shader or object to which it belongs.

Scenes containing both customized text and standard Maya nodes can't be expected to successfully render with mental ray any more, especially when using customized light nodes, due to limitations with Maya light dependencies.

Custom text is expected to not use any shaders which return structures. In connections they are always written just with their node name, not appended with names of output plugs like, for instance, .outColor, as is usual in the procedure in Maya.

Custom vertex data

For polygon meshes, mental ray for Maya checks for additional custom attributes with the fixed prefix "miCustomTex".

All characters after this prefix are considered the custom data's name, for example MyData for the attribute name "miCustomTexMyData". These data attributes are recognized and translated to additional mental ray texture spaces if they meet the following requirements:

• their type is one of (in MEL):

Int32Array, doubleArray, vectorArray, pointArray, respectively (in Maya API): MFnIntArrayData, MFnDoubleArrayData, MFnVectorArrayData, MFnPointArrayData. the number of array data elements exactly matches the number of unstices in the mash chiest

•

vertices in the mesh object. These array attributes can be created either by MEL or the Maya API. They should contain values when processing starts, otherwise they are

ignored. The data elements of the array attribute is attached to the mesh vertices i

The data elements of the array attribute is attached to the mesh vertices in the presented order. According to the data type, they occupy one or more texture spaces in mental ray. This implies a data type conversion to

About > Custom vertex data

floating point format in any case. It also ensures that the vertex data are automatically be interpolated for the current intersection point on a triangle.

Maya type	number of elements	mental ray texture access
int	1	tex_list[i].x
double	1	tex_list[i].x
vector	3	tex_list[i].x, tex_list[i].y, tex_list[i].z
point	4	tex_list[i].x, tex_list[i].y, tex_list[i].z, tex_list[i+1].x

The information about the texture space that is actually used for a certain custom array is still missing. In the current mental ray for Maya, exactly one texture space is reserved for texturing by default. But meshes can hold more than one UV space. Therefore, all custom vertex data start at an arbitrary texture space offset. If more than one custom array is attached to a mesh, the order of the attributes as listed on the node determines the texture space sequence in mental ray.

This actual layout of the data needs to be supplied to the shaders that want to make use of it. Two ways are currently implemented: user data and custom text replacement. The user data approach attaches a user data block to the mesh object in mental ray. This can be retrieved in shaders. The declaration of the data block *maya_vertexdata* is contained in the mayabase.mi declaration file.

If custom text is applied to the material of the mesh, a special placeholder syntax allows convenient parameter value assignment. The following placeholders are supported (examples assume custom data of type *vector* with name "MyData" found as first custom attribute):

placeholder	replaced by	example
\$ <name></name>	texture space index	\$MyData -> 1
\$ <name>Offset</name>	texture space index	\$MyDataOffset -> 1
\$ <name>Size</name>	number of used texture components	\$MyDataSize -> 3

About > Custom vertex data

placeholder	replaced by	example
\$ <name>Type</name>	custom data type, 1 - int, 2 - double, 3 - vector, 4 - point	\$MyDataType -> 3

Note The placeholders are case sensitive. The use of the special dollar sign (\$) for other than the placeholder names should be avoided.

Example

This is a complete example of custom vertex data and a custom text shader connected to a mesh with the following custom attributes:

- miCustomTexMyInt (Int32Array),
- miCustomTexMyDouble (doubleArray),
- miCustomTexMyVector (vectorArray),
- miCustomTexMyPoint (pointArray).

The custom text connected to the material looks like this:

```
int "$MyInt"
int offset "$MyIntOffset"
int type "$MyIntType"
int size "$MyIntSize"
double "$MyDouble"
double offset "$MyDoubleOffset"
double type "$MyDoubleType"
double size "$MyDoubleSize"
vector "$MyVector"
vector offset "$MyVectorOffset"
vector type "$MyVectorType"
vector size "$MyVectorSize"
point "$MyPoint"
point offset "$MyPointOffset"
point type "$MyPointType"
point size "$MyPointSize"
"offsets" [$MyInt $MyDouble $MyVector $MyPoint]
"sizes" [$MyIntSize $MyDoubleSize $MyVectorSize $MyPointSize]
"types" [$MyIntType $MyDoubleType $MyVectorType $MyPointType]
```

In the exported .mi file the text has changed to:

int "1"
int offset "1"

About > Custom vertex data

```
int type "1"
int size "1"
double "2"
double offset "2"
double type "2"
double size "1"
vector "3"
vector offset "3"
vector type "3"
vector size "3"
point "4"
point offset "4"
point type "4"
point size "4"
"offsets" [1 2 3 4]
"sizes" [1 1 3 4]
"types" [1 2 3 4]
```

The exported user data block on the polygon mesh shows up as:

```
data "plane:vxdata"
       "maya vertexdata" (
               "magic" 1298749048,
                "data" [{
                               "name" "Int",
                               "type" 1,
                               "size" 1,
                               "offset" 1
                               },{
                               "name" "Double",
                               "type" 2,
                               "size" 1,
                               "offset" 2
                               },{
                               "name" "Vector",
                               "type" 3,
                               "size" 3,
                               "offset" 3
                               },{
                               "name" "Point",
                               "type" 4,
                               "size" 4,
                               "offset" 4
                               }
                       ]
               )
```

Using either the placeholder syntax or the user data block, custom shaders can be written that can safely retrieve the custom data at the appropriate places.

About > Advanced information

Advanced information

The following information is for advanced users of mental ray and mental ray for Maya.

Custom nodes

The following node types are added to Maya after loading the plug-in and opening one of the mental ray editors:

- mentalrayItemsList
- mentalrayGlobals
- mentalrayOptions
- mentalrayFramebuffer
- mentalrayCurveApprox
- mentalrayDisplaceApprox
- mentalraySurfaceApprox
- mentalraySubdivApprox
- mentalrayPhenomenon
- mentalrayText

Nodes of these types are under control of mental ray for Maya and the user interface extensions. With the help of specialized editors the attributes of these nodes can be manipulated and custom connections can be made.

The mentalrayOptions and mentalrayFramebuffer nodes are used to hold most of the settings and properties to control the rendering options of mental ray. A number of convenient presets are available to start with. New nodes can be created within the Render Global Settings window. Their values are initialized to the default settings of mental ray for Maya, if appropriate. Existing nodes can be deleted as usual in Maya; they are removed from the UI the next time the Render Global Settings window are forced to update.

The mentalrayOptions node is the main entry for manipulating quality, performance, and features of mental ray.

The mentalrayFramebuffer node determines the output properties of the final image, like resolution, aspect, data type and image format. This way, any information of a rendered framebuffer can be saved to an output file. It's important to note that the Maya camera carries other attributes that are respected during image generation: if the Z Depth attribute is enabled then a depth file are rendered additionally to the usual color image. It gets the same name as the image file with "Depth" appended. This is saved in

How do I? > Custom Commands

the mentalDepth proprietary file format, which can be viewed and converted with the imf_disp and imf_copy tools provided with mental ray. There is a way to change the default depth image format.

The mentalrayText node is used to hold custom mi text. It's the basis for the current implementation of custom shader support.

In general, those attributes that are guaranteed to be supported and recognized in the plug-in are exposed in the user interface with a descriptive name. Most of the attributes of the Render Globals node mentalrayGlobals are working similar to the matching ones in the Maya Render Globals. For details about the mental ray Render Globals, see *"Render Global Settings window" on page 159* in the Rendering guide.

The mentalrayCurveApprox, mentalrayDisplaceApprox, mentalraySurfaceApprox, and mentalraySubdivApprox nodes hold information regarding mental ray approximation of geometric entities. They should be handled and applied with the help of the Approximation Editor. For more information, see "*Obtain quads for subdivision surfaces*" on *page 61* in the Rendering guide.

Custom Commands

The following additional commands are available in *Maya* after loading the plug-in:

- Mayatomr
- MayatomrJob
- convertLightmap
- miProgress

The Mayatomr command executes the main functions of the plug-in. It controls the actual translation of the scene animation, takes care of the rendering and preview inside Maya. The MayatomrJob command is used to call MEL procedures on certain plug-in events. The miProgress command is used to display export progress in Maya, and can be used to interrupt the translation by pressing the Escape key. Both commands are executed and controlled via the custom user interface.

How do I?

Build shading networks

How do I? > Open and navigate Hypershade

Open and customize Hypershade

Open and navigate Hypershade

For more information on the Hypershade, see "Hypershade" on page 99.

To open Hypershade

• Select Window > Rendering Editors > Hypershade from Maya's main menu bar.

To navigate Hypershade

To zoom or track in the Hypershade view, use the same view navigation methods you use in the scene view. See *"Camera aim" on page 30* in the *Rendering* guide for more details.

Tip See also "Show node connections" on page 62 to see content of the tabs in different ways.

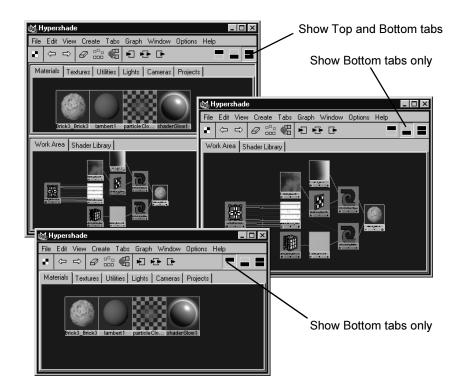
- If you can't see the swatch names in the panel, either zoom in, or drag the cursor over the swatches to display the swatch names.
- Shift-click to select more than one swatch.
- Double-click a node to show its attributes in the Attribute Editor.

Show top and bottom level tabs

For more information on the Hypershade, see "Hypershade" on page 99.

You can view shading networks within tabs in a split panel display (the default) or in separate panels by selecting the buttons at the top-right of Hypershade. These items are also accessible in the Tabs menu.

How do I? > Create Hypershade tabs



Create Hypershade tabs

For more information on the Hypershade, see "Hypershade" on page 99.

Hypershade's tabs contain the nodes that make up the current scene. Click a tab to view specific nodes.

To create a new tab in Hypershade

- **1** Select Tabs > Create New Tab.
- **2** Enter the name of the new tab. This name appears on the new tab in Hypershade.

Tip Use names that indicate the content of the tab.

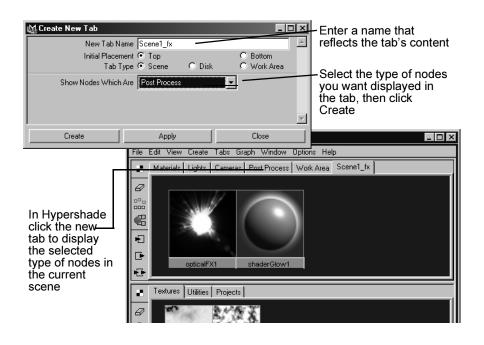
- **3** For the Initial Placement, select either the Top or Bottom option to view the new tabs at either the top or bottom panels of Hypershade.
- **4** Select a Tab Type and specify the corresponding options:

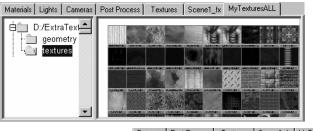
How do I? > Create Hypershade tabs

	Scene	Displays a collection of nodes in the current scene. When you select this tab, you must specify an option from the Show Nodes Which Are drop-down list.
	Work Area	Displays shading networks that are in the scene depending on the mode you choose: Input, Output, or Input and Output Connections.
	Disk	Displays files and/or directories on disk. When you select this tab type, the Create New Tab window expands to display the "Root Directory" option.
	Show Nodes	
	Which Are	For Scene tabs, select to display only certain node types within a specified tab.
	Root Directory	For Disk tabs, either type the path name if you know it, or click the folder icon to browse through directories to select the directory where the items are stored.
	Only Show Files (Hide Directory	
	Tree)	For Disk tabs, turn this on or off to hide or show the directory tree. This is especially helpful if you find you routinely work with files located in one specific directory. You can switch between viewing directory folders or just the files within that directory.
5	Click Create.	

For example, if you want to create a tab that displays only the special effects nodes of the scene, name it appropriately, select Post Process from the list, then click Create. Hypershade displays the Post Process nodes in the scene.

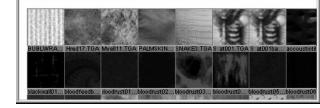
How do I? > Hide, resize or customize the Create bar





When on, only files within the specified directory appear. Both the nodes and directory tree display in Hypershade.

Cameras Post Process Textures Scene1_fx MyTexturesALL MyTexturesICONS



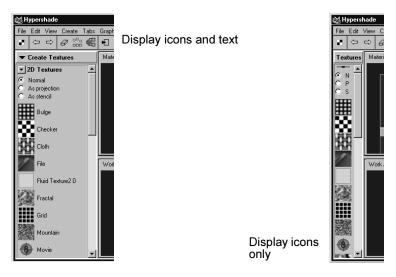
Hide, resize or customize the Create bar

For more information on the Hypershade, see "Hypershade" on page 99.

 Hide or show the Create bar by clicking the button in the Hypershade toolbar, or select Create Bar > Show Create Bar from the Options menu.

How do I? > Change default connection line colors

- Resize the Create Bar by clicking the _____ and _____ buttons at the bottom of the Create Bar panel.
- The Options menu also provides items to customize the icon display. Select either Options > Create Bar > Display Icons and Text (the default) or Display Icons Only.



Change default connection line colors

For more information on the Hypershade, see "Hypershade" on page 99.

For more information on node connections, see "Render node connections" on page 21.

To change the default color of connection lines

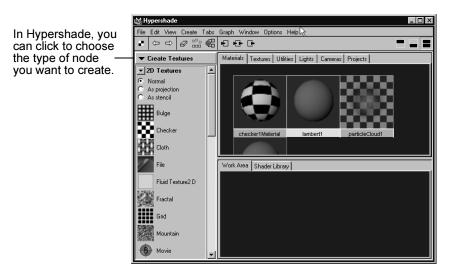
- 1 Select Window > Settings/Preferences > Colors to open the Colors window.
- **2** Open the Hypergraph/Hypershade section to view a list of the default connection colors.
- **3** To change the colors, drag the sliders or click the color swatch to open the Color Chooser and select a color.

Create nodes

Create a node

For more information render nodes, see "Render nodes" on page 20.

How do I? > Create a node



For more information on the Hypershade, see "Hypershade" on page 99.

To create a node

- **1** Do any of the following:
 - Middle-drag a node from the Create Bar into the Hypershade panel or onto another node in the Work Area.

If you drop the new node onto another node, a connection pop-up menu may appear. Select an attribute on which you want to connect a node, and release the mouse button. Hypershade displays the new node swatch and the material swatch updates. For more information about render node connections, see "Render node connections" on page 21.

- Select Create > from Hypershade's menu bar to access the "Create > Create Render Node" items.
- Middle-drag a node from the Create Render Node window, or a directory (such as the Shader Library).
- Right-click in a panel and select a node from the pop-up menu.

How do I? > Duplicate a node

Tips If you want a clear the Hypershade Work Area every time you drag a new node into Hypershade, turn on Options > Clear Before Graphing. This is helpful especially if you have large networks with many nodes and you want to work on just one node or a smaller section of the network. You can select the node you want to work on and graph upstream or downstream connections to show you just that section without having to look at the rest of the network.

For more information on the work area, see "Work Area tab" on page 101.

Duplicate a node

For more information about render nodes, see "Render nodes" on page 20.

To duplicate a node and its network

- **1** Select the node you want to duplicate.
- 2 In Hypershade, select Edit > Duplicate > Shading Network. Maya creates the duplicated shading network in Hypershade with the original node. Each node you duplicate is placed in the appropriate directory.
- Tips
 If you want to duplicate a node without its network, select the node and select Edit > Duplicate > Without Network.
 If you want to duplicate a node and connect it to the same network (in effect sharing the network), select Edit > Duplicate > With Connections to Network.

Delete a node and its network

For more information on render nodes, see "Render nodes" on page 20.

For more information about shading networks, see "Shading networks" on page 19.

To delete a node and its network

1 Click the node you want to delete (marquee-select or Shift-click to select more than one node).

The associated node swatches are highlighted.

How do I? > Import and export shading networks

2 Press Backspace (Windows, IRIX and Linux) or Delete (Mac OS X) to delete the node(s).

The swatches in Hypershade are deleted.

Import and export shading networks

Use the import or export options in Hypershade's File menu to import and export rendering networks among scenes (see "Hypershade" on page 99). You can also import rendering networks into the current scene by dragging them from the project directory.

For more information about shading networks, see "Shading networks" on page 19.

To import a rendering network

• Drag the network you want from the Project tab directory into the Work Area. The network swatch appears in Hypershade's Work Area.

To import all networks from another scene

• Open the scenes directory in the Project tab and middle-drag a Maya scene file into the Work Area.

Maya imports all the nodes from that scene into the current scene.

To export a rendering network

- **1** In Hypershade, select the node(s) you want to export.
- **2** Select File > Export Selection.
- **3** Select the folder you want to export to, and choose Export Selection. (You can also export all the nodes in the scene by selecting File > Export All in the main Maya window.)

Connect nodes

Show node connections

For more information about render nodes and connections, see "Shading networks" on page 19.

To show connections

Select the node for which you want to see the connections, then click one of the following icons at the top-right of Hypershade. (Point to an icon to display its name.)

How do I? > Connect render nodes using their default connections

Note Input and output connections are sometimes called upstream/ downstream connections.

Input Connections

Displays the input connections of the selected node. Input connections are those Maya automatically creates depending on the node type.



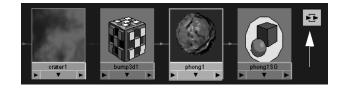
Output Connections

Displays the output connections of the selected node. Output connections show the Shading Group Node. Double-click the Shading Group swatch to open its Attribute Editor.



Input and Output Connections

Displays both the input and output connections of the selected node.



Connect render nodes using their default connections

For more information about render nodes and connections, see "Shading networks" on page 19.

How do I? > Connect default output to a specific input attribute

To automatically connect nodes

If you drag and drop rendering nodes on top of each other, Maya automatically connects them in a default way. The default depends on the type of node. For example:

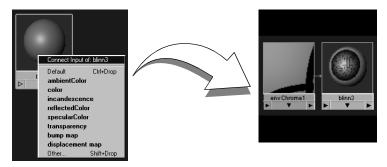
- Middle-mouse button drag a 2D or 3D texture swatch over a material to automatically connect the texture's output color to the material's output color.
- Middle-mouse button drag a Bump2d General utility node over a material node to automatically connect the bump map to the material's Bump Mapping attribute.

Connect default output to a specific input attribute

For more information about render nodes and connections, see "Shading networks" on page 19.

To connect two rendering nodes using a default output and explicit input connection

- 1 Middle-drag a node from within Hypershade, the Create Render Node window, the Create Bar, or from the Shader Library, onto a node in Hypershade. The Connect Input menu of the receiving node appears.
- **2** Select the input attribute from the pop-up menu to make the desired connection.



Connect render nodes by dragging existing connection lines

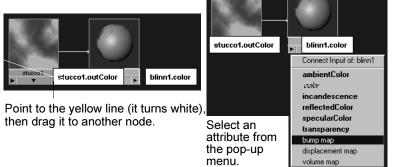
For more information about render nodes and connections, see "Shading networks" on page 19.

How do I? > Connect render nodes using the Connection Editor

To connect attributes using connection lines

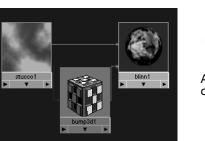
- **1** Click the connection line.
- **2** Drag one end of the connection line (it turns white when you point to it) to the material to which you want to connect the node, then select an attribute from the Connect Input menu.

Click connection line...



Maya makes a new connection, a new line and new node displays, and the material updates with the new connections.







After connection

Connect render nodes using the Connection Editor

For more information about render nodes and connections, see "Shading networks" on page 19.

To open the Connection Editor

Do one of the following:

•

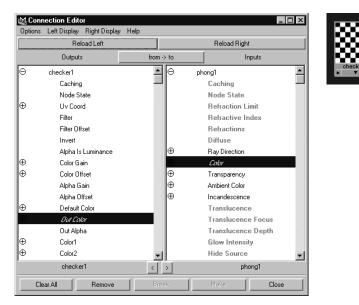
- Click Window > General Editors > Connection Editor.
- Double-click a connection line.
- Shift+middle-mouse button drag a node onto another node in Hypershade.

How do I? > Change existing render node attribute connections

To connect rendering nodes in the Connection Editor

• In the Connection Editor, select the output attribute on the left, and the input attribute on the right to connect the nodes.

When you select an output attribute, some of the input attributes on the right are dimmed, indicating either that they cannot be connected to this type of output node or you must double-click the dimmed attributes to see the nested, connectable nodes



Change existing render node attribute connections

For more information about render nodes and connections, see "Shading networks" on page 19.

- **1** Do one of the following to show the Connection Editor:
 - Drag a node over a material swatch
 - Double-click the connection line between nodes.
- **2** Select an item from the Outputs column (for example, a utility node you selected), then select an item from the Inputs column (the material attributes) to connect them.

Delete a render node connection

For more information about render nodes and connections, see "Shading networks" on page 19.

How do I? > Adjust node attributes

To delete a node connection

1 Click the connection line(s) you want to delete (marquee-select or Shift-click to select more than one).

The lines are selected.

2 Press Backspace (Windows, IRIX and Linux) or Delete (Mac OS X) to delete the connections.

The lines are deleted and the swatches in Hypershade update to show the changes.

Adjust node attributes

Adjust node attributes

For more information about render nodes and their attributes, see "Shading networks" on page 19.

For a detailed description of the material node attributes, see "Material nodes (Maya software)" on page 116.

You can adjust one node at a time (for example if you want to adjust an individual attribute while using IPR), or you can adjust several nodes at the same time using the Attribute Editor, Attribute Spread Sheet, the Rendering Flags window, or the Channel Box.

To set an attribute for one node

- Select the node whose attribute you want to adjust and open its Attribute Editor (double-click the swatch in Hypershade to open its Attribute Editor, or select Window > Attribute Editor).
- **2** Adjust the attribute by moving the slider or typing a value in the field next to the attribute name. If you want to map a texture, utility, or optical effect, click the map button at the end of an attribute's name.

To set attributes for multiple rendering nodes in the Attribute Spreadsheet

- 1 Select the surfaces or rendering nodes whose attributes you want to adjust.
- 2 Select Window > General Editors > Attribute Spread Sheet.
- **3** Click a tab heading to see the attributes.
 - The Keyable tab contains the render node attributes.
 - The Render tab contains the attributes that determine how a surface renders.
- **4** Use the scroll bar to view the attributes horizontally.

How do I? > Adjust node attributes

- **5** Drag down an attribute column to select its contents and select the top field to select all the entries in the column.
- **6** Type the value you want in the top field of the selected attribute column and press Enter (Windows, IRIX and Linux) or Return (Mac OS X).

All the attributes in the column update with the new value.

To set attributes for nodes in the Rendering Flags window

- 1 Click Window > Rendering Editors > Rendering Flags.
- **2** In the Rendering Flags window, from the Show drop-down list, select the item(s) for which you want a list of attributes.

The attributes for these items are listed in the right panel where you can change and set them, much like in the Channel Box.

lp ^{W:} Objects ·	-		
Objects	ereShape1	nurbsSphereShape1	_
Lights	ere1	Visibility off	
Dynamics		Double Sided on	
Cameras	Shape1	Opposite off	
Textures		Smooth Shading on	
Materials	ereShape2	Motion Blur on	
General	ere2	Visible In Reflections on	
	pnelez	Visible In Refractions on	
		Casts Shadows on	

- **3** Do one of the following:
 - To change the attributes of one node, click the listed node in the left panel to display the attributes in the right panel, then change the attributes.

Help			
now: Tex	itures 💌		
	place2dTexture1	water1	-
	water1	Color Gain R	1
	Waterr	Color Gain G	
		Color Gain E	1
		Color Offset R	
		Color Offset G	0
		Color Offset E	0
		Dofout Color F	<u>م د</u>

• To change attributes for several related objects by selecting them in the left panel of the Rendering Flags window, and setting the attribute value in the right panel. For example, if you want to turn

How do I? > Animate a node attribute

the visibility off for two NURBS spheres in the scene, select both spheres from the left panel and type **off** beside Visibility in the right panel.

M Rendering	Flags		_ 🗆 ×
Show: Objects	•		
// nur	bsSphereShape1	nurbsSphereShape2	
	bsSphere1	Visibility	off
	•	Double Sided	on
🛛 🤝 pLj	ylinderShape1	Opposite	off 🚽
pCj 💖 pC	ylinder1	Smooth Shading	on
	bsSphereShape2	Motion Blur	on
1 nurbsSphere2	theSphere?	Visible In Reflections	on
🥥 Hu	bsopherez	Visible In Refractions	on
		Casts Shadows	on 🖉
		A	-44
Close			
·			

Once you change an attribute for a selected item, the heading changes color in the list, reminding you of the change.

Tip You can also set an attribute for multiple nodes using the Render Flags window or the Channel Box.

Animate a node attribute

For more information about render nodes and their attributes, see "Shading networks" on page 19.

For a detailed description of the material node attributes, see "Material nodes (Maya software)" on page 116.

To animate an attribute

- **1** In Maya's main window, set the Time Slider to a frame.
- **2** In the node's Attribute Editor, right-click the label of the attribute you want to key, such as the Color attribute, and select Set Key from the pop-up menu to create a key.

–	Common Material Attribute	\$
	Color	
	Create New Expression	• • • • • • • • • • • • • • • • • • •
	Set Key	
	Set Driven Key	
	Create New Texture	
	Color Chooser	
	Lock Attribute	

3 Set the Time Slider to another frame.

How do I? > View the Shader Library Gallery

- **4** Adjust the attribute and set another key. For example, click the Blinn material's color attribute and select a different color from the Color chooser each time you set a new key.
- **5** Playback the animation. The surface to which the rendering attributes are assigned animate in the view (for instance, the Blinn color changes at each key you set).

Work with shader libraries

View the Shader Library Gallery

For more information about shading network libraries, see "Shader network libraries" on page 20.

To view the Shader Library gallery

In the directory where you store the Shader Library, click the readme.html file or the gallery.html file to view these shading networks on your browser. Click an image to get a closer look and use the arrows to navigate.

Assign a shading group from the Shader Library

For more information about shading network libraries, see "Shader network libraries" on page 20.

To assign a shading group from the Shader Library

- 1 Click to open a folder, then middle-drag the swatch representing a shading network into Hypershade.
- **2** To view how the shading network is connected, select the swatch, then click the Input and Output Connections button to graph the shading network into the Work Area tab.
- **3** To assign the shading network to an object, middle-drag the material swatch over the object in the view.
- Note By default, the material type for the shading networks is PhongE. To achieve different results, you may want to change the Material type (by selecting a new Type in the material's Attribute Editor). When you do this, however, some of the material attributes change which requires you to manually reconnect some parts of the network.

How do I? > Create a material

Create and assign materials to surfaces

Create a material

For more information about Maya materials, see "Maya materials" on page 23.

For more information about mental ray for Maya shaders, see "mental ray for Maya Shaders" on page 36 and "mental ray for Maya nodes" on page 224.

Use one of the following methods to create a material in Hypershade:

- Right-mouse button click in Hypershade, then select a material from the pop-up menu (Create > Materials).
- Select a material from the Create menu in the menu bar.
- From the Create Bar, middle-drag a material swatch into Hypershade.
- Select a material from the "Create Render Node window" window.

To open the Create Render Node window

- Do one of the following:
 - Click the map button 🖬 next to an attribute in an Attribute Editor.
 - In Hypershade, select Create > Create New Render Node.

Assign existing materials to surfaces

For more information about Maya materials, see "Maya materials" on page 23.

The following lists a few quick ways to assign (connect) a material to a surface.

In the scene view, you can be in either wireframe or shaded mode to make the connection. If you are in wireframe mode, make sure the cursor touches the surface when you release the mouse button, otherwise the connection may not be made.

Assign a material to surfaces

You have several options to assign a material to a surface or surfaces.

To assign a material to a surface or surfaces (option 1)

• Right-mouse button click the object(s), then click Assign new material.

How do I? > Assign a material to a group of faces on a polygonal surface

To assign a material to a surface or surfaces (option 2)

- **1** In the view, select the surface(s) to which you want to assign the material.
- **2** From the Hypershade, middle-drag the material swatch over the selected surface(s).

To assign a material to a surface or surfaces (option 3)

- 1 In the view, Shift-select the object to which you want to assign the material, and in the Hypershade, click the material swatch.
- **2** While the cursor is over the material swatch in the Hypershade, rightclick-drag to select Assign Material to Selection from the pop-up menu.

To assign a material to a surface or surfaces (option 4)

• Middle-drag and drop a Hypershade swatch onto an object in the IPR Render View.

To assign a material to several surfaces

- **1** Select the surfaces in a view.
- **2** In the Hypershade, right-click over the material swatch and select Assign Material To Selection from the pop-up menu. Maya applies the material to the surfaces.

Assign a material to a group of faces on a polygonal surface

You have several options to assign a material to a group of faces.

To assign a material to a group of faces on a polygonal surface (option 1)

- **1** Right-mouse button click the surface.
- **2** Select Face from the marking menu.
- **3** Choose Select by component type icon (or press the hotkey F11).

To assign a material to a group of faces on a polygonal surface

- **1** Select (either drag or Shift-click) the faces you want to map.
- **2** In Hypershade, right-mouse button click the material you want to assign, then select Assign Material To Selection from the pop-up menu.

Maya applies the material to the faces.

How do I? > Layer shaders

Layer shaders

For more information on layered shaders, see "Layered shaders" on page 24.

To create a layered shader (example)

- **1** Open the Layered Shader's Attribute editor.
- **2** Create a Lambert shader and drag to the area with the green swatch in the Attribute Editor.
- **3** Create a Phong and do the same.

The leftmost shader is the topmost material. You'll have to have some level of transparency to see the shader underneath. So, for this example, you'll need to map the Lambert's transparency channel with something to see the shiny Phong underneath. Then assign the shader to an object.

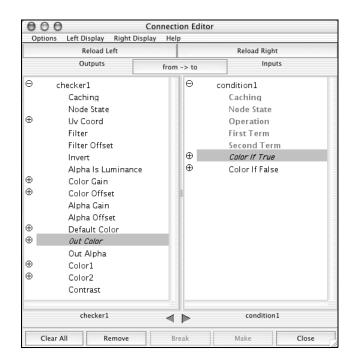
Create double-sided shaded surfaces

For more information about double-sided surfaces, see "Double-sided shaded surfaces" on page 25.

To create a double-sided shaded surface

- **1** In the Hypershade, create one of each of the following:
 - Material (this procedure uses a Phong material).
 - A Sampler Info utility. The Sampler Info utility provides access to camera and surface information that you can pipe into your shading networks during rendering.
 - A Condition utility. The Condition utility lets you specify which texture is mapped to each side of the surface.
 - Checker texture.
 - Crater texture.
- **2** Assign the Phong material to the surface.
- **3** In the Hypershade, middle-drag the Checker texture onto the Condition utility to open the Connection Editor.
- **4** In the Connection Editor, connect the Checker's Out Color attribute to the condition utility's Color If True attribute (click the Out Color attribute in the Checker column, then click Color If True in the Condition column).

How do I? > Create double-sided shaded surfaces



- **5** In the Hypershade, middle-drag the Crater texture onto the Condition swatch, and in the Connection Editor, connect the Crater's Out Color to the Condition's Color if False attribute.
- **6** Middle-drag the SamplerInfo swatch over the Condition swatch to open the Connection Editor.
- **7** In the Connection Editor, click the Flipped Normal attribute then click the Condition's First Term or Second Term attribute.

How do I? > Swapping the textures on the surfaces

000)	Connecti	ion Edite	or		
Options	Left Display Right	Display Help	p			
	Reload Left				Reload Righ	t
	Outputs	from	-> to Inputs			
	amplerInfo1 Caching Node State Point Camera Point Obj Point World Normal Camera Uv Coord Ray Direction Tangent UCamera Tangent UCamera Matrix Eye To Wo Pixel Center <i>Flipped Normal</i> Facing Ratio	1	⊕ ⊕	Ci N O Fi Se Ci	lition1 aching ode State peration <i>irst Term</i> econd Term olor If True olor If False	
	samplerInfo1 condition1				1	
Clear	Clear All Remove Break Make Close					

- **8** In the Hypershade, middle-drag the Condition swatch onto the Phong material swatch and select color to connect it to the Phong's Color attribute.
- **9** Perform a test render.

Maya shades each side of the surface with a different texture.

Swapping the textures on the surfaces

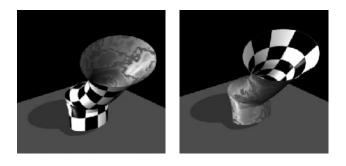
For more information about double-sided surfaces, see "Double-sided shaded surfaces" on page 25.

You can use the Condition utility to specify which texture is applied to the front and back sides of the surface. For more information about the condition utility, see "Condition" on page 343.

To swap texture mapping for double-sided shading

- **1** Double-click the Condition swatch in Hypershade to open its Attribute Editor.
- **2** In the Condition Attributes section, change the Operation attribute to Not Equal (or if it is set to Not Equal, change it to Equal).
- **3** Perform a test render. The following shows the result.

How do I? > Map a 2D or 3D texture



Note You can apply more than one material to polygonal models at the face level.

Map and position textures

Map a 2D or 3D texture

When you map a 2D or 3D texture to an object, you connect it to an attribute of the object's material. Textures map to geometry based on the object's UV texture coordinates. For more information about texture mapping, see "Texture mapping" on page 30.

Unless you use a method that explicitly connects a texture to a specific attribute of the object's material, it connects to the material's default attribute (usually color or transparency). For more information on node connections, see "Render node connections" on page 21.

To map a texture using Hypershade

- 1 In the Create bar, make sure the Create Texture tab is shown.
- **2** Select a mapping method.

For information about mapping methods, see "Mapping methods" on page 32.

- **3** Do one of the following:
 - From the Create textures bar, middle-mouse drag a 2D or 3D texture onto the desired object's material. You can drag either directly to the material in Hypershade, or to the object in the scene view.

The texture is placed on the object in a default position, and a placement node appears in the Hypershade. For more information on placement nodes, see "Placement nodes" on page 220.

How do I? > Position 2D textures and labels

Note When you middle-drag-drop a file texture on to a material and select Default in the pop-up menu, this automatically connects the file.outColor to the material.color and, if the image file has an alpha channel, connects the file.outTransparency to the material.transparency.
 In versions previous to Maya 4.5, this connected the file.outColor to material.transparency. If you prefer the old behavior, you can disable the automatic connection of file.outTransparency to

disable the automatic connection of file.outTransparency to material.transparency in the situations described above. To do so, set the environment variable:

MAYA_DISABLE_OUTTRANSPARENCY_CONNECT

• In the Attribute Editor, click the map button next to the attribute to which you want to connect the texture. The Create Render Node window appears. See "Create > Create Render Node" on page 107.

Position 2D textures and labels

You can reposition 2D textures with numerical precision in the place2dtexture node's Attribute Editor, or you can use Maya's Texture Placement Tool to reposition textures or labels interactively.

For more information about texture positioning the place2dtexture node "2D texture positioning" on page 33.

To position a 2D texture interactively

1 In the Hypershade, click the place2dtexture swatch that is connected to the texture you want to reposition.

The place2Dtexture's Attribute Editor appears

Тір	If you cannot see the place2dtexture swatch, do the following:
	• Select the texture swatch, then click the Input Connections button on the Hypershade toolbar.
	• If no place2Dtexture swatch exists, it has been deleted or not created (because it's automatic creation has been turned off by default). You must add one (see "Create a node" on page 59), then connect it to the texture (see "Connect nodes" on page 62) before you can reposition it.

2 Do one of the following:

How do I? > Position 3D textures

- Change the values of the attributes in the Attribute Editor. For detailed descriptions of the attributes, see "Place 2d Texture" on page 220.
- For NURBS, click the Interactive Placement button in the Attribute Editor to use the Texture Placement tool. To set the Texture placement tool, see "Texture placement vs. label mapping" on page 35.
- Tip It may be difficult to place a texture using only the manipulator. Use both the manipulator and the Attribute Editor to get the desired result.

Position 3D textures

For more information about texture positioning the place3dtexture node "3D texture positioning" on page 34.

To use the 3D placement manipulator

1 Assign a 3D texture to a surface.

The texture's place3Dtexture node (swatch) appears in Hypershade and a manipulator appears in the view panel.

- **2** Double-click the node to open the Attribute Editor.
- **3** Select the Interactive placement (see "Interactive Placement" on page 220) to reposition the 3d texture to show the placement manipulator. (This tool similar to a combined version of the move, scale, and rotate tool.)

To use the Fit to group bbox option

1 Assign a 3D texture to a surface.

The texture's place3Dtexture node (swatch) appears in Hypershade and a manipulator appears in the view panel.

- **2** Double-click the node to open the Attribute Editor.
- **3** Select the Fit to group bbox to reposition the 3d texture. This causes the 3D texture to be scaled, moved, rotated as necessary to the assigned object's bounding box.

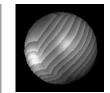
How do I? > Position 3D textures

Interactive Placement



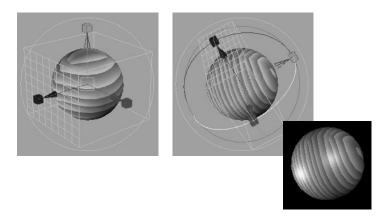
Wood texture applied to a sphere





The result after adjustment.

Fit to Bbox



Tip You can also use Maya's transform tools to position the Fit to group bbox manipulator.

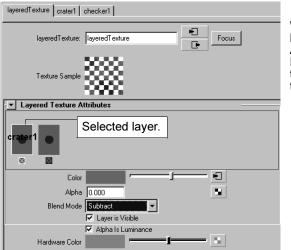
How do I? > Use a layered texture

Use a layered texture

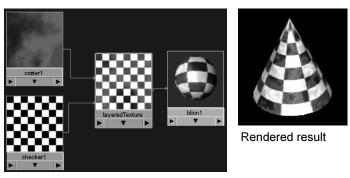
For more information on layered textures, see "Layered textures" on page 26.

To use a layered texture

1 In the Layered Texture's Attribute Editor, select the layer you want to edit.



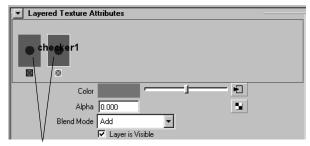
When you select a layer, Maya updates the Color, Alpha, Blend Mode, and Layer visibility attributes to reflect the properties of the selected layer.



Hypershade view

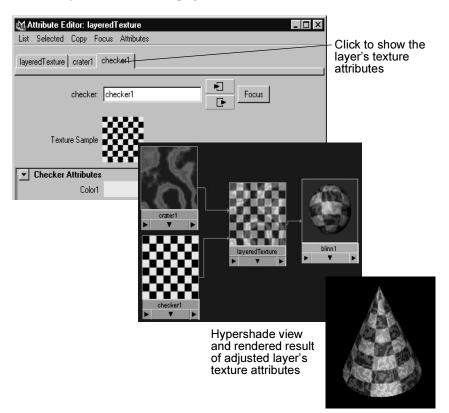
• To re-order the layers in the Layered Texture's Attribute Editor, middle-mouse button drag the texture swatch.

How do I? > Use a layered texture



Middle-drag these swatches to re-arrange layers

- To change a layer's texture attributes, click the tab at the top of the Attribute Editor to access that texture's attributes.
- **2** Edit any of the attributes. For a detailed description of the attributes, see "Layered texture" on page 218.



How do I? > Create Texture Reference Object

Create Texture Reference Object

You can create a texture reference object for the selected surface to lock a 3D texture or projected 2D texture to the surface. As the surface animates or deforms, the texture stays with the surface, producing a very natural looking result.

lote	٠	You must create a reference object before you animate or
		deform the original surface.

- A reference object for a polygonal surface must have the same topology (number of faces) as the original surface. When you create a reference object, the topology of the reference object is identical to the original surface. However, if you make subsequent changes to the topology of the original surface, you must create another reference object.
- A scene can contain any number of reference objects, but each surface in the scene can only have one reference object.

To create a Texture Reference Object

1 Select a surface and assign a 3D texture to it.

If the 3D texture node is grouped within an object's hierarchy, see "Troubleshoot:When I move a referenced object, texture swim" on page 94.

2 Select Texturing > Create Texture Reference Object.

Maya creates a templated copy of the surface called the reference object. You can move a reference object anywhere in the scene.

- **3** Use the texture placement manipulators to position the texture relative to the reference object.
- **4** Animate the original surface (not the reference object).

As the original surface moves or deforms, Maya uses the reference object to move or deform the texture so that it matches the motion or deformation of the original surface.

Select and delete a texture reference object

To select a reference object

- Do one of the following:
 - Click Texturing > Select Texture Reference Object.
 - Click the reference object's heading in the Channel Box.

How do I? > Convert a texture or shading network to a File Texture

To delete a reference object

• Click Texture > Delete Texture Reference Object.

Convert a texture or shading network to a File Texture

When you convert illumination, shadow, shading, and textures to a file texture, you are performing a render; the process draws on the settings in Maya Software Render Global Settings (see *"Render Global Settings window" on page 159* in the Rendering guide for more information). Be sure you set these settings to achieve the result you want.

Use this procedure when you map a procedural texture or shading network to a surface and want to change it to a file texture.

To find out more about file textures in general, see "Procedural textures" on page 26.

For more information on the difference between converting and baking, see "Baking illumination and color" on page 299.

To convert a procedural texture or shading network into a File texture

- **1** Shift-click the object in the view and the material swatch in Hypershade.
- **2** Do one of the following:
 - Select Edit > Convert to File Texture in Hypershade.
 - Click Edit > Convert to File Texture > □, adjust the options, then click Convert Texture.

Work with mental ray shaders

Use a custom-made mental ray for Maya shader in Maya

To use custom-made mental ray for Maya shaders in Maya

1 Write or obtain a shader declaration file (that is, an .mi file that contains the description of the shader(s)).

See "Write a shader declaration file" on page 84.

- **2** Insert the shader into a shader library (.dll on Windows, and .so on IRIX, Linux, MAC).
 - *Maya6.0/mentalray/lib* contains shader libraries compiled and loaded into Maya by default.

How do I? > Write a shader declaration file

• Compiling and linking a shader on NT requires to include shader.h and link to shader.lib. These two files are shipped with maya, and can be found at *Maya6.0/devkit/mentalray*.

For more information on shader libraries, see "mental ray for Maya Shaders" on page 36.

3 Edit the maya.rayc file to link the shader declaration file to it, so that Maya can use mental ray for Maya to render the shader.

See "Edit the maya.rayrc file" on page 85.

4 Load the shader by doing one of the following

See "Load shaders" on page 86.

Note Compiling and linking a shader on NT requies to include "shader.h" and link to "shader.lib". These two files are shipped with maya, and can be found at *Maya6.0/mentalray/devkit*.

Write a shader declaration file

- For an example of how to write shader header and source code, see *Maya6.0/devkit/mentalray*.
- *Maya6.0/mentalray/include* contains *base.mi, contour.mi* and *physics.mi* that declares basic shaders.
- As a part of devkit, Microsoft Visual Studio project files are shipped. You can open *base.dsw*, *contour.dsw*, *physics.dsw* and compile them yourself.

If *apply* is not provided in the shader declaration, you will find the shader node in *Miscellaneous* section of the Create Render Node window (or bar in the Hypershade).

To place the node into a different category, use the *apply* keyword in the shader declaration. For example, for *mib_texture_vector* (*base.mi*). *mib_texture_vector* node is under *Textures* section:

```
declare shader
  vector "mib_texture_vector" (
        integer "select",
        integer "selspace",
        integer "vertex",
        integer "project"
    )
    version 2
    *apply texture*
end declare
```

Shading 84

How do I? > Edit the maya.rayrc file

Note For some categories not supported by the *apply* flag (contour, for example), we provide a mel script: mentalrayCustomNodeClass.mel

Please refer to the comment in the file for further detail.

Click your shader node. The shader has blank icon and the *Script Editor* will have a warning message, unless you provided *render_myshader.xpm*.

Check out the *Attribute Editor* of the shader. If the shader had any parameters, you should be able to see corresponding fields in the *Attribute Editor*.

You can create your own Attribute Editor Template file to provide better look of the attribute editor.

If the shader is called *myShader*, create a file called *AEmyShaderTemplate.mel*, and place it in Maya6.0/scripts/AETemplates.

Edit the maya.rayrc file

You need to edit this file for every shader that is to be rendered by mental ray for Maya; it allows Maya to see the shader. Find this file *Maya6.0/mentalray*.

Editing the maya.rayrc requires you to restart Maya. Alternatively, you can type the following in the script editor (see Mayatomr MEL documentaiton for more details):

Mayatomr -updateRayrc

To edit the maya.rayrc file

The following is an example of how to edit the maya.rayrc file.

Assuming the declaration file is myshader.mi and the shader file is myshader.dll/so, do the following:

mi "MI_FILE_DIRECTORY/myshader.mi"
link "SHADER FILE DIRECTORY/myshader.{DSO}"

An example of *maya.rayrc* :

registry "{MAYABASE}" value "C:/Program Files/ AliasWavefront/Maya6.0/mentalray" end registry registry "{SYSTEM}" value "windows" end

registry "{DSO}" value "dll" end registry

How do I? > Load shaders

```
$lookup "{MAYABASE}"
$lookup "{SYSTEM}"
$lookup "{DSO}"
registry "{MRMAYA_START}"
  <B>link "C:/myshader/Release/myshader.{DSO}"<b>
  link "{MAYABASE}/lib/base.{DSO}"
  link
         "{MAYABASE}/lib/physics.{DSO}"
  link "{MAYABASE}/lib/mayabase.{DSO}"
  link "{MAYABASE}/lib/contour.{DSO}"
  <b>mi "C:/myshader/include/myshader.mi"</b>
  mi "{MAYABASE}/include/mayabase.mi"
  mi
        "{MAYABASE}/include/base.mi"
        "{MAYABASE}/include/physics.mi"
  mi
  mi
        "{MAYABASE}/include/contour.mi"
  echo "mental ray for Maya - startup done"
end registry
         "{MRMAYA START}"
$lookup
```

Load shaders

To import a custom shader library

- 1 Copy the declaration file to the include directory of your mental ray for Maya installation.
- **2** Copy the library file into the lib directory of your mental ray for Maya installation.
- **3** Modify the configuration file "maya.rayrc" in the plug-ins directory of your Maya installation. Add statements to include the declaration file and to link with the library file.

mental ray for Maya is able to load and render with your custom shader library. Placing the declaration file in the include directory also uses mental ray for Maya to parse the file and create new Maya node types that correspond to the shaders declared in the library.

With the Shader Manager

The Shader manager allows you to dynamically load a custom shader (as opposed to loading all the shaders up front, even though you may not require them). See *"mental ray shader manager" on page 268* in the What's New guide for more details.

How do I? > With the MI_CUSTOM_SHADER_PATH environment variable

With the MI_CUSTOM_SHADER_PATH environment variable

You need to add your .mi file to this environment variable path (unless you use the Shader manager) to load any shader that is to be rendered mental ray for Maya.

This variable tells mental ray for maya a directory where .mi files are located. Every .mi file located in MI_CUSTOM_SHADER_PATH will be parsed on plugin load.

This environment variable should be set prior to loading the plug-in. mental ray for Maya interprets this variable in different ways. If it is not empty but does not point to an existing file or directory, a file dialog opens up as the mental ray for Maya plug-in is (auto-)loaded. A .mi file should be selected that contains mental ray shader/phenomenon declarations which the Factory should create Maya node types for. The file dialog comes up again in a loop to allow more than one .mi file to be loaded. It stops when the Cancel button has been pressed.

If the Factory should load all required files automatically, then a file or a directory containing .mi files should be given in the environment variable. For loading a single file, set MI_CUSTOM_SHADER_PATH e.g. like this

• Unix

setenv MI_CUSTOM_SHADER_PATH /usr/local//aw/maya6.0/ include/base.mi

• Windows

set MI_CUSTOM_SHADER_PATH=C:/Program Files/Alias/Maya6.0/
mentalray/include/base.mi

For parsing all files in a directory, you could use (in which no file dialog will appear).

• Unix

setenv MI_CUSTOM_SHADER_PATH /usr/local/mi/rayinc31

Windows

set MI_CUSTOM_SHADER_PATH=c:/usr/local/mi/rayinc31

The default value of *MI_CUSTOM_SHADER_PATH* is *Maya6.0/mentalray/ include*.

You can modify *Maya.env* to add your own directory to the path. For example, the following line in *Maya.env* will append *C:\myshader\include* to the path :

MI CUSTOM SHADER PATH = C:\myshader\include

To make your shader be loaded by default, you can either add the directory to the path, or put the file in the path.

How do I? > Use a mental ray for Maya shader

While mental ray plugin is loaded, *base.mi*, *contour.mi* and *physics.mi* are parsed, nodes for each shader declared in the .mi files will be created. See the *Script Editor* for nodes being created.

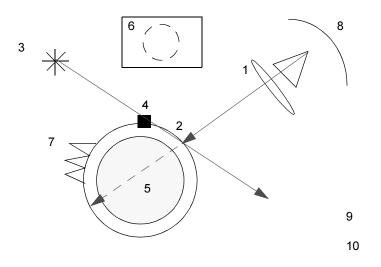
Same for your shader. If the .mi file is in MI_CUSTOM_SHADER_PATH, you should be able to find your shader name in the *Script Editor*. For example, my *Script Editor* has following lines (if optionVar miFactoryVerbosity is set to 4 or higher. (*myshader1* and *myshader2* are declared in *myshader.mi*)

- // generating nodes ...
- // parsing C:/myshader/include/myshader.mi
- // myshader1
- // myshader2

Use a mental ray for Maya shader

You can use mental ray for Maya shaders the same way you use Maya materials, textures, and other render nodes; you build shading networks out of them in Hypershade. See "Connect nodes" on page 62.

The following shows where in a scene specific mental ray for Maya nodes are typically connected:



- **1** Lens shader. Attaches to camera.
- **2** Surface shader. For surface effects (Blinn, Phong, etc.). Attaches to Shading Group.
- **3** Light shader. For lighting style (point, spot, etc.), and shadowing controls. Attaches to light.

How do I? > Specify light parameters

- **4** Shadow shader. Called when a shadow ray hits an object. Overrides the appearance of the object to shadow rays (color, transparency). Attaches to Shading group.
- **5** Volume Shader. Handles rays passing through objects. Attaches to Shading Group (or to Camera for Environment Fog).
- **6** Geometry shaders. Calle d prior to rendering for rendering. Attaches to transform node.
- 7 Displacement shader. Same as Maya, displaces surface geometry. Attaches to Shading Group.
- **8** Output shader. For post effects (glow, 2D blur, DOF, etc.). Attaches to camera, attaches to multiple shaders, control order of execution.
- **9** Contour shading. 2 Global shaders, 1 shader on object, attaches to Shading group.
- 10 Photon / photon volume shaders. Describe how photons are scattered/absorbed. Not commonly overridden. Attaches to Shading Group.

Specify light parameters

Light parameters are message attributes. Connect any output attribute of a light node (not the shape node) to, for example, the desired element of a light array of your custom material shader.

These extensions should enable you to create pretty much any shading network supported by mental ray. It can be either exported to a file or rendered from within Maya. Some restrictions apply:

- Cooperation between proprietary mental ray shaders and the Maya base shader library is not always seamlessly possible. Although much work has been put into making the Maya base shaders compatible with standard mental ray shaders, some restrictions still apply. Custom shaders might thus have to be designed in a special way, if cooperation between the Maya base shader library and custom shaders is desired.
- The mental ray Phenomenizer represents a shader declaration, not a definition. Therefore, it cannot be directly linked into a shading network.

Work with phenomenon

Build Phenomena

How do I? > Use a Phenomenon in a scene

To build a phenomenon

- **1** In Hypershade, build a shading network normally with mental ray for Maya base shaders or any custom shaders.
- **2** Add a phenomenon node to the Work Space.

This is the root node for the phenomenon.

- **3** Middle mouse drag from the node that has the look you want to capture in the phenomenon (for example, the final node that plugs into the Shading Network's Shading Group) to the Phenomenon root, then select Other
- **4** The Connection Editor appears.
- **5** Connect one of the following to the root.
 - for materials, connect the outcolor
 - for geometry, connect the meshout
 - for volume, connect the outvalue
- **6** Add an attribute for the Phenomenon node by middle mouse dragging from the root to a node in the Shading Network, then selecting Other.

The Connection Editor appears.

Connect Interface to whatever attributes you want to make available on the Phenomenon for adjustments.

- **7** Repeat for any other nodes whose attributes you want to make available for adjustments.
- **8** Do the following:
 - specify version (optional)
 - apply flags for the type (optional)
 - apply global flags (optional)
- **9** Select the entire Shading Network, including the Phenomenon root.
- **10** Select File > Export Selection > \Box

The Export Selection Options window appears.

- **11** Select mental ray from the File Type dropdown list.
- **12** Turn on Export Selected Items only.
- **13** Select *Shaders, Phenomena, Materials* from the Predefined Export Filters.
- **14** Save to your project's mental ray directory.

Use a Phenomenon in a scene

To use a phenomenon in a scene, you must load the phenomenon with the Shader Manager.

How do I? > Assign custom text to an object or shader

After the Phenomenon is loaded, you can find it in the Miscellaneous section of the Create Render Node window, unless you set the Apply flag, in which case, you'd find it in the appropriate section. (See "Write a shader declaration file" on page 84 for more information on the Apply flag.)

Work with Custom mental ray text

Assign custom text to an object or shader

For more information about the Custom mental ray text, see "Custom mental ray text" on page 45.

To assign a material shader (example)

- 1 Create a new scene.
- **2** Create a NURBS object.
- **3** Assign a new Blinn node to the NURBS object.
- **4** Select the Blinn node (either in the Attribute Editor, the Hypergraph, or the Hypershade).
- **5** Select Window > Rendering Editors > mental ray > Custom Text Editor.

The Custom Text Editor opens. For a description, see "mental ray Custom text editor" on page 115.

When selecting objects or shaders in Maya the editor is updated according to the selected entity and enable the appropriate control if the current selection allows creation and assignment of custom mi text.

6 Click the new button in the Custom Text Editor.

The Attribute Editor displays the custom text user interface.

7 Enter some text and click Apply.

Any valid mi text can be entered and is stored once Apply is selected. Selecting Clear deletes the current text from the node and clears the text field.

The custom text can make use of special placeholder characters or strings that are recognized during translation. They are replaced by actual values on export. Right now, there is just one such variable supported: the at sign (@) is a placeholder for the current frame number.

8 Select a Custom Text Mode to specify if this text should be appended, prefixed to or completely replace the corresponding entity in the mi.

What went wrong? > Assign text to entities

Select the name in the Attribute Editor, for example mentalrayText1, 9 and type *myMaterial*.

After applying the text you should rename the node to some descriptive identifier, perhaps including a hint about the mode of application. Especially the shader text nodes should get a name that mentions their intended use because the Custom Shader Text section gathers all light, camera, material, and shader text nodes into one menu.

10 Select the Blinn node again.

The text editor shows the new entry myMaterial.

11 Select File > Export All and export the scene to a mental ray (mi) file.

Assign text to entities

For more information about the Custom mental ray text, see "Custom mental ray text" on page 45.

Click the button in the Custom Text Editor to create a custom text node and assign it to the selected node in the scene. The Attribute Editor is updated.

The option menu lists all the available text nodes that were previously created. By selecting a new entry in this option menu the text assignment of the current scene entity is replaced with this newly chosen text node. Saving the scene to a Maya file also stores all the existing text nodes, both connected and unconnected. Custom text nodes have to be deleted by standard Maya methods, as the Custom Text Editor doesn't provide a way to do it.

For more information on the different types of text assignments refer to "Types of text assignments" on page 47.

What Maya materials and textures went wrong?

Troubleshoot: Movies don't play on Image Plane

Not all movie file formats are readable in Maya's image planes.

On Windows: Only .avi files are accepted. On IRIX: Only .mov (quicktime) and sgi movie files (uncompressed or using RLE, RLE24, JPEG, MVC1, or MVC2 compression) are accepted.

What went wrong? > Troubleshoot: NURBS surface blend renders incorrectly

Troubleshoot: NURBS surface blend renders incorrectly

At times, the result of NURBS surface blend will appear not to render smoothly with the original surfaces.

Running *stitchAndExplodeShell* on the prompt line, with the surfaces in question selected, may correct this situation.

Troubleshoot:Warped textures

A 2D texture is positioned directly onto a NURBS surface's UV space. If it the texture appears warped the first time you apply the texture, you may need to edit the surface direction, fix uneven UV values (fix texture warp), or even rebuild the surface. See "Texture Map" on page 223.

Note Convert to File Texture does not support Fix Texture Warp If the surface uses Fix Texture Warp, it is ignored when converting the material.

Troubleshoot:Can't see the place2Dtexture swatch

- Tip If you cannot see the place2dtexture swatch, do the following:
 - Select the texture swatch, then click the Input Connections button on the Hypershade toolbar.
 - If no place2Dtexture swatch exists, it has been deleted or not created (because it's automatic creation has been turned off by default). You must add one (see "Create a node" on page 59), then connect it to the texture (see "Connect nodes" on page 62) before you can reposition it.

Troubleshoot:Animated objects swim through 3D texture

Converting a solid texture to a file texture can prevent an animated object from swimming through a 3D texture. For more information, see "Baking illumination and color" on page 299. See also "Troubleshoot:Textures on deforming surfaces" on page 94.

What went wrong? > Troubleshoot:When I move a referenced object, texture swim

Troubleshoot:When I move a referenced object, texture swim

This workflow allows you to be able to move the referenced object anywhere in the scene without having the texture swim on the original object.

If the 3D texture node is grouped within an object's hierarchy

- **1** Select the top node of your object's hierarchy.
- **2** Create the referenced object. See "Create Texture Reference Object" on page 82.
- **3** Run the Optimize Scene Size tool.
- **4** Move the original 3D texture node from the original object's hierarchy into the referenced object's hierarchy.

Troubleshoot: Movies files are slow to load

The first time you access a frame from an MPEG file, it may be slow to load. The movie library has to scan to the end of an MPEG file to see how many frames are in it since this information is not available in the movie header.

Troubleshoot:Textures on deforming surfaces

If a procedural texture is very noisy and appears to shift and swim during an animation, try increasing the Filter and/or Filter Offset values to try to achieve a slightly blurred effect and to reduce the sharpness that causes the swimming. You can also try increasing the Shading Samples as a last resort.

If a texture does not stick to a deforming surface, you have a few options, each of which have advantages and disadvantages. Check the following table to find out which option is best for your particular circumstance.

What went wrong? > Troubleshoot:Textures on deforming surfaces

Option	Advantage	Disadvantage
Parent the 3D placement node or projection to the object being animated.	Simple, fast and uses minimal memory. It works for complex object with many sub objects as long as none of the children objects are animated. For example attaching to a robot would not work because the arms are animated relative to the body. However an animated chair would work well. The texture may also be animated.	Handles only a single animated transform. For example, for a space scene containing many asteroids, each asteroid would need a separate shader (or texture if switch nodes are used). This method does not work at all for objects with morphing CVs.
Turn on "local" on the 3d texture	Simple, fast, uses minimal memory, and works for multiple objects.	You cannot customize the placement for different objects.
or projection.	For example, the texture would move correctly with each of many asteroids even if the asteroids are moving in different directions. You don't need to group with objects. The texture can also be animated.	Complex object hierarchies appear seamless only if you do a zero transform on the object first. It does, however, move with transforms on sub objects, such as the arms of a robot.
		The placement node does not reflect the actual position of the texture, which additionally is transformed to the position of each object (at render time).
		This method does not handle morphing surfaces.
Convert to file texture	Handles morphing surfaces (CV animation) well. Renders as file textures, which can be faster and supports blurring. Can be exported to game engines, and complex texture networks can be collapsed to a single more optimal file texture.	Can be too blurry unless the generated resolution is high. For complex objects, this method can generate many textures that use switch nodes. This is a more complicated workflow and can consume a lot of memory; it takes time to do the convert operation.
	Handles multiple objects with different transforms and instances.	Any animation on the 3D textures is ignored.

What went wrong? > Troubleshoot: crash or render abort

Option	Advantage	Disadvantage
Create a reference object	Handles morphing surfaces (CV animation) well. Shows animation on texture and does not blur (unlike converting to file texture).	Can be complex to setup and manage, and it may affect render times and memory, particularly for large complex objects.
	For simple objects memory usage may be substantially less than converting to file texture.	

mental ray for Maya shaders

Troubleshoot: crash or render abort

mental ray for Maya expects only certain connections to be made the the message attribute in the Attribute Editor. See "mental ray shader connections" on page 37 for more details.

Troubleshoot: Node factory errors in Script Editor

The Node Factory prints progress and error messages to the Script Editor. If Maya was unable to create a node (that is, a node seems to be missing) or an attribute on a node, a parsing error may have occurred and an error message is printed.

The reason for such errors are usually name clashes.

Troubleshoot: error messages

PHEN 0.2 error 051011: shader "myShader" not found : missing link statement

Make sure the maya.rayrc have a proper link statement for myShader?

API 0.0 error 301031: call to undeclared function "myShader"

Make sure maya.rayrc has a proper mi statement for myShader

Does a shader file have extension .cpp? A shader written in c++ is not be recognized correctly.

Reference > API 0.0 error 301032: while defining "": undefined shader "myShader"

API 0.0 error 301032: while defining "": undefined shader "myShader"

Make sure maya.rayrc has a proper mi statement for myShader

Does a shader file have extension .cpp? A shader written in c++ will not be recognized correctly.

Troubleshoot: Cannot find main function

Did you choose Win32 Dynamic-Link Library when starting a new project?

Troubleshoot: Cannot open input file "shader.lib"

Make sure the library path is valid. There is be no space between */libpath:* and the path name.

Reference Menus

Rendering menu set

Lighting/shading

Lighting/shading > Material Attributes

Opens the Attribute Editor for the shading group and material assigned to the selected surface.

- For more information on the Attribute Editor, see "*Attribute Editor*" on *page 189* in the *Basics* guide.
- For more information on the shading group, see "Shading group node" on page 19
- For more information on materials, see "Surface, displacement, volumetric materials" on page 23.

Lighting/shading > Assign New Material

Select an item from the menu to create a new material and assign it to selected object(s)

For more information on materials, see "Surface, displacement, volumetric materials" on page 23.

Reference > Menus

Automatic Attribute Editor

If on (on by default), the Attribute Editor opens and displays the new material's attributes.

Lighting/shading > Assign Existing Material

Assigns one of the shading groups in the Assign Existing Material submenu to all selected surfaces. This menu updates depending on the materials you create.

- For more information on the shading group, see "Shading group node" on page 19
- For more information on materials, see "Surface, displacement, volumetric materials" on page 23.

Texturing

Texturing > Create Texture Reference Object

Creates a texture reference object for the selected surface to lock a 3D texture or projected 2D texture to the surface. As the surface animates or deforms, the texture stays with the surface, producing a very natural looking result.

See also, "Create Texture Reference Object" on page 82.

Texturing > Delete Texture Reference Object

Deletes the texture reference object for the selected surface if one exists. To select a reference object for a selected surface to delete it, either use "Texturing > Select Texture Reference Object" (see next), or click the reference object's heading in the Channel Box.

See also, "Create Texture Reference Object" on page 82.

Texturing > Select Texture Reference Object

Selects the texture reference object for the selected surface if one exists. You can also click its heading in the Channel Box.

See also, "Create Texture Reference Object" on page 82.

Reference > Windows and Editors

Texturing > NURBS Texture Placement Tool

Provides you with a 2D texture placement manipulator for the selected surface. When you create a 2D texture, an icon for the Texture Placement Tool appears in Maya's tool bar.

For more information, see "Texture placement vs. label mapping" on page 35.

Texturing > NURBS Texture Placement Tool > Texture Placement Options >

Modify texture

Controls which of the texture's 2D Texture Placement attributes you can interactively adjust—Surface mapping or Label Mapping.

Notes See "3D texture positioning" on page 34 to find out how to place 3D textures on surfaces.

Windows and Editors

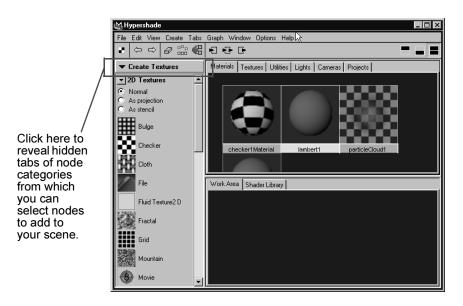
Hypershade

Hypershade

The Hypershade is the central working area of Maya rendering, where you can build shading networks by creating, editing, and connecting rendering nodes, such as textures, materials, lights, rendering utilities, and special effects.

To open and customize Hypershade, see "Open and customize Hypershade" on page 55.

Reference > Create bar



Create bar

When you first open Hypershade, the Create Bar panel appears at the left. From this panel, you can choose among node types that let you create different types of rendering effects.

Different types of nodes are nested in sections within the bar. Click the bar to see the categories of nodes, then click a section to see the nested nodes.

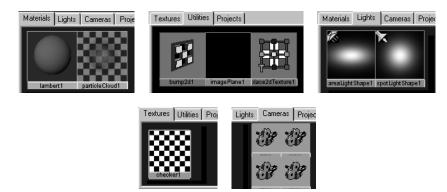
The Create bar is very similar to the Create Render Node window. For a description of what is in the Create bar, see "Create Render Node window" on page 107.

Hypershade tabs

Hypershade's tabs contain the rendering components that contribute to the current scene.

Each Hypershade tab displays specific rendering node as a node icon (a swatch), that visually represents the characteristics of the node. When you edit a node's attributes or assign textures or special effects, the swatch updates in Hypershade.

Reference > Hypershade tabs



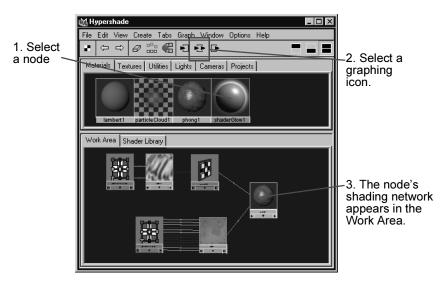
For a detailed description of Hypershade tabs, see "Hypershade" on page 99.

Work Area tab

Displays the shading network for a selected node.

Select a node, then select one of the graphing icons on the tool bar, such as Input Connections. The selected nodes appear in the Work Area tab. If another Work Area tab is selected, the graph operation graphs the selected nodes into that tab. (The Work Area tab cannot be deleted.)

For more information about Shading networks, see "Shading networks" on page 19.



Shading 101

Reference > Hypershade tabs

Shader Library tab

The Shader Library tab in the bottom panel of Hypershade provides access to several shading networks comprised of different node types such as materials, textures, and utilities. You can use these shading networks can be used to create interesting natural and artificial substances (see Shading networks, see "Shading networks" on page 19).

Projects tab

The Projects tab displays the contents of the default projects directory.

If you keep projects elsewhere, create a new disk tab pointing to the directory in which you keep your projects. See "To create a new tab in Hypershade" on page 56.

For example:

• Windows

drive:\Documents and Settings*username*\My Documents\maya\projects

• Mac OS X

/Users/username/Documents/maya/projects.

• IRIX and Linux

~username/maya/projects

File > Import (Hypershade)

Opens the Import dialog so you can choose a Maya scene file, such as a file containing a shader, to import into Maya.

File > Import Selected Scene Files

Reads elements from another file and loads them into the current file.

File > Import Selected Image Files

Select an item from the drop-down menu to choose how to import image files.

For a description of the mapping options, see "Mapping methods" on page 32.

Include Placement

When on, Maya automatically creates a texture placement node when you create a texture render node. The default setting is on.

Reference > Hypershade tabs

File > Export Selected Network

Exports the selected item into a new file. The file browser opens to its best guess directory, but you can browse to any directory, or cancel, before exporting.

Edit > Delete (Hypershade)

Deletes the selected node(s). When you delete a node from Hypershade, Maya deletes it from the session.

Edit > Delete Unused Nodes

Deletes nodes not assigned to geometry or particles.

Edit > Delete All by Type

Deletes all nodes of the type you select, whether they are assigned or not.

Edit > Revert Selected Swatches

Reverts the selected swatches to their default shapes.

Edit > Select All by Type

Highlights all the node swatches you select from this menu.

Edit > Duplicate (Hypershade)

Duplicates the selected node or shading network. To duplicate a node without its network, select the node and select Edit > Duplicate > Without Network. To duplicate a node and connect it to the same network (in effect, sharing the network), select Edit > Duplicate > With Connections to Network.

For more information on shading networks, see "Shading networks" on page 19.

Edit > Convert to File Texture

Converts (renders) illumination, shadow, shading, and textures to a file texture you can use as a texture map.

See "Baking illumination and color" on page 299 for more information.

Reference > Convert to File Texture (Maya Software) > □

Convert to File Texture (Maya Software) > □

Note For Convert to File Texture to work properly for polygonal objects, the polygons must have (UV) values, and unique (UV) values across the surface. Otherwise, the result may not be what you expected.

Anti-alias

If on, sharp, jagged edges within the solid texture are blurred or antialiased.

Background Mode

When converting a file to a texture, occasionally some of the pixels along texture edges are missed. As a result parts of the geometry are not properly covered and the background color shows through. In the Background Mode drop-down list, there are three options for managing this situation.

Shader Default	A default color is applied to the background. The color may be a blend of the shader colors. This option is intended for compatibility with previous versions of Maya. This is the default.
Custom Color	Specify a color to apply to the background. For example, this can be useful if you want to import the file texture into image editing software and want a special key (color) to select the background for processing.
Extend Edge Color	Looks at the neighboring pixels' colors to determine the appropriate background color to extend the texture pattern at the edges. This option provides the best quality in some situations.

TipIn the Hardware Texturing Options window, set the TextureFilter option to Filtered for best quality. Set the Texture Filteroption to Unfiltered to see the potential artifacts.

Reference > Convert to File Texture (Maya Software) > □

Fill Texture Seams

If the selected UV space contains boundaries, these boundaries may appear as black stripes in renderings that use the baked textures. This occurs when the texture is sampled so close to a boundary that the filter picks up values (generally black) from outside the desired space.

This setting artificially extends the boundaries by a small amount to alleviate this problem. It is measured in texels (pixels of texture). Typically, the filter is only a few texels in diameter and can only reach as far as its radius into these boundary spaces, so a value of 1 or 2 is usually enough.

Note The Convert to File Texture algorithm consists of two passes by default. The first pass samples the color of the inside of triangles; the second pass extends the sampled color slightly in each direction along the polygon border to fill texture seams. Game developers, or other users who have no room for overscanning, can disable the second pass by turning the Fill Texture Seams attribute off.

Bake Shading Group Lighting

Bakes the lights that illuminate the selected surface into a new image file when you convert a texture or material into an image file. The new image file is lit by the same lights linked to the surface in the scene. (This option is ideal for color matching.)

Bake Using Virtual Plane

This option lets you create an image map for layered shaders or other non directly supported shading networks properly without having the image cropped based on an object's UVs. This bakes out a sample image using a virtual plane with UVs from 0,0 to 1,1 square.

Bake Shadows

Specifies whether to compute shadows when baking lighting. Diskbased shadow maps are used. Only lights with depth map shadows turned on (Use Depth Map Shadows in a light's Attribute Editor) are used.

Bake Transparency

Specifies whether to compute transparency when baking lighting. Bake transparency samples both the color and transparency of the shading network—Maya sets the alpha channel of the file texture to correspond to the sampled transparency's result. Transparency is not computed by default.

Reference > Convert to File Texture (Maya Software) > □

Double Sided

Turn this option off when baking lighting or shadows. If on, normals that are needed when sampling the shading network are flipped to face the camera. (You can use this option when baking a shading network's lighting to light both sides of the surface).

Not

e Turning Double Sided on makes the conversion dependent on the camera which may be undesirable in some cases, particularly with baked lighting and shadows.

UV Range

Specifies the amount of the surface to sample in UV space. For example, if you select one or more faces on a polygonal object, instead of sampling the whole surface, only the selected faces are sampled.

Note UV Range c faces.	, , , , , , , , , , , , , , , , , , , ,		
Default	For NURBS surfaces, Maya samples the entire surface. For polygonal and SubDivision surfaces, Maya samples an area from [0,0] to [1,1].		
Entire Range	Samples the entire surface (for example, a polygonal cube is sampled from [-1,0] to [2,4]). A place2dTexture node is created and connected to the file texture.		
User Specified	Turn on to enable the U and V Min/Max options (see next). A place2dTexture node is created and connected to the file texture.		
U Min/Max, V Min/Max			
Slider values specify how much to stretch the sampling range of U or V components. Maya stretches the sample region to fit the output image size within the [0,0] to [1,1] sampling range.			

X Resolution, Y Resolution

The horizontal and vertical resolution of the image file, measured in pixels. The slider range is 1 to 512. The default value is 256.

Reference > Create Render Node window

File Format

Lets you choose a format in which to save the file texture. The default is IFF.

View > Frame All

Frames all the nodes displayed in the current Hypershade layout.

View > Frame Selected

Frames only the selected nodes in the current Hypershade layout.

Create > Create Render Node

Opens the Create Render Node window from which you can select rendering nodes. Icons representing the nodes are displayed under each tab.

Create Render Node window

The Create Render Node window provides access to materials, textures, lights, and utility nodes you can create and customize in Hypershade. Icons representing the nodes are displayed under each tab.

To open the Create Render Node window, from the Hypershade, select Create > Create Render Node.

Note The Create Render Node window has the same functionalities as the Create Bar in the Hypershade.

Materials

With Shading Group

When on, Maya automatically creates a shading group when you create a material node. See "Shading networks" on page 19 for more information about the Shading Group.

If you create a material with a shading group, Maya automatically selects all surfaces assigned to that shading group, or when you select a surface, Maya automatically selects the shading group to which it is assigned.

To display the shading group icon in Hypershade, click the Graph > Input and Output Connections button.

Reference > Create Render Node window

Surface Materials

Describe the physical appearance of surfaces. See "Surface materials" on page 116 for more information.

Volumetric Materials

Describe the physical appearance of phenomena which occupy a volume of space (for example, fog or particles). See "Volumetric materials" on page 147 for more information.

Displacement Material

Change the surface of geometry. When viewed in silhouette, you can see the displacement of the surface. See "Displacement material" on page 147 for more information.

Textures

With New Texture Placement

Click the Textures tab to display this option. When on, Maya automatically creates a texture placement node when you create a texture render node. The default setting is on.

Normal

See "Mapping methods" on page 32.

As projection

See "Mapping methods" on page 32.

As stencil

See "Mapping methods" on page 32.

2D Textures

2D patterns that simulate various types of surface materials by using either an image file (File texture) or a computer graphic procedure. See "2D and 3D textures" on page 25.

3D Textures

3D patterns that simulate solid materials (for example, wood or marble) using a computer graphic procedure. When you map a 3D texture to a surface, the surface appears to be carved out of the material. See "2D and 3D textures" on page 25.

Reference > Create Render Node window

Environment Textures

Simulate three-dimensional spaces using a series of image files (Env Ball, Env Cube, and Env Sphere textures) or using a computer graphic procedure (Env Chrome and Env Sky textures). See "Environment textures" on page 207.

Other Textures (Layered Texture)

Provides a quick way to layer attributes. You can create a texture consisting of two or more of the textures already existing in the scene and control how they are composited. See "Layered textures" on page 26

Lights

Surfaces are illuminated by light rays directly emitted from these light sources. Using the attributes and properties associated with lights, you can simulate many different types of real-world light sources and special effects.

For more information about light sources and their attributes, see "Sources of direct light" on page 13 in the Lighting guide.

Utilities

General Utilities

Utilities provided to enhance and blend various attributes and textures. See "General utilities" on page 339.

Color Utilities

Utilities provided to color correct and enhance texture colors. See "Color utilities" on page 314.

Switch Utilities

Several objects can share shading characteristics, and you can define unique characteristics for each object on an object-by-object basis. See "Switch utilities" on page 314.

Particle Utilities

For more information about particles, see "*Particles*" on page 15 in the Dynamics guide.

Image Planes

Control the appearance and placement of an image plane. You can assign a texture or image file to an image plane to create a background for the scene.

For more information, see "Create, edit, or position an image plane" on page 265.

Reference > Create Render Node window

Glow Utilities

Glows, halos, or lens flares optical effects are produced when a light shines directly into the camera. You can add an optical FX to any light.

For more information, see "Glows, halos, and lens flares" on page 18 in the Lighting guide.

Tabs > Create New Tab

Opens a window in which you can set options for the new tab you want to create.

For more information on Hypershade tabs, see "Hypershade tabs" on page 100.

Tabs > Move Tab Up, Down, Left, Right

Select a tab then select one of these options to move the tab up, down, left, or right.

For more information on Hypershade tabs, see "Hypershade tabs" on page 100.

Tabs > Rename Tab

Opens a window in which you can assign a new name for a selected tab.

For more information on Hypershade tabs, see "Hypershade tabs" on page 100.

000		Rename Tab	
	Old Tab Name	Materials	
	New Tab Name	My Materials	
	Rename	Close	

Tabs > Remove Tab

Select a tab then select this option to remove it.

For more information on Hypershade tabs, see "Hypershade tabs" on page 100.

Tabs > Revert to Default Tabs

Removes new tabs and reverts to the default organization.

Reference > Create Render Node window

For more information on Hypershade tabs, see "Hypershade tabs" on page 100.

Tabs > Current Tab

For more information on Hypershade tabs, see "Hypershade tabs" on page 100.

When the current tab is a disk tab or the default Projects tab, the following options become available:

Show Directories Only

The tab displays only the directory lists.

Show Files Only

The tab displays only the file icons.

Show Both

The tab displays both the directory lists and the file icons in a split panel.

Refresh File Listing

The tab refreshes the list display.

Refresh Selected Swatches

The tab refreshes the selected swatches. This applies to disk tabs in Hypershade.

Refresh All Swatches

The tab refreshes all the swatches. This applies to disk tabs in Hypershade.

Generate Swatch Files for Current Images

When you navigate to a directory containing images in a disk tab (such as the default Projects tab), Hypershade reads each image file from disk and displays a swatch that represents it. Reading every image file and creating a swatch takes time, particularly for directories containing large image files and/or many image files, or over a network.

Once the swatches for the image files are created and displayed, you can use the *Generate Swatch Files for Current Images* menu item to save them. Now, every time you navigate to the same directory in Hypershade, the display updates much faster since Hypershade no longer has to read each image file—it can read the saved swatches instead.

Reference > Create Render Node window

The swatch files are saved in a .mayaSwatches subdirectory of the directory containing the images, and the names of the swatch files correspond to the names of the image files. For example, for an image file called earth.tif, the .mayaSwatches subdirectory contains a file called earth.tif.swatch.

Notes Because the swatch files are saved in a subdirectory, you need write permissions to the directory to successfully Generate Swatch Files for Current Images.

Refreshing a swatch may require some processing time due to the disk/network access times.

Tip In the Project and custom disk tabs of Hypershade you can right-click a file and select Refresh Swatch to refresh that file swatch.

Graph > Graph Materials on Selected Objects

Displays the shading group networks of selected objects.

For more information on shading networks, see "Shading networks" on page 19.

Graph > Clear Graph

Clears the Hypershade Work Area tab of all nodes and shading networks.

For more information on the Work Area tab, see "Work Area tab" on page 101.

Graph > Input Connections

Displays only the input connections of selected nodes. See also "Input Connections" on page 63.

For more information on render node connections, see "Render node connections" on page 21.

Graph > Output Connections

Displays only the output connections of selected nodes. See also "Output Connections".

Reference > Create Render Node window

For more information on render node connections, see "Render node connections" on page 21.

Graph > Input and Output Connections

Displays the input and output connections of the selected nodes. See also "Input and Output Connections" on page 63.

For more information on render node connections, see "Render node connections" on page 21.

Graph > Show Previous Graph

Displays the previous graph that you were working on in the Work Area. This is similar to a web browser's Back button.

For more information on the Work Area tab, see "Work Area tab" on page 101.

Graph > Show Next Graph

Displays the next graph you were working on (if you showed one or more previous graphs) in the Work Area. This is similar to a web browser's Forward button.

For more information on the Work Area tab, see "Work Area tab" on page 101.

Graph > Add Selected to Graph

Adds the selected nodes to the Work Area. This is helpful for adding non-rendering nodes, such as shape and transform nodes, to the Hypershade for use in shading networks.

For more information on the Work Area tab, see "Work Area tab" on page 101.

Graph > Remove Selected from Graph

Removes the selected nodes from the Work Area. This helps to reduce clutter.

For more information on the Work Area tab, see "Work Area tab" on page 101.

Reference > Create Render Node window

Graph > Rearrange Graph

Rearranges the nodes in the current layout to view all nodes and shading networks without overlaps.

For more information on the Work Area tab, see "Work Area tab" on page 101.

Window > Attribute Editor

Displays the Attribute Editor for the selected node.

Window > Attribute Spread Sheet

Displays the Attribute Spread Sheet and loads it with the selected nodes so you can edit attributes for all nodes at one time.

For more information on the Attribute Spread Sheet, see "Attribute Spread Sheet" on page 195 in the Basics guide.

Window > Connection Editor

Displays the Connection Editor (without pre-loading nodes in either column).

For more information on the Connection Editor, see "Render node connections" on page 21.

Window > Connect Selected

Displays the Connection Editor with the selected node loaded in the Outputs column.

For more information on the Connection Editor, see "Render node connections" on page 21.

Options > Create Bar

Contains options for managing the Create Bar display: Show Create Bar, Display Icons and Text, Display Icons Only. See "Hide, resize or customize the Create bar" on page 58.

For more information on the Create Bar, see "Hypershade" on page 99.

Reference > Hypershade toolbar

Options > Keep Swatches at Current Resolution

Does not rerender swatches in the Hypershade when you zoom. This is helpful if a scene is complex and there are many swatches in a Hypershade layout.

Options > Clear Before Graphing

If Clear Before Graphing is on, selecting a node already in the Work Area and performing a Graph Input and/or Output Connections operation clears the Work Area before the new graph is drawn. If Clear Before Graphing is off, the same workflow adds the nodes in the new graph to the Work Area without removing previous nodes.

Hypershade toolbar

Create Bar On/Off

Displays or hides the Create Bar. See "Create bar" on page 100.

Show Previous Graph, Show Next Graph

☞, ➡ These work just like Back and Forward page commands in a web browser. As you graph and work with networks in the Work Area, Hypershade remembers the networks that have been shown. Use Show Previous Graph to step back through the networks. Use Show Next Graph to move forward through the networks.

Clear Graph

Rearrange Graph

Rearranges the nodes in the current layout to display all nodes and networks.

Graph Materials on Selected Objects

Displays the Hypershade layout of nodes and/or shading networks for the selected objects.

mental ray Custom text editor

For more information on the mental ray Custom Text Editor, see "Custom mental ray text" on page 45.

Reference > Nodes

custom shader text

Enabled when selecting any light, any camera, any shading group, except the initial variants, any shader, except Maya's default lambert1 and particleCloud1.

custom object text

Enabled when a mesh or NURBS shape is selected. If a direct transform of a shape is selected, the underlying shape is automatically determined and used.

Nodes

Material nodes (Maya software)

Surface materials

Overview of surface materials



The Material tab in the Create bar and the Create Render Node window includes Surface Materials, Volumetric Materials, and Displacement Materials. For more information on surface materials, see "Surface material" on page 23.

• Some attributes (such as color and transparency) are common to most surface materials and are described in "Common surface material attributes" on page 117.).

Reference > Common surface material attributes

- Some attributes are shared among many surface materials, are therefore grouped separately from the Common surface attributes and are described in "Shared surface material attributes" on page 138.
- Surface material-specific descriptions are provided in this section under the material name.

Common surface material attributes

The following attributes are common to most surface materials.

For material-specific specular shading attributes, see the particular material. For example, for information on the specular shading attributes of the Anisotropic material, see "Anisotropic" on page 122.

Туре

The material's basic type (such as Blinn or Phong).

When you change a material's type, only those attributes common to both types retain their previous values or settings. For example, if you change the material type from Blinn (which has a Color attribute and a Specular Color attribute) to Lambert (which has a Color attribute but no Specular Color attribute), the Color setting is preserved, but the Specular Color setting is lost.

Color

The default material color. Transparency

A material's color and level of transparency. For example, if the Transparency Value is 0 (black), the surface is totally opaque; if the Transparency value is 1 (white), the surface is totally transparent.

To make an object semi-transparent, set the Transparency color to a shade of grey or to the same color as the material Color. The default value is 0 (black).

If you change Transparency from the default black (0), the background of the material's Hypershade swatch becomes a checkered pattern. This is a visual aid and is not rendered.

For more information, see "Transparency" on page 16.

Note If the material has specular highlights the transparency setting do not affect the highlights. So if you are trying to make an object disappear by animating the transparency attribute, you may also have to animate the specular highlight attributes.

Reference > Common surface material attributes

Ambient Color

Set to black by default, which means it does not affect the material's Color. As the Ambient Color becomes lighter, it affects the material's Color by lightening it and blending the two colors. If there are ambient lights in the scene, the color and brightness of those lights is used to control how much the ambient color contributes to the final color of the material.

Incandescence

The color and brightness of light that a material appears to be emitting. (Incandescent objects do not illuminate other objects.) For example, to simulate lava, use a bright red Incandescence. The default color value is 0 (black).

Tip Use a little Incandescence for vegetation to make it look organic.

Note Although incandescence makes a surface appear to glow, it does not actually act as a source of light in the scene.

Bump Mapping

Makes the surface appear rough or bumpy by altering surface normals (during rendering) according to the intensity of the pixels in the bump map texture. A bump map does not actually alter the surface. A silhouette of the surface appears smooth.

For more information about bump mapping, see "Surface relief" on page 247.

Diffuse

Gives the material the ability to reflect light in all directions. The Diffuse value acts like a scaling factor applied to the Color setting—the higher the Diffuse value, the closer the actual surface color is to the Color setting. The valid range is 0 to infinity. The slider range is 0 (no light is reflected in all directions) to 1, but you can type in a higher value. The default color value is 0.8.

Translucence

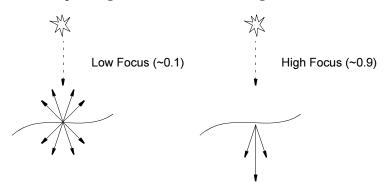
Gives the material the ability to transmit and diffuse light. Light falling on a translucent surface is first absorbed beneath the surface, and then diffused in all directions. If set to 0, the default, no light shows through the object. If set to 1, all the light shows through. The default value is 0.

Reference > Common surface material attributes

Тір	Use Translucence to simulate clouds, fur, hair, marble, jade, wax, paper, leaves, flower petals, or frosted light bulbs.		
Notes	• The Translucence value of a surface lit by a non-shadow casting light is zero or infinite (all non-zero values).	7-	
	• If the scene combines a translucent surface with a shade casting spotlight, faint grid-like artifacts may become vi If this happens, increase the spotlight Dmap Filter Size o lower the Dmap Resolution.	sible.	
	• For high values of Translucence, lower Diffuse accordin to avoid washout.	gly	
	• A surface's actual translucence is based on the illuminat receives from lights, and is not related to its transparence However, as an object becomes more transparent, its translucent (and diffuse) illumination gets dimmer.		
	• Ambient lights have no effect on translucent (or diffuse) illumination.)	

Translucence Focus

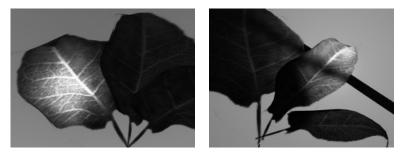
The Translucence Focus value controls how much translucent light is scattered depending on the direction of the light.



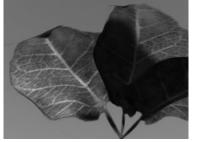
For example, use a high value for very thin materials, such as wax paper or steam, where most of the light is scattered over a small angle relative to the light's direction. The object looks brightest with the light source directly behind it.

Reference > Common surface material attributes

Note When a spotlight is used to light an object with a translucent material, the light does not scatter past the light's cone of influence, even if Translucence Focus is lowered.



Use a mid-range focus value for items such as leaves. The leaves glow when backlit, but do not wash out when lit from the front.







Use a low focus value for thicker objects, such as wax. To compensate for the added light and avoid a washed out result, lower the diffuse value, or lower the overall color (which also affects ambient lighting).

Reference > Common surface material Specular Shading attributes



Tip Lower the color value for very shiny objects that have a bright specular component.

Common surface material Specular Shading attributes

For more information about specular highlights, see "Specular highlight (shine)" on page 17.

For material-specific specular shading attributes, see the particular material. For example, for information on the specular shading attributes of the Anisotropic material, see "Anisotropic" on page 122.

Specular Color

The color of shiny highlights on the surface. A black Specular Color produces no surface highlights. The default color value is 0.5.

Tip For glossy plastic surfaces, use a whitish Specular Color. For metallic surfaces, use a Specular Color similar to the surface color.

Reflectivity

Gives the surface the ability to reflect its surroundings or the Reflected Color (similar to Specular Roll Off). The valid range is 0 to infinity. The slider range is 0 (no reflections) to 1 (clear reflections). The default value is 0.5.

Reflectivity values for common surface materials are car paint (0.4), glass (0.7), mirror (1), chrome (1).

Reference > Anisotropic

- Notes For the Anisotropic material, you must turn off Anisotropic Reflectivity to change this value.
 - Real reflections are only calculated during raytracing.
 - If you are doing raytracing and you want other objects in the scene to be seen in reflections, then for those objects you must ensure the Visible In Reflections attribute is turned on in the Render Stats section of the Attribute Editor. (It is on by default.)

Reflected Color

Represents the color of light reflected from the material. When raytracing, Maya multiplies the color with the light color reflected mirror-like from the surface. This can be used to tint a reflection.

If you are not raytracing, you can map an image, texture, or environment map to the Reflected Color attribute to create fake reflections, which is faster and uses less memory than raytracing. This is called *reflection mapping*. For more information on reflections, see "Reflection" on page 283.

Anisotropic

Is a material (shader) that represents surfaces with grooves, such as a CD, feathers, or fabrics like velvet or satin. The appearance of specular highlights on an Anisotropic material depends on the properties of these grooves and their orientation. The Specular shading attributes (shiny highlights) determine the direction of the grooves as well as their properties.

- An *isotropic* material (such as Phong or Blinn) reflects specular light identically in all directions. If you spin an isotropic sphere, its specular highlight remains still.
- An *anisotropic* material reflects specular light differently in different directions. If you spin an anisotropic sphere, its specular highlight changes, depending on the direction of the grooves.

You can set attributes of Anistropic materials to control the appearance of highlights, determine the orientation and spread of grooves, set the roughness and reflectivity, and reduce spherical abnormalities (fresnel index).

Find this material in the Create bar.

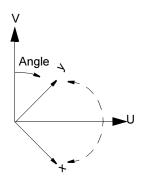
Reference > Specular Shading attributes (Anisotropic)

Specular Shading attributes (Anisotropic)

Control the appearance of specular highlights on a surface.

Angle

Determines the orientation of the grooves. The range is 0.0 (default) to 360.0. Use to determine the X and Y direction for non-uniform specular highlight.



Spread X/Spread Y

Determines how much the grooves spread out in the X and Y directions. The X direction is the U direction rotated counter-clockwise by the specified Angle degrees. The Y direction is perpendicular to the X direction in UV space.

For Spread X, the range is 0.1 to 100.0 and the default is 13. For Spread Y, the range is 0.1 to 100.0 and the default is 3.0

Large values correspond to surfaces which vary smoothly in the X or Y direction. Small values correspond to surfaces with fine structure. When increased, the specular highlight in the X or Y direction shrinks in size—when decreased, the specular highlight spreads out.

When the Spread X value is equal to the Spread Y value, the surface becomes isotropic—equally smooth in all directions. When the Spread X value is more than the Spread Y value, the surface is smooth in the X direction and rough in the Y direction.

For example, when a surface such as a piece of cloth whose fibers run along the X direction is rendered, the highlights non-uniformly spread out with more highlights along the Y direction.

Reference > Specular Shading attributes (Anisotropic)

Roughness

Determines the overall roughness of the surface. The range is 0.01 to 1.0. The default is 0.7. Smaller values correspond to smoother surfaces and the specular highlights are more concentrated. Larger values correspond to rougher surfaces and the specular highlights are more spread out—similar to being diffused.

Fresnel Index

A *fresnel* is a flat lens consisting of a number of concentric rings that reduces spherical abnormalities. The Fresnel Index value computes the fresnel factor that connects the reflected light wave to the incoming light wave. For instance, the Fresnel Index for water is 1.33. Values range from 1.0 to 20.0.

Specular Color

See "Common surface material Specular Shading attributes" on page 121.

Reflectivity

See "Common surface material Specular Shading attributes" on page 121.

Reflected Color

See "Common surface material Specular Shading attributes" on page 121.

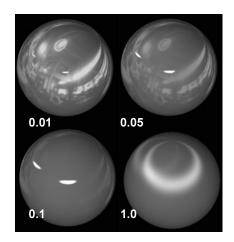
Anisotropic Reflectivity

If on, Maya automatically calculates Reflectivity as a fraction of Roughness. Reflectivity is on by default.

If off, Maya uses the specified Reflectivity value for the environment map (mapped on the Reflected Color attribute), similar to how the Phong and Blinn materials work.

In the following, Anisotropic Reflectivity is on, an environment is mapped on the Reflected Color, and the Roughness is set to 0.01, 0.05, 0.1, and 1.0 (from very smooth to very rough).

Reference > Blinn



Blinn

Is a material (shader) that is particularly effective at simulating metallic surfaces (for example, brass or aluminum) which typically have soft specular highlights.

You can set attributes of Blinn materials to control the size of shiny highlights and the ability of the surface to reflect its surroundings.

Find this material in the Create bar.

Note Blinn is the most computationally expensive of the three common materials: Lambert, Phong, and Blinn.

Tip The soft highlights on Blinn surfaces are less likely to exhibit artifacts or flickering for thin highlights than the harder highlights on Phong surfaces. Use the Blinn surface material for surfaces with bump or displacement maps to reduce highlight artifacts or flickering.

Specular Shading attributes (Blinn)

Eccentricity

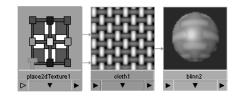
Controls the size of shiny highlights on the surface. The valid range is 0 (no highlight) to 0.999 (broad highlight, not very shiny surface). A value of 0.1 produces a small highlight (very shiny surface). The default value is 0.3.

Reference > Lambert

Specular Roll Off

Gives the surface the ability to reflect its surroundings (the environment, other surfaces) or the Reflected Color, when viewed at oblique angles. The slider range is 0 to 1. The default value is 0.7.

To help visualize the effect of Specular Roll Off in a Blinn material swatch, assign a texture to the Reflected Color.



Tip Use a Specular Roll Off value of 0.3 to simulate a wet surface (for example, wet paint).

Specular Color

See "Common surface material Specular Shading attributes" on page 121.

Reflectivity

See "Common surface material Specular Shading attributes" on page 121.

Reflected Color

See "Common surface material Specular Shading attributes" on page 121.

Lambert

Is a material (shader) that represents matte surfaces (such as chalk, matte paint, unpolished surfaces) with no specular highlights.

The initial (default) shading group uses a special Lambert surface material. Do not modify it; instead, create and apply a new Lambert material.

Find this material in the Create bar.

You can set attributes of Lambert materials to control its appearance. See "Common surface material attributes" on page 117.

Reference > Layered Shader

Layered Shader

For more information on layered shaders, see "Layered shaders" on page 24.

Find this material in the Create bar.

Layered Shader Attributes

Transparency

Sets the material's transparency. By default the material is semitransparent.

Compositing Flag

Composites the layers in either Layered Shader node or Layered Texture node. Each mode calculates the transparency flag differently.

For more information, see "Layered textures with the Layered Shader node" on page 24.

Layered Shader	The color and transparency are processed and passed together to the Layered Shader. In other words, transparency is taken into consideration to modify the color before the color is reported to the Layered Shader.
Layered	

Texture

Color and transparency are passed separately to the layered shader. In other words, color is reported to the Layered Shader with no consideration of the transparency setting; transparency is passed as a separate channel. The color and transparency are then composited. However, this can lead to dark halos where the negative space of the alpha channel is represented.

Hardware Shading Attributes

Hardware Color

Helps you distinguish the objects assigned to a layered shader in the views.

Ocean Shader

Find this material in the Create bar.

For information on Ocean Shader, see "Ocean shader and texture" on page 169 in the Fluid Effects guide.

Reference > Phong

Phong

Is a material (shader) that represents glassy or glossy surfaces (such as car moldings, telephones, bathroom fittings) with a hard specular highlight.

Find this material in the Create bar.

Tip The soft highlights on Blinn surfaces are less likely to exhibit roping or flickering for thin highlights than the harder highlights on Phong surfaces. Use the Blinn surface material for surfaces with bump or displacement maps to reduce highlight roping or flickering.

Specular Shading attributes (Phong)

Cosine Power

Controls the size of shiny highlights on the surface. The valid range is 2 to infinity. The slider range is 2 (broad highlight, not very shiny surface) to 100 (small highlight, very shiny surface), though you can type in a higher value. The default value is 20.

Specular Color

See "Common surface material Specular Shading attributes" on page 121.

Reflectivity

See "Common surface material Specular Shading attributes" on page 121.

Reflected Color

See "Common surface material Specular Shading attributes" on page 121.

Phong E

Is a material (shader) that is a simpler version of the Phong material. The specular highlights on Phong E surfaces are softer than those on Phong surfaces, and Phong E surfaces render faster.

Find this material in the Create bar.

Specular Shading attributes (Phong E)

Roughness

Controls the specularity focus.

Reference > Ramp Shader

Highlight Size

Controls the amount of specular highlight.

Whiteness

Controls the specular highlight color. The default is white, but you can choose any color. You can also map a texture to this value.

Ramp Shader

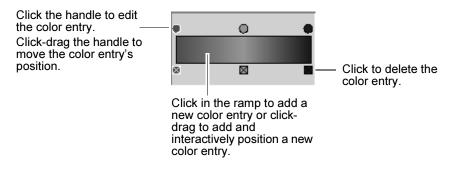
Find this material in the Create bar.

Is a material (shader) that you can use for extra control over the way color changes with light and the view angle. You can simulate a variety of exotic materials and tweak traditional shading in subtle ways.

All the color-related attributes in the Ramp Shader are controlled by ramps (gradients). Graphs let you avoid complex shading networks by making certain looks, like toon shading, easier to achieve.

You can set the many attributes of the Ramp Shader to control the appearance of objects.

Each color entry in a ramp has a circular color handle above the ramp, and a square color icon below the ramp. The active color has a white border around its color handle and icon.



Tip To make a shader that avoids linear artifacts on the edge where a surface turns away from the light try the following:

Diffuse = 0

Translucence = 1

Color: two entries, black at 0.5 and surface color at 1.0

With Linear Interpolation, this should be the same as a normal lambertian falloff. Using Smooth Interpolation makes the linear shading artifacts disappear.

Reference > Color

Color

The basic color of the surface.

Selected Position

Position of the active color entry in the ramp.

Selected Color

The color of the active color entry.

Interpolation

Controls the way colors blend in the ramp. Select an option from the drop-down list: None, Linear, Smooth, Spline. The default is Linear.

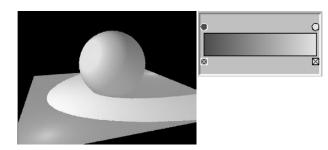
None	There is no interpolation; the different colors show up as distinct bands in the final texture.
Linear	The values are interpolated linearly in RGB color space.
Smooth	The values are interpolated along a bell curve, so that each color on the ramp dominates the region around it, then blends quickly to the next color.
Spline	This takes into account neighboring indices for a smoother effect.

Color Input

Determines how the color is spread over the surface. Select an option from the drop-down list: Light Angle, Facing Angle, Brightness. The default is Light Angle.

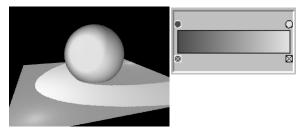
Light Angle The position along the ramp is determined by the angle of the light with the surface normal. The right side of the ramp is the color where the normal points directly towards the light. The center of the ramp represents the point at which the surface normal is perpendicular to the light. The left side is the color where the normal faces directly away from the light. The color values to the left of the ramp center is not be visible unless the shader has some translucency. This takes into account all lights in the scene.

Reference > Color



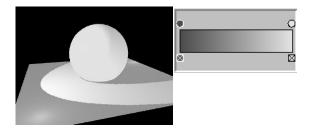
Facing Angle

The position along the ramp is determined by the angle of the surface with the view direction. The right side of the ramp is the color where the surface normal faces the camera. The left side is the color where the surface normal is perpendicular to the camera.



Brightness

The total light brightness is used to index the ramp. This can be used to create cartoon style shading by using a ramp with stepped values. The right side of the ramp is the output color where the brightness of the diffuse and translucent lighting is 1.0 or greater. The left side is the output color where the brightness is zero.



Reference > Transparency attributes

Transparency attributes

Controls how transparent or opaque the material is, as well as the transparency color. Black, the default, is completely opaque and white is completely transparent. You can set it to any level in between. If there is more than one index in the ramp then the transparency value varies with the facing angle.

For descriptions of the attributes, which are the same as the Color attributes, see "Color" on page 130.

Incandescence attributes

Makes a material appear as if it were emitting light, such as lava or a phosphorescent moss. The default color is black, which has no effect on the surface. If there is more than one index in the ramp the incandescence value varies with the facing angle.

For descriptions of the first few attributes, which are the same as the Color attributes, see "Color" on page 130.

Ambient color

See "Ambient Color" on page 118.

Bump Mapping

See "Bump Mapping" on page 118.

Diffuse

See "Diffuse" on page 118.

Forward Scatter

Controls how much of the light is diffusely scattered along the light direction. At a value of 0 the light is scattered uniformly in a lambertian fashion, which is good for most surfaces. Some materials, such as skin, scatter the light more along the forward direction so values larger than zero may help in simulating these materials.

Translucence

See "Translucence" on page 118.

Translucence Focus

See "Translucence Focus" on page 119.

Translucence Depth

See "Translucence Depth" on page 132.

Reference > Specular Shading attributes

Specular Shading attributes

Specularity

Controls how bright the specular highlights are. It is a simple multiplier of the specular color.

Eccentricity

Controls how big the specular highlights, or hot spots, are. For more information, see "Specular Shading attributes (Blinn)" on page 125.

Specular Color

Is the color of the specular reflections, also called hot spots, on the material. The final color of a specular reflection is a combination of the Specular Color and the color of the light. By making the Specular Color brighter or dimmer, you can control the brightness of the specular reflections on an object. If there is more than one ramp index, the specular color varies based on the brightness of the highlight.

For descriptions of the attributes, which are the same as the Color attributes, see "Color" on page 130.

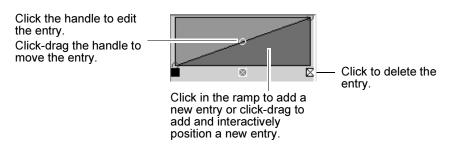
Specular Roll Off attributes

This modulates or scales the intensity of the specular highlight. The facing ratio is the input to the graph. Making the graph slope down to the right simulates the fresnel effect, where objects with a low refractive index are more reflective towards the edge (where the normal is perpendicular to the view). Water and wax both have a relatively low refractive index, thus this can help simulate the look of a waxed car finish, an ocean surface or a wet object. The horizontal dimension of the graph represents the brightness of specular reflections and the vertical represents the facing angle with the view.

Specular Rolloff does not affect the reflections produced when you render using raytracing.

Tip To get a wet look, such as wet paint, make the edges more reflective.

Reference > Specular Shading attributes



Selected Position

The active value on the x-axis of the ramp graph.

Selected Value

The active value on the y-axis of the ramp graph.

Interpolation

Controls the way values are calculated in the ramp. Select an option from the drop-down list: None, Linear, Smooth, Spline. The default is Smooth.

None

There is no interpolation; the different colors show up as different bands in the final texture.

Linear

The values interpolated linearly in RGB color space.

Smooth

The values interpolated along a bell curve, so that each value on the ramp dominates the region around it, then blends quickly to the next value.

Spline

This takes into account neighboring indices for a smoother effect.

Reflectivity attributes

This functions in the same manner as specular rolloff, but modulates the environment and reflected color instead of specularity. It also affects raytrace reflections. Reflectivity is used to make an object reflect light and its environment like a mirror. Set to 0 for no reflection. Increase the value to make brighter reflections. Note that brighter reflections hide more of the base surface color. This attribute is only meaningful if there is a reflection map, or if you are raytracing the render.

Reference > Shading Map

Note If you are doing raytracing and you want other objects in the scene to be seen in reflections, then for those objects you must ensure the Visible In Reflections attribute is turned on in the Render Stats section of the Attribute Editor. (It is on by default.)

For descriptions of the Selected Position, Selected Value, and Interpolation attributes, see "Specular Roll Off attributes" on page 133.

Environment attributes

Defines a simple sky to ground environmental reflection using a ramp. The left of the ramp is the top of the sky and the right is the bottom.

For descriptions of the Selected Position, Selected Color, and Interpolation attributes, see "Color" on page 130.

Reflected Color

Affects the color of light reflected from the material. You can map an image, texture, or environment map to this attribute in order to make fake reflections, which are less expensive than raytracing. This is called reflection mapping. Reflection mapping and raytracing may be used together, in which the reflection map is used as background, and raytraced reflections appear in the foreground.

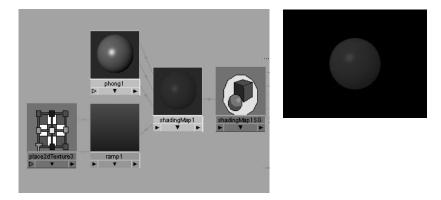
Shading Map

Is a material (shader) that lets you create various non-photorealistic shading effects, such as cartoon-style materials, or highlight threshold values in a rendered image.

Use a Shading map shader with a basic shader (such as a Phong or Blinn shader) and a texture (such as a Ramp or File texture).

For example, you can create a material that renders the bright areas of an object (the areas facing light) as red, and the dark areas of an object (facing away from light) as blue. For this example, you would use a Shading Map shader, a Lambert shader, and a Ramp texture. The Ramp texture is red on the top, and blue on the bottom. Connect the Lambert shader's Out Color attribute to the Shading Map shader's Color attribute. Connect the Ramp texture's Out Color attribute to the Shading Map shader's Shading Map Shader's Shading Map Color attribute.

Reference > Shading Map Attributes



Shading maps work like a post process: the regular shader computes a color for each point on the surface, then the shading maps shader replaces this color with another color. This mapping is based on two things; the brightness of the original color, and the hue of the original color.

Find this material in the Create bar.

Shading Map Attributes

Color

Select a color, or map with a shader to this attribute. This provides the base color to which the shading map is applied.

Shading Map Color

Defines the color of the material. The default is gray.

Map Options

Map Function U, Map Function V

Their defaults are Hue and Value, respectively, but other options include Saturation, Red, Green, Blue, and RGB Average. Map Function U specifies how the input color is used when looking up in the U direction of the shadingMapColor. Map Function V specifies the input color is used when looking up in the V direction of the shadingMapColor.

Surface Shader

Is a material (shader) that is a wrapper node, which means that you can connect any keyable attribute to this shading group, and then connect the shading group to an object. For example, you can connect an object's Translate Position to a Surface Shader's Out Color attribute to determine the object's color by the object's position.

Reference > Surface Shader Attributes

Find this material in the Create bar.

Surface Shader Attributes

Out Color

The color of the material. The default is black.

Out Transparency

The transparency of the material. The default is black (opaque).

Out Glow Color

The glow color of the material. The default is black, without glow.

Out Matte Opacity

Connect another attribute to this to control the opacity of the material's matte (alpha) channel.

Use Background

You can create custom shadow and reflection passes with the useBackground material which catches shadow and/or reflections.

When the shadow pass is rendered, a black image is created with mask channel that contains the shadow information. A compositor can work with this channel to blur, lighten, darken, etc., the look of the shadows. When the reflection pass is rendered, an RGB image is created with a white mask in the mask channel.

Find this material in the Create bar.

For more information about the Use Background material as a catcher, see *"Shadow catching" on page 35* in the *Lighting* guide.

Use Background Attributes

Specular Color

Defines the material's specular color. If you change this color or assign a texture to it, the reflections in the scene display your changes. For instance, if you map a checker texture to the Specular Color, the reflection appears in a checkered pattern. Drag the slider to set the Specular Color to white if you want to see very clear reflections in the rendered result. The default is gray.

Reflectivity

Determines how much of the object's texture reflects on the Use Background material. For instance, if the object is very shiny, increase this value. The default is 0.5.

Reference > Matte Opacity

Reflection Limit

Determines the reflection's distance. The default is 2.

Shadow Mask

Determines the density of the material's shadow mask. If you change this value, the shadow masks becomes darker or lighter, allowing you to better verify the shadows and reflections in the scene when viewing the mask channels in Render View.

Click to display RGB channels

Click to display mask channels

The default value is 1.0. If set to 0.0, the shadow does not display.

Matte Opacity

For best results when adjusting these attributes, select the Display Alpha Channel icon in the Render View to view the mask channels when rerendering the scene.

Matte Opacity Mode

Opacity Gain	Displays both reflections and shadows.	
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Solid Matte Adjusts the density of the Use Background material.

Matte Opacity

Use the slider or enter a value to adjust the density of the mask channels.

Shared surface material attributes

The following sections of the Attribute Editor provide attributes that are shared between most materials.

Special Effects

These attributes control the appearance of glows produced from light reflecting off surfaces, or from surface incandescence. Special Effects attributes are available for Anisotropic, Blinn, Lambert, Phong, and PhongE material types. See also "Glow" on page 315 for more information.

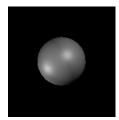
Reference > Matte Opacity

Hide Source

Makes the surface invisible when rendered (if the Glow Intensity value is non-zero) showing only the glow effect. Hide Source is off by default.

Glow Intensity

The brightness of the surface glow effect. The slider range is 0 to 1, but you can type in higher values to create a 'blown out' or 'burn in' effect. The default value is 0. Mapping a texture to the Glow Intensity can create very interesting effects. Turn on Hide Source to view the results.



Blinn material, color applied



Glow Intensity mapped to Bulge texture, Hide Source off



Result when Hide Source is on

Matte Opacity

You can control the mask value for individual objects. Matt Opacity attributes are available for Anisotropic, Blinn, Lambert, Layered Shader, Phong, PhongE, Shading Map and Use Background material types.

Matte Opacity Mode

Select from the list of modes in the drop-down menu.

For best results when adjusting these attributes, select the Display Alpha Channel icon in the Render View to view the mask channels when re-rendering the scene.

Opacity Gain

This is the default Matte Opacity Mode. This mode produces both reflections and shadows.

The matte channel is first calculated, and then multiplied by the specified Matte Opacity value. The Opacity Gain value is used as a multiplier on the matte value produced by this material.

The Matte Opacity Mode value is also keyable. The Opacity Gain range is from completely invisible to no effect (rendered as usual).

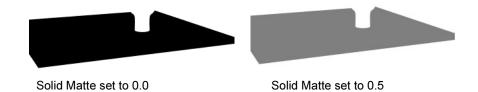
Reference > Matte Opacity



Solid Matte

Solid Matte makes the value of the matte channel constant for the material. The value you specify in the Matte Opacity slider is used, instead of the default value.

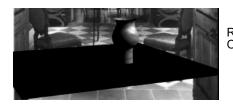
Use Solid Matte to adjust the overall density or visibility of the Use Background material.



Black Hole

When you select the Black Hole mode, the matte channel for the material is set to 0 (fully transparent). This creates a black hole in the alpha output where the object assigned shader renders the matte 'knocked out'.

In this mode, the Matte Opacity slider is disabled and its value ignored.



Rendered result with Matte Opacity Mode set to Black Hole

Note For the Opacity Gain and Solid Matte modes, if an object has non-zero Transparency, objects behind it make their usual contribution to the matte channel's values. This is the difference between setting Matte Opacity to 0.0 in these modes, and choosing the Black Hole mode.

Reference > Raytrace Options

Matte Opacity

This value depends on which Matte Opacity Mode is selected (Opacity Gain or Solid Matte). For example, for Opacity Gain, the Matte Opacity value indicates the multiplier amount for the alpha channel. The default is 1, which means that any opaque material registers an unaffected alpha value.

Any values between 0 and 1 act as a multiplier to the alpha channel value to arrive at modified value. Use the slider or enter a value to adjust the density or visibility of the mask channels.



Opacity Gain with a Matte Opacity value of 1.0

Opacity Gain with a Matte Opacity value of 0.5

Raytrace Options

The Raytrace Options attributes control the appearance of a surface during raytracing only.

Raytrace Options attributes are available for Anisotropic, Blinn, Lambert, Phong, and PhongE material types.

Refractions

When enabled, rays that are traced through transparent or semitransparent objects are refracted, or bent according to the material's refraction index.

Refractive Index

The amount that light rays bend when passing through a transparent object. A Refractive Index value of 1 does not bend light rays at all, so you need to set the index value higher than 1. Refractive Index values for common materials are: glass (1.6), air (1), water (1.333), crystal (2), diamond (2.417). The valid range is 0.01 to infinity. The slider range is 0.01 to 3, but you can type in a higher value. The default setting is 1.6.

Reference > Raytrace Options

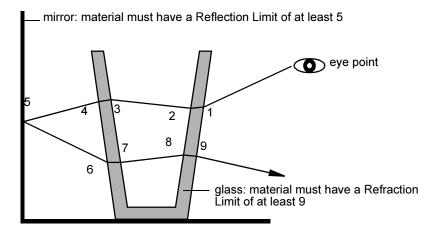
- Tips The material's Hypershade swatch only approximates the effect of the Refractive Index attribute.
 - Surfaces must have thickness for Refractive Index to have any effect. If a surface does not have thickness (for example, a plane or face element), set the Refractive Index value to 1.
 - For best results, make sure there are suitable objects in the background to be refracted.

Refraction Limit

The maximum number of times the surface allows a light ray to be refracted. For example, if the Refraction Limit value is 10, the surface refracts light rays that have previously been refracted and/or reflected (off itself or off other surfaces) 9 times or less; the surface does not refract light rays that have previously been refracted and/or reflected 10 or more times. The valid range is 0 to infinity. The slider range is 0 to 10. The default value is 6. Increasing this value may significantly increase render times.

You must also consider the Render Global Settings window Raytracing Refraction attribute too. Maya uses the lower value of the 2. For instance, if your limit is set to 9 on the material and 6 in the Render Global Settings window, a value of 6 is be used. See also, Reflection Limit

In the following example, a glass sits in front of a mirror.



The number of refractions includes both the entry and exit of a light ray from a surface having thickness.

Reference > Raytrace Options

The physical property Total Internal Reflection (TIR) can make some transparent objects appear not to refract light. This is caused by light rays reflecting inside the thickness of the object. If this occurs, increasing Refraction Limit has no effect because the Reflection Limit is stopping light rays before they can exit the surface. However, because TIR is a real-world property, you may want to keep this effect.

Tip To simulate realistic looking glass, set the Refraction Limit value to 9 or 10.

Reflection Limit

The maximum number of times the surface allows a light ray to be reflected. For example, if the Reflection Limit value is 4, the surface reflects light rays previously reflected (off itself or off other surfaces) 3 times or less; the surface does not reflect light rays previously reflected 4 or more times. The valid range is 0 to infinity. The slider range is 0 to 10. The default value is 1.

Set the Reflection Limit value according to the material's Reflectivity value. For example, if the Reflectivity value is between 0 and 0.5, set the Reflection Limit value between 1 and 2. If the Reflectivity value is between 0.5 and 1, set the Reflection Limit value between 2 and 5.

High values for Reflection Limit greatly increase rendering time. Test render the scene using various settings, and use the lowest values that give you acceptable results. Even highly reflective surfaces rarely need a Reflection Limit value as high as 10 or more.

You must also consider the Render Global Settings window Raytracing Reflection attribute too. Maya uses the lower value of the 2. For instance, if your limit is set to 5 on the material and 1 in the Render Global Settings window, a value of 1 is used. See also Reflection Limit.

Reflection Specularity

This attribute is available for Blinn, Anisotropic, Phong, and PhongE materials.

Reduce this value to avoid highlight aliasing artifacts produced in reflections during raytracing because of very thin or small highlights. Maya adds Reflection Specularity to each material to control the contribution of the specular highlights in reflections. The valid range is 0 to 1. The default is 1 (full contribution).

Reference > Raytrace Options

Translucence Depth

Simulates the way light diffusely penetrates through translucent objects. For example, when light shines on one side of the object, the other side is partially illuminated. This can be used for effects such as clouds, fur, hair, marble, jade, wax, paper, leaves, etc. (To see this effect, turn on raytraced shadows for the light shining on the object.)

Translucence depth is based on worldspace. If it is set to 0 (the default), no light shows through the object. If set to 10, light penetrates through the surface, 10 units past the point where the object is in shadow.

Tip To see the effects of translucence depth, set the transparency to a non-zero value. If the surface is supposed to be opaque, set the transparency to a very small value, such as 0.0001.

Light Absorbance

Describes how light-absorbing a material is. A material with an Absorbance of 0.0 transmits completely. The higher the value, the less light passes through.

Transparent materials generally absorb an amount of the light which passes through them. The thicker the material, less light gets through—the thinner the material, more light gets through.

Surface Thickness

The simulated thickness (in world space) of transparent objects created from single surfaces (for example, a NURBS plane, or polygon face).

Using Surface Thickness does not produce the same results as building a surface with actual thickness—the effect works well when the edges of the surface are not visible (for example, closed surfaces, or bounded shapes, like a car windshield).

Shadow Attenuation

Shadows of transparent objects are brighter in the center, simulating a light's focus. A setting of 0 results in constant intensity shadows. The focusing increases as the parameter increases from 0 to 1. The default value is 0.5. The amount of attenuation for a given light ray depends on the angle between the light ray and the surface normal of the transparent object: the greater the angle, the greater the attenuation. To turn off the shadow attenuation completely, set shadow attenuation to 0.

Reference > mental ray

Chromatic Aberration

Different wavelengths of light refract at different angles when passing through a transparent surface during raytracing. Chromatic Aberration only affects light rays as they pass through the second surface of a transparent object (the first exit ray).

mental ray

Use the irradiance attributes to control the appearance and strength of global illumination effects (photons and final gathering) on surfaces.

Irradiance

Use this to map an incoming illumination map, such as one generated using "Lighting/shading > Batch Bake (mental ray)" on page 307. For information about baking in general, see "Baking illumination and color" on page 299.

Irradiance Color

This controls the strength of the global illumination effect on the surface.

Photon Attributes

Set attributes to Derive From Maya, or turn the option off and set remaining attributes, such as Specular Color and Diffuse, so that they are calculated using mental ray. Alternatively, you can change the settings in the Maya sections of the Attribute Editor (Common Material Attributes, etc.) and click Take Settings From Maya to compute the equivalent mental ray values for these attributes.

Hardware Shading

This is not rendered.

Override hardware shading for Lambert, Blinn, Phong, PhongE and Anisotropic shaders.

Hardware Shader

Plug-in writers can use this to override the hardware display while preserving software rendering.

Hardware Texturing

This is not rendered.

Preview rendered materials and textures in the modeling views. You can select specific channels to view and determine the hardware render quality. Hardware Texturing attributes are available for Anisotropic, Blinn, Lambert, Phong, and PhongE material types.

Reference > Hardware Texturing

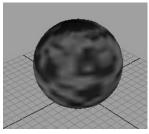
Textured channel

This drop-down menu displays the mapped attributes for a texturemapped material. This can be useful if you map several textures to a material and want to view them one by one. If, for example, you map a Checker texture to a Blinn material's Color attribute, and a File texture to its Specularity attribute, you can select Color from the dropdown menu to display only the Checker texture in the view. The top of a material's Attribute Editor also provides tabs for each texture so you can select and edit the texture and watch the results in the view.

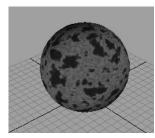
The Combined Textures option can be used to process the entire shader into one texture for hardware display purposes. It allows the entire shader to be previewed on the applied object and not just single channels, for example, color and incandescence.

Texture resolution

Lets you choose to view the textured object with varying degrees of accuracy and clarity.



Default



Highest (256 x 256

Notes • Some effects, such as bump mapping or glows, cannot be seen in hardware texture mode (in the modeling views). Use the Render View or IPR render to view the results.

• The Texture Resolution options only improve the quality of the hardware textured image in the modeling views. You cannot use these options to improve the test render quality in Render View. Instead, change the Resolution and Antialiasing Quality settings in the Render Globals Settings window. Remember: the higher the quality the slower the render time.

Reference > Displacement

Displacement material

Displacement

For more information on the displacement material, see "Displacement material" on page 23

Find this material in the Create bar.

The Displacement Shader only has one attribute.

Displacement

The amount by which the surface is displaced. The default displacement value is 0.

Volumetric materials

Overview of volumetric materials

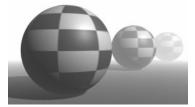


The Material tab in the Create Bar (in the Hypershade) and the Create Render Node window includes Surface Materials, Volumetric Materials, and Displacement Materials. For more information on volumetric materials, see "Volumetric material (atmosphere)" on page 24.

- Some attributes (such as Matte Opacity) are common to all volumetric materials and are described in "Common Volumetric material attributes" on page 161.).
- Volumetric material-specific descriptions are provided under the material name.

Reference > Environment Fog

Environment Fog



Simulates the effect of fine particles (fog, smoke, or dust) in the air. These particles affect the appearance of the atmosphere and the appearance of objects in the atmosphere. To simulate particles in the air illuminated by a particular light, use Light Fog (see "Light Fog" on page 156).

There are two types of Environment Fog: Simple Fog (default) and Physical Fog, each of which have specific attributes.

Find this material in the Create bar.

Important!

Environment fog cannot cast shadows. If you want to cast shadows, use Light Fog (see "Light Fog" on page 156). See also Matte Opacity.

Simple Fog

Color

Change to simulate different effects, such as smog (brown fog), or to create the illusion of great distance (blue fog). The default setting is white.

Color Based Transparency

If off, objects obscured by environment fog appear as flat-shaded silhouettes. If on, objects obscured by environment fog are fully shaded, not just flat-shaded silhouettes.

If the fog Color is dark (black), turn off Color Based Transparency or the fog is not visible. Color Based Transparency is on by default.

Saturation Distance

The distance (measured in the scene's linear working unit) from the camera at which environment fog becomes fully saturated (its color value reaches the Color setting). The Saturation Distance affects how much objects within or behind the fog are obscured. The slider range is 0.001 to 200. The default value is 100.

Reference > Physical Fog

To change the amount that objects within or behind environment fog are obscured, adjust the Saturation Distance attribute and the value of the Color attribute.

Use Layer

If on, you can assign a texture to the Layer attribute to create variations in the density and color of environment fog across the camera's view (that is, in two dimensions). If off, constant density environment fog fills the camera's view. Use Layer is off by default.

Layer

Lets you map a texture to the fog, which gives the effect of patchiness in the fog's density. The most common application is mapping the Density to a 3D texture, like a Solid Fractal, and mapping a Ramp texture to the Layer attribute. Make the Ramp black and white to get a contrast of transparency and opacity. Use Layer is off by default.

Use Height

If on, environment fog exists between the Min Height and Max Height. If off, environment fog fills the camera's view. Use Height is off by default.

Min Height, Max Height

The minimum and maximum height (measured in the scene's linear working unit) from the origin within which environment fog exists (when Use Height is on). If Max Height is less than Min Height, environment fog extends from Min Height to infinity. The slider range is -10 to 10. The default value is -1 for Min Height and 1 for Max Height.

Blend Range

The vertical distance (measured in the scene's linear working unit) over which environment fog gradually fades from full density to zero density. (The edges of the fog are defined by the Min Height and Max Height values.) The slider range is 0 (fog suddenly ends at Min Height and Max Height) to 1 (fog gradually fades at Min Height and Max Height). The default value is 0.

Physical Fog

To access the attributes of Physical Fog, you must turn it on (click the check box under the swatch in the Attribute Editor).

Fog Type

Controls how Maya simulates the fog in the scene. It has a number of different settings, depending on what kind of fog effect you want. This attribute is only available when Physical Fog is turned on.

Reference > Physical Fog

Uniform Fog	Fog has uniform density in all directions.
Atmospheric	Fog is thickest near the ground, and thins out (decays) as you move upwards.
Sky	Simulates the effect of a whole sky, with fog blending properly at the horizon, etc. Use this to provide a complete background to a foggy scene. Especially useful for scenes where you can see a long distance.
Water	Simulates the effect of water, scattering light shining in from above. Useful for underwater shots, or for shots where objects are visible in a pool of water from above.
Water/Fog	Uniform Fog appears above the water in the scene.
Water/Atmos	Atmospheric Fog appears above the water in the scene.
Water/Sky	The full Sky Fog simulation appears above the water in the scene.

Fog Axis

Controls the direction the fog simulation uses for the up direction. You can choose any of the X, Y, or Z axes in the positive or negative direction.

This attribute is only available when Physical Fog is turned on, and the Fog Type is not Uniform.

Planet Radius

Available for the Atmospheric, Sky, Water/Atmos, Water/Sky Fog Types.

Fog

Depending on the Fog Type you select, Fog attributes are either available or disabled.

Fog Color

Controls the color of light scattered by the fog. When light passes through air or fog, some frequencies (colors) pass directly through, while other frequencies are scattered. The scattered frequencies give the fog its distinctive color.

Fog Opacity

Controls which light frequencies (colors) are absorbed as they pass through the fog. This affects the way objects in the background seem to be tinted by the fog.

Reference > Physical Fog

Fog Density

Controls the optical density of vapor in the fog layer. Increase this value to thicken the fog.

Fog Min Height

Controls the height of the bottom of the fog layer. *This attribute is only available when Physical Fog is turned on, and Fog Type is not Uniform.*

Fog Max Height

Controls the height of the fog layer. If the Fog Type is Atmospheric (or Water/Atmos), the density of the fog decreases exponentially from Fog Min Height upwards. If the Fog Type is Sky (or Water/Sky), Fog Max Height is the height of the top of the fog layer. *This attribute is only available when Physical Fog is turned on and Fog Type is not Uniform*.

Fog Decay

Fog Decay controls the rate that the fog *thins out* at higher altitudes. A value of 0.5 makes the fog decay linearly. Values between 0.5 and 1 makes the fog fairly even near the ground, then drop off suddenly at the top. Values between 0 and 0.5 causes the fog to thin out very rapidly near its base. *This attribute is only available when Physical Fog is turned on and Fog Type is not Uniform*.

Fog Light Scatter

Controls how evenly light is scattered in the fog. A value of 1 uniformly scatters the light spread throughout the fog. Lower values make the fog brighter near the position of the sun.

Air

Depending on the Fog Type you select, Air attributes are either available or disabled. The following table lists the Air attributes available for the Fog Type.

Air Color

Controls the color of light scattered by the air. When light passes through air or fog, some frequencies (colors) pass directly through, while other frequencies are scattered. The scattered frequencies give the sky, for example, its distinctive color.

Air Opacity

Controls the light frequencies (colors) absorbed as they pass through the air. This affects the way objects in the background appear to be tinted by the air. For example, objects on the horizon often appear bluish to the naked eye.

Reference > Physical Fog

Air Density

Controls the optical density of air in the fog simulation. Increase this value to make the air seem denser.

Air Min Height

Controls the height of the bottom of the air layer. *This attribute is only available when Physical Fog is turned on and Fog Type is not Uniform.*

Air Max Height

Controls the height of the air layer. If the Fog Type is Atmospheric (or Water/Atmos), the air density decreases exponentially from Air Min Height upwards. If the Fog Type is Sky (or Water/Sky), Air Max Height is the height of the top of the air layer. *This attribute is only available when Physical Fog is turned on, and Fog Type is not Uniform.*

Air Decay

Controls the rate at which the air thins out at higher altitudes. A value of 0.5 makes the air decay linearly. Values between 0.5 and 1 makes the air fairly even near the ground, then drop off suddenly at the top. Values between 0 and 0.5 cause the air to thin out rapidly near the ground. *This attribute is only available when Physical Fog is turned on and Fog Type is not Uniform.*

Air Light Scatter

Controls how evenly the light is scattered in the air. A value of 1 means that the light is uniformly scattered, and appear s to spread throughout the air. Lower values cause the atmosphere to appear brighter around the sun position. *This attribute is only available when Physical Fog is turned on*.

Water

These attributes become available if the Fog Type is either Water, Water/ Fog, Water/Atmos, or Water/Sky.

Water Color

Controls the color of light scattered by the water. When light passes through air or water, frequencies (colors) pass directly through, while other frequencies are scattered. The scattered frequencies give the water its distinctive color. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Opacity

Controls the light frequencies (colors) absorbed as they pass through the water. This affects the way objects in the background appear to be tinted by the water. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Reference > Sun

Water Density

Controls the optical density of water in the fog simulation. Increase this value to make the underwater fog seem more dense. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Level

Value represents the water level. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Depth

Value represents the water depth. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Light Decay

Controls the rate illumination drops off with depth. Set this to 0 if you don't want the light to decay (that is, you don't want it to get darker as it gets deeper). A value of 1.0 results in a linear decay, and higher values darken faster. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Water Light Scatter

Controls how evenly the light is scattered in the water. A value of 1 uniformly scatters the light and it appears to spread throughout the water. Lower values cause the water to appear brighter near the surface from where the light is coming. *This attribute is only available when Physical Fog is turned on and Fog Type is set to one of the Water types.*

Sun

Sun Intensity controls the overall brightness of the sunlight illuminating fog. *Only available when Physical Fog is turned on, and the Fog Type is not Uniform.*

Sun Color

Controls the color of the sunlight illuminating the fog.

Sun Azimuth

Controls the position (angle) of the sun along an imaginary circle that goes around the Fog Axis.

Reference > Clipping Planes

Sun Elevation

Controls the position (angle) of the sun along a line from the horizon to directly overhead. A value of 90 puts the sun directly above (actually, directly in the position pointed to by the Fog Axis) and a value of 0 puts the sun at the horizon.

Clipping Planes

Distance Clip Planes

If set to Fog Near/Far, environment fog exists between the Fog Near Distance and the Fog Far Distance. If set to Camera Near/Far, environment fog exists between the camera's near and far clipping planes. The default setting is Fog Near/Far.

Fog Near Distance, Fog Far Distance

The minimum and maximum distance (measured in the scene's linear working unit) from the camera where environment fog exists when Distance Clip Planes is set to Fog Near/Far.

If Fog Far Distance is less than Fog Near Distance, environment fog extends from the Fog Near Distance to infinity. The slider range is 0 to 200. The default value is 0 for Fog Near Distance and 200 for Fog Far Distance.

Volume Fog

Find this material in the Create bar.

Apply this material to volumetric primitives to create effects such as spherical, conical, or cubicle smoke, fog, or dust. For more information on strategies, see "Create > Volume primitives" on page 296.

Color

Assign a color or map a texture to the volume. To use the color ramp, see "Ramp" on page 179.

Transparency

Represents the amount of the volume's Transparency.

Incandescence

To make a material appear as if it were emitting light, such as lava or a phosphorescent moss. A slight touch of incandescence on vegetable matter, for example, can make the vegetation look alive. The color is black by default, which has no effect on the surface.

Reference > Dropoff

Note Although a surface appears to glow when you apply Incandescence, it does not act as a source of light in the scene. See also Glow Intensity.

Glow Intensity

As you increase this value, the material seems to glow and is surrounded by a faint halo of light. Glow Intensity is different from Incandescence in two ways:

- Glow adds a halo to the surface.
- Maya adds the glow effect at the end of rendering as a post-process; Incandescence just makes the surface appear brighter.

Density

Represents the density or transparency of the fog.

Density Mode

Determines if the density is defined in world space or object space. Object space density preserves the look when an object is scaled.

Illuminated

If on, lights are computed for the fog. The lighting for each volume span is determined by the volume sample's attribute on the geometry.

Light Scatter

The amount the fog scatters light in all directions. As it approaches zero, the fog tends to scatter light directionally, which results in halos around light sources.

Dropoff

Dropoff Shape

Select either the Cone, Sphere, Cube, or Light Cone as a shape used to define an outer boundary to create a soft-edged volume. For example, if rendering a box volume, Cube should match the edges of the volume.

Note Light Cone is different from Cone—the dropoff (or fade) occurs near the point of the cone.

Reference > Light Fog

Edge Dropoff

Defines how suddenly the density falls off near the edges defined by the Dropoff Shape. A value of 0.0 results in a hard edge with no dropoff. A value of 1.0 results in smooth density fade from the edge to the center of the volume.

Axial Dropoff

Defines the density dropoff down the center axis of a cone. Higher values make the fog less dense further from the peak of the cone. (Only works with Cone shapes).

Dropoff Method

Scale Opacity	Multiplies the overall density by the fade value, causing a uniform change in transparency.
Subtract	
Density	Subtracts the fade value multiplied by the Dropoff Subtract value from the density. Useful when density or transparency is textured. Low density regions become completely transparent, while high density regions are not very affected. This can help preserve the character of a fluffy cloud, for example.

Dropoff Subtract

The maximum amount of density subtracted from the volume when Dropoff Method is Subtract Density. If the volume density is 1.0 and Dropoff Subtract is 1.0, the edge of the volume is completely transparent.

Light Fog

Simulates particles in the air (for example, fog, smoke, dust) illuminated by a particular light. You can add light fog to spot lights or point lights. Light Fog can cast depth map shadows. Environment Fog cannot.

Find this material in the Create bar.

Color

The color of illuminated fog. (The light's Color also influences the color of illuminated fog.) The default color is white.

Density

The density of illuminated fog. The higher the density, the more obscured the objects within or behind the fog. (The density also influences the brightness of illuminated fog.) Color Based

Reference > Particle Cloud

Transparency and Fast Drop Off also influence how objects are obscured by illuminated fog. The slider range is 0 to 1. The default value is 1.

Color Based Transparency

If on, the amount that objects within or behind the fog are obscured is based on the Density value *and* the Color value. Objects obscured by the fog are fully shaded, not just flat-shaded silhouettes. If the fog Color is dark (for example, black), turn off Color Based Transparency (otherwise the fog is not visible). Color Based Transparency is on by default.

Fast Drop Off

If off, all objects within or behind the fog are obscured by the same amount, based on the Density value. If on, each object within or behind the fog is obscured by a different amount, based on the Density value *and* the object's distance from the camera (that is, the amount of fog between the camera and the object). Fast Drop Off is off by default.

An object (or part of an object) which has more fog between it and the camera appears more obscured than an object (or part of an object) which has less fog between it and the camera. This is the way real-world fog behaves.

Tip If Fast Drop Off is on, objects within the fog that are further from the camera may be obscured too much, so you may want to reduce the Density value.

Particle Cloud

Used to achieve effects such as gas or clouds. You can software render particles as thin gas, cloud, thick cloud, blobby surface or tube.

Volume material which can be connected to the volume port of a shading group. The initialParticleSE is a shading group that has a lambert material connected to its Surface port, and a particle cloud material connected to its Volume port. You can connect the particle cloud shading group to a particle emitter to achieve effects such as gas or clouds. You can software render particles as thin gas, cloud, thick cloud, blobby surface or tube.

Color, Transparency, and Incandescence can be set to a fixed value, or texture mapped over the particles' lifetime. If mapped, the V values of the map are mapped onto the particles' lifetime.

Find this material in the Create bar.

Reference > Particle Cloud

Color

The basic color of the particle cloud. The default color is a green-blue.

Transparency

Controls how much you can see through the particle cloud. It is a color, so that you can control the transparency of the red, green, and blue channels separately. To make the cloud more opaque, set transparency to be darker. To make the cloud more transparent, set transparency to be brighter.

Incandescence

Use Incandescence to make the particle cloud brighter, as though it were a light source. By default, Incandescence is black, meaning no glow is added.

Note When Incandescence is turned on, although the particle cloud glows, it does not cast light on other objects in the scene.

Life Color, Life Transparency, and Life Incandescence are driven by the particle age (the texture defines color, transparency, and incandescence, all of which get their UV information from the Particle Age Mapper utility node). The Particle Age Mapper utility node is created automatically at the time the texture is created.

Life Color

Determines the color at a particular time in the life of the particle. You can use the Particle Sampler Info node to animate this attribute over a particle's lifetime.

Life Transparency

Determines the transparency at a particular time in the life of the particle. You can use the Particle Sampler Info node to animate this attribute over a particle's lifetime.

Life Incandescence

Determines the incandescence at a particular time in the life of the particle. You can use the Particle Sampler Info node to animate this attribute over a particle's lifetime.

Glow Intensity

Controls how much of a halo-like glow effect is added to the particle cloud. This glow effect is added as a post-process, after the rendering is completed. Glow Intensity is zero by default, meaning that no glow is added.

Reference > Particle Cloud

Transparency

Density

Similar to transparency; it controls how dense the cloud of particles appears to be, and therefore how much of the background can be seen through it. Increase this value to make the cloud more dense.

Blob Map

Specifies a scaling factor applied to the transparency of the particle cloud. You can connect a 3d texture to it in order to give some internal texture or shape to the cloud beyond what it gets from the particles.

Roundness

Controls the noise's irregularity. The smaller the value, the less rounded the shape.

Translucence

Specifies a scaling factor for density that is used only to compute shadows. The larger the translucence value, the more light penetrates. The formula is:

density * (1 - translucence)

Built-in Noise

Noise

Controls the jitteriness within the particle cloud. If it is set to zero, the cloud looks very smooth and uniform throughout. As the amount of noise increases, the cloud appears *noisier*, like static on a television screen. Noise is set to 0.75, by default.

Noise Freq

Determines the size of the noise artifacts when Noise is turned on. Higher values of Noise Frequency produce smaller, finer artifacts, and lower values produce larger, coarser artifacts. If Noise Frequency is set to zero, that is the same as turning Noise off.

Noise Aspect

Controls the distribution of the noise (when Noise is turned on). It is zero by default, meaning the noise is equally distributed in X and Y. Positive values make the noise run perpendicular to the particle's path. Negative values make the noise run more parallel to the path.

Noise Anim Rate

Specifies a scaling factor that controls the rate of built-in noise changes during an animation.

Reference > Particle Cloud

Solid Core Size

Determines the size of the core, which is the area where the particle is opaque.

Surface Shading Properties

Diffuse Coeff

Controls how much of the light in the scene is reflected from the particles. Most materials absorb some of the light falling on them, and scatter the rest.

The default value is 0.0. If you set this to 1.0, all the light falling on the material is reflected. Use a high value when creating dense clouds. If you set this to 0.0 (the minimum), no light is reflected and no surface shading occurs.

The surface color is modulated by the transparency. This value can be greater than 1.0, so the surface property can still appear even when the material is transparent.

Surface Color

Specifies the basic color of the particle cloud surface (as opposed to the inside of the cloud). Diffuse Coeff must be set to a value greater than 0 to enable this option.

Bump Mapping

Makes the surface appear rough or bumpy by altering surface normals (during rendering) according to the intensity of the pixels in the bump map texture. Diffuse Coeff must be set to a value greater than 0 to enable this option. (A bump map does not actually alter the surface. A silhouette of the surface appears smooth).

Translucence Coeff

Simulates the way light diffusely penetrates through translucent objects. This means that when light shines on one side of the object, the other side is partially illuminated. You can use this to create effects such as clouds, fur, hair, marble, jade, wax, paper, leaves, etc. If you set Translucence Coeff to 0 (the default), no light shows through the object. If you set Translucence Coeff to 1, all the light shows through. Diffuse Coeff must be set to a value greater than 0 to enable this option.

Surface Shading Shadow

Determines if the surface shading is combined with the preillumination, which contains shadows, if enabled (see the Filter Radius attribute description next). Diffuse Coeff must be set to a value greater than 0 to enable this option.

Reference > Volume Shader

Pre-illumination Controls

Filter Radius

Volumetric particles use pre-illumination, which evaluates the lighting at each particle's center by default. This can sometimes cause popping if the illumination changes too fast in an animation, and is especially noticeable if Surface Shading Shadow is on.

Filter radius lets you filter the pre-illumination results so the value at each particle's center is the average of all the pre-illumination results within the filter radius. Higher values increase render time but produce smoother images.

Volume Shader

Controls the color, transparency, and matte opacity of a volumetric material, such as light fog. This shader lets you connect other attributes and effects directly to its color, transparency, and matte opacity. The Volume Shader can be used with a Spot Light, Point Light, Environment Fog, and particles.

Find this material in the Create bar.

Out Color

Defines the out color of the material. The default is black.

Out Transparency

Sets the out Transparency of the material. The default is black, which is opaque.

Fluid Shape

Find this material in the Create bar.

For information on Fluid Shape, see "Fluid Shape shader as a particle shader" on page 169 in the Fluid Effects guide.

Common Volumetric material attributes

The following attributes are common to the Environment Fog and Light fog Volumetric materials:

Matte Opacity

You can control the mask value for individual objects. See Matte Opacity.

Reference > Common Volumetric material attributes

Matt Opacity attributes are available for Anisotropic, Blinn, Lambert, Layered Shader, Phong, PhongE, Shading Map and Use Background material types.

Matte Opacity Mode

Click to display the three Matte Opacity Modes from the drop-down menu.

Opacity Gain

Default Matte Opacity Mode. The Opacity Gain value is used as a gain control on the usual matte value contribution of a material.

A matte channel is first calculated this way— a value of 1.0 for an opaque surface completely covers a pixel, less if it covers part of a pixel. The value is reduced appropriately for transparent objects, and then multiplied by the specified Matte Opacity value.

The Matte Opacity Mode value is also keyable. The Opacity Gain range is from completely transparent to no effect (rendered as usual).

Solid Matte

Makes the value of the matte channel constant for all pixels covered by these surfaces. The value you specify in the Matte Opacity slider is used.

Black Hole

The matte channel for all pixels covered by the object is set to 0 (fully transparent), even if the object is transparent, and regardless of what is behind the object if it is transparent. This creates a black hole where the object is in the image, to *knock out* the matte. In this mode, the Matte Opacity slider is disabled and its value ignored.

Note For the Opacity Gain and Solid Matte modes, if an object has non-zero Transparency, objects behind it makes their usual contribution to the matte channel's values. This is the difference between setting Matte Opacity to 0.0 in these modes, and choosing the Black Hole mode.

Matte Opacity

This value behaves in different ways based on which Matte Opacity Mode is selected (Opacity Gain or Solid Matte).

For example, for the Opacity Gain mode, the Matte Opacity slider value indicates the transparent multiplier amount for the alpha channel. The default is 1, which means that any opaque object registers a full alpha value.

Reference > Shading group node

If the Matte Opacity value is 1, a 0 alpha value is registered. Any values between 0 and 1 act as a multiplier to the alpha channel value to arrive at a new alpha value.

Shading group node

Shading group node

For more information on Maya's shading group node, see "Shading group node" on page 19.

Shading Group attributes

In the Shading Group's Attribute Editor, the mental ray section contains the following options:

Suppress all Maya shaders

Use this for backwards compatibility as it disables automatic translation of Maya shaders. Only the mental ray ports are evaluated and exported.

Opaque

Turn this on if the material is fully opaque. It should assist in speeding up mental ray rendering.

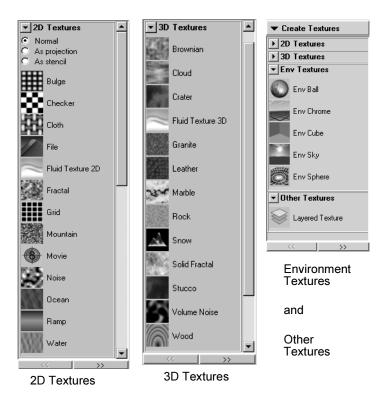
Export with Shading Engine/Export with Volume Sampler

When turned on, these both insert additional helper shaders into the export stream. These shaders are required if you want to write custom shaders that cooperate with the Maya base shader package delivered with mental ray for Maya. These options are for advanced mental ray for Maya users only.

Reference > Overview of texture nodes

Texture nodes

Overview of texture nodes



The Texture tab in the Create Bar and the Create Render Node window includes 2D textures, 3D textures, Env(ironment) textures, and Other textures (Layered Texture). For information about 2D textures, see "2D textures" on page 25. For information about 3D textures, see "3D textures" on page 25.

- Some attributes are shared among many surface materials, are therefore grouped separately, and are described in:
 - "Shared 2D texture attributes" on page 185.
 - "Shared 3D texture attributes" on page 204.
- For texture-specific attributes, see the 2D or 3D texture name.

2D textures

Reference > Bulge

Bulge



Procedurally creates a grid of white squares that fade to gray toward the edges. Use as a bump or displacement map to create surface bulges, as a transparency map or specular map to simulate real-world objects, such as windows that are dirty around the edges, or as a color map to simulate tiles.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Uwidth, Vwidth

The width of the texture squares in U and V directions. The range is 0 to 1. The default value is 0.1.

Checker



Represents a checkerboard pattern.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Color1, Color2

The two colors of the checkerboard squares.

Contrast

Contrast between the two texture colors. The range is 0 (the two colors are averaged over the entire texture) to 1. The default value is 1.

Cloth

Cloth

Simulates fabric or other woven materials.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Reference > Cloth

Tips	•	Rendering is faster if the randomizing attributes	
		(Randomness, Width Spread, and Bright Spread) are set to 0.	

- Very fine cloth textures may produce aliasing or moiré patterns, especially when viewed from a distance. If this occurs, set the Randomness value to a small non-zero value.
- If you apply the cloth texture as a bump or displacement, set the U Color and V Color to white, the Gap Color to black, and use the Color Balance attributes (Alpha Gain and Alpha Offset) to control the intensity of the bump/displacement effect.
- Decrease the bump node's Bump Filter value to provide greater definition in the bump/displacement effect. Generally, the Alpha Gain and Bump Filter values should be very low (less than 0.1).

Gap Color

The color of the area between the warp (U direction) and weft (V direction) threads. The colors blend into the Gap Color at their edges. A lighter Gap Color simulates a cloth with softer, more translucent threads.

U Color, V Color

U and V thread colors. Double-click the color bar to open the Color Chooser and select colors.

U Width, V Width

U and V thread widths. If the thread width is 1, the threads touch with no gap between them. If the thread width is 0, the thread disappears. The range is 0 to 1. The default value is 0.75.

U Wave, V Wave

The waviness of U and V threads. Use to create special weave effects. The range is 0 to 0.5. The default value is 0.

Randomness

Smears the texture randomly in U and V directions. Adjust the Randomness value to create natural-looking cloth with irregular threads, or to prevent aliasing and moiré patterns on very fine cloth textures. The valid range is 0 to infinity. The range is 0 to 1. The default value is 0.

Reference > File

Width Spread

Randomizes the width of each thread along its length by subtracting a random amount (between 0 and the Width Spread value) from the U Width and V Width values. For example, if Width Spread is greater than or equal to the Width value, some threads disappear at certain points along their length. The range is 0 to 1. The default value is 0.

Bright Spread

Randomizes the brightness of each thread along its length by subtracting a random amount (between 0 and the Bright Spread value) from U Color and V Color (similar to Width Spread). The range is 0 to 1. The default value is 0.

File



Lets you use an image file as a 2D texture.

To learn more about File textures and how to create them, see "File textures" on page 27.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Filter Type

The sampling technique applied to the image file during rendering. The Quadratic, Quartic, and Gaussian filters only work when the File texture is mapped directly to a shading group. The default setting is Quadratic.

If off, there is no filtering. For games design, this can be useful to view a texture's pixels without interpolation by the renderer.

Note Advanced filtering (box, quadratic, quartic, and Gaussian) for file textures is equivalent to mipmap when used with: Environment Balls, Environment Cubes, and Environment Spheres.

> Advanced filtering is also equivalent to mipmap when used with Projection Textures that: (1) are of a type other than "planar" or "triplanar" or (2) have a non-zero noise component (i.e., amplitudeX or amplitudeY is non-zero) or (3) have a texture reference object.

Reference > File

Tips •	The quadratic filter type provides the best quality to cost ratio. With the default settings, this filtering scheme provides crisper details than mipmap, at a reasonable cost. IFF image file format is optimal for performance.	
Quadratic, Quartic,		
Gaussia		
	<i>Extreme</i> means points in the texture near the far edge of the filter's sample region.	
	<i>Center of the curve</i> means the center of the region being filtered.	
	Quadratic and Quartic approximate the Gaussian filter type, but are optimized for speed. Since this method can decrease rendering speed, use mostly for high-quality rendering. Quadratic is the most efficient filter type.	
Mipmap fil	ter	
	Mipmap stores values starting with values averaged at a large texture map size, and linearly decreasing map sizes down to a single pixel value.	
	Use this filter for previewing—it's fast and provides moderately good results. Do not use for high quality renders, however. Textures may swim or appear blurry.	
	Mipmap is inexpensive to use. Maya uses it as a technique to store color values by default. The performance cost associated with using the Mipmap filter type is negligible compared to using other filter types.	
Box filter		
	Uses a simple box sampling method for the texture map. Each sample of the map is given the same shading sample weight. The Box filter uses the sum of the values sampled divided by the number of samples taken.	

Reference > File

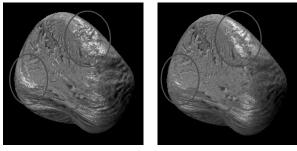
Pre-Filter

The Pre-Filter and Pre-Filter Radius attributes are used to correct file textures that are aliased or contain noise in unwanted areas. This can be very useful when displacement mapping.

When on, the image file is pre-filtered to cancel out noise and aliasing which helps provide better quality results, particularly for bump maps. Pre-Filter is off by default. Turn it on to enable the Pre-Filter Radius attribute.

Pre-Filter Radius

Determines the size of the filtering radius. The default value of 2.0 works for most images, but you can increase the radius to provide even smoother results.



Before Pre-filter

After Pre-filter

Image Name

The name of the image file or movie file used by the File texture.

For tips on creating images for File textures, see "Considerations for creating file textures" on page 27.

To use a sequence of image files to create an animation, the file name must be expressed in one of the following three formats:

```
name.#.ext
name.ext.#
```

```
name.#
```

where *name* is the base name of the file; # is the frame number (with or without leading 0s), *ext* is the file extension of the file.

To use a sequence of image files to create an animated file texture, the file extensions must be separated from the basename and/or the extension by dots (.).

For example, the following works:

Reference > File

```
test.1.iff
test.0001.iff
test.1
test.0001
test.iff.1
test.iff.0001
But the following would not work:
test1
```

test0001 test1.iff test0001.iff

Reload File Texture

Use this to force a refresh (read from disk to temporary memory) of the texture. This is recommended in situations where textures being used are updated by other artists.

Use Cache

When off, Maya loads the entire image file into memory during rendering. When on, Maya only loads 8x8 tiles of the image file into memory when needed, and unloads them from memory when they are no longer needed (provided that the image is block ordered textured [BOT]. This reduces the amount of memory for image file textures, and can reduce render times.

If Use Cache is on and the image file is not a BOT file, Maya creates a temporary BOT file for the image file during rendering. This can make rendering slower and can increase the amount of disk space used during rendering. However, it uses less memory during the rendering process. Because of this, converting all image file textures to BOT files *before* rendering using the Optimize Scene command can be helpful.

Use Frame Extension

Appends the frame extension number (Frame Extension) to the Image file name. To use a sequence of image files as an animated texture when rendering, turn on Use Frame Extension, then keyframe the Frame Extension value. Use Frame Extension is off by default.

Reference > Hardware Texture Cycling Options

Frame Extension

The frame extension number appended to the Image file name. To use a sequence of image files to create an animation, turn on Use Frame Extension, then keyframe the Frame Extension value. If Use Frame Extension is off, Frame Extension is not available.

Hardware Texture Cycling Options

Use Hardware Texture Cycling

Hardware Texture Cycling is used for caching file textures when animating textures to play the animation at regular speed.

When Use Hardware Texture Cycling is on, the file textures you specify within the range of the Start Cycle Extension, End Cycle Extension, and By Cycle Increment, are loaded into memory only once. This provides faster interactive animation of the file textures.

Turn Use Hardware Texture Cycling on to get better performance when:

- using a sequence of frames for the file textures (see also "Use Frame Extension" above.)
- using Hardware texturing in the 3d view
- you need to *scrub* along the time line (move the time slider back and forth) and see the animated texture update.

Use the following attributes to indicate which frames you want to load. If you don't load them all, Maya uses the closest available frame at playback.

Note These attributes do not alter the final rendered image.

Start Cycle Extension

The number of the first frame Maya loads into memory when Use Hardware Texture Cycling is on.

End Cycle Extension

The number of the last frame Maya loads into memory when Use Hardware Texture Cycling is on.

By Cycle Increment

Controls how many frames are skipped (if any) Maya loads into memory when Use Hardware Texture Cycling is on. If 1, Maya loads every frame between Start Cycle Extension and End Cycle Extension. If 2, Maya loads every second frame, etc.

Reference > Fluid Texture 2D

Fluid Texture 2D

Fluid Texture 2D

Find this texture in the Create bar. To use this texture, see "Apply a fluid texture to an object" on page 170 in the Fluid Effects guide.

Fractal



Represents a random function with a particular frequency distribution (a fractal). You can use the Fractal texture as a bump or displacement map to simulate rock or mountains, or as a transparency map to simulate clouds or flames. The Fractal texture has the same level of detail at any level of magnification (that is, at different distances from the camera).

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Amplitude

A scaling factor applied to all values in the texture. The valid range is 0 to infinity. The range is 0 to 1. The default value is 1.

Threshold

An offset factor applied to all values in the texture. The valid range is 0 to infinity. The range is 0 to 1. The default value is 0.

Ratio

Controls the frequency of the fractal pattern. The range is 0 (low frequency) to 1 (high frequency). The default value is 0.707.

Frequency Ratio

Determines the relative spacial scale of the noise frequencies. If this ratio is not a whole integer then the fractal does not repeat at the integer uv boundaries. A cylinder with default placement would then display a seam.

Level Min, Level Max

The minimum and maximum number of iterations used to calculate the fractal pattern. These values control the granularity of the fractal pattern. The valid range is 0 to 100. The range is 0 to 25. The default value is 0 for Level Min and 9 for Level Max.

Reference > Grid

Inflection

This applies a kink in the noise function. This is useful for creating puffy or bumpy effects.

Animated

Animate the fractal pattern by setting Animated on and keyframing the Time value. The Fractal texture takes longer to calculate when Animated is on. Animated is off by default.

Time

Change the Time value to adjust an animated fractal pattern. If Animated is off, the Time attribute is unavailable. The range is 0 to 100. The default is 0.

Time Ratio

Determines the relative time scale of the noise frequencies. If this ratio is not a whole integer then the animation does not repeat when time = 1. The default is equal to the frequency ratio, which means that higher frequency noises move faster in direct proportion to the frequency. Many natural effects, such as water waves, move instead relative to the square root of the frequency, therefore it may create better motion to make the timeRatio = sqrt(frequencyRatio). For example, if the frequencyRatio is 2, make the timeRatio = 1.4.

Grid



Represents a scalar grid pattern.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Line Color

Color of the grid lines. The default color is white.

Filler Color

Color of the spaces between the grid lines. The default color is black.

U Width, V Width

Width of the grid lines in U and V directions. The valid range is 0 to 1. The range is 0 to 0.5. The default value is 0.1.

Reference > Mountain

Contrast

Contrast between the Line Color and the Filler Color. The range is 0 (the two colors are averaged over the entire texture) to 1. The default value is 1.

Mountain

Mountain

Find this texture in the Create bar.

Simulates rocky terrain using a 2D fractal pattern. To apply this texture as a texture map, see "Map and position textures" on page 76.

Use the Mountain texture as both a color map and a bump or displacement map (on a flat surface) to simulate snow-capped mountains. To do so, apply the Mountain texture this way:

- The texture calculates the color map based on the bump/displacement map, so, for example, the location of snow is based on the surface's displacement.
- The color attributes (Snow Color and Rock Color) relate only to the color map and have no effect on the bump/displacement map—and all non-color attributes relate only to the bump/displacement map and have no effect on the color map.
- The Boundary, Snow Altitude, Snow Dropoff, Snow Slope, and Depth Max attribute values of the bump/displacement map override those of the color map. For example, the Boundary value of the bump/ displacement map controls the raggedness of the snow/rock boundary of the color map.

Snow Color, Rock Color

Color of the snow and rock. Click the color file to choose a different color from the Color Chooser.

Amplitude

Scaling factor applied to all values in the texture. The valid range is 0 to infinity. The range is 0 to 1. The default is 1.

Snow Roughness

Roughness of the snow. The range is 0 (very smooth snow) to 1 (very rough snow). The default is 0.4.

Rock Roughness

Roughness of the rock. The range is 0 (very smooth rock) to 1 (very rough rock). The default is 0.707.

Reference > Movie

Boundary

Raggedness of the rock/snow boundary. The range is 0 (very smooth rock/snow boundary) to 1 (very rough rock/snow boundary). The default is 1.

Snow Altitude

The level (altitude) of the transition between rock and snow. The valid range is 0 to infinity. The range is 0 to 1. The default is 0.5.

Snow Dropoff

The suddenness with which snow no longer sticks to the mountain. The valid range is 0 to infinity. The default is 2.

Snow Slope

The maximum angle (expressed as a decimal value) over which snow does not stick to the mountain. For example, where the slope exceeds the Snow Slope value, it would be bare rock. The valid range is 0 to infinity. The range is 0 to 3. The default is 0.8.

Depth Max

The maximum number of iterations used to calculate the fractal pattern, which controls the granularity of the fractal pattern. The range is 0 to 40. The default is 20.

Movie

🛞 Movie

The movie texture assumes the following:

- an entire multiple frame sequence is stored in a single multiple frame file (a movie file) instead of a sequence of individual image files.
- is optimized for reading and displaying those frames interactively as quickly as possible.

The Movie texture shares the same attributes as the File texture. The difference is that the Movie texture assumes all frames are stored in a single concatenated file using the assigned Image Name instead of separate files.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Reference > Noise

Note The first time you access a frame from an MPEG file, it may be slow to load. The movie library has to scan to the end of an MPEG file to see how many frames are in it since this information is not available in the movie header.

Noise



Can be used to create many different types of effects.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Threshold

The number added to the whole fractal effect, making it uniformly brighter. If some parts of the fractal are pushed up out of range (greater than 1.0), they are clipped to 1.0. If the Volume Noise is used as a bump map, it appears as plateau regions.

Amplitude

Scaling factor applied to all the values in the texture, centered around the texture's average value.

- When you increase Amplitude, the light areas get lighter and the dark areas get darker.
- If Noise is used as a bump map, increasing Amplitude results in higher bumps and deeper valleys.
- If set to a value greater than 1.0, the parts of the texture that scale out of range are clipped. On a bump map, they display as plateau regions.

Ratio

Controls the fractal noise frequency. Increase this value to increase the fineness of the fractal detail.

Frequency Ratio

Determines the relative spacial scale of the noise frequencies. If not a whole number, the fractal does not repeat at the UV boundaries. For instance, a cylinder with default placement displays a seam.

Reference > Noise

Depth Max

Controls how much calculation is done by the Noise texture. Since the Fractal texture process produces a more detailed fractal, it takes longer to perform. By default, the texture chooses an appropriate level for the volume being rendered. Use Depth Max to control the maximum amount of calculation for the texture.

Inflection

Applies a kink in the noise function. Useful for creating puffy or bumpy effects.

Time

Used to animate the Noise texture. You can keyframe the Time attribute to control the rate and amount of change of the texture.

Frequency

Determines the fundamental frequency for the noise. As this value increases the noise becomes more detailed. It has the inverse effect of the scale parameter.

Implode

This warps the noise function in a concentric fashion about a point defined by the Implode Center. At a value of zero there is no effect, while at a value of 1.0 it is a spherical projection of the noise function, creating a starburst effect. Negative values can be used to skew the noise outward instead of inward.

Implode Center

This defines the center UV point about which the implode effect is defined.

Noise Type

Determines which noise to use during the fractal iteration.

Perlin Noise	The standard 3D noise used in the solidFractal texture. Billow has a puffy, cloud-like effect.
Wave	A sum of 3D waves in space.
Wispy	A Perlin noise that is uses a second noise as a smear map; this makes the noise stretch out in places, looking wispy. When the time value is animated the smear texture is moved causing an undulating effect. It creates an effect similar to thin clouds being blown by wind.
SpaceTime	A 4-dimensional version of the Perlin noise, where time is the 4th dimension.

Reference > Noise

Density

Controls how many cells are imbedded in the medium used by the Billow noise type.

At 1.0, the medium is completely packed with cells. Reduce this value to make the cells sparser. If the texture is used as a bump map, low values for Density results in smooth looking surfaces with occasional bumps.

Spottyness

Controls the density randomization of individual cells used by the Billow noise type.

When set close to 0, all the cells are the same density. As you increase Spottyness, some cells are randomly denser or thinner than others.

Size Rand

Controls the randomization of the size of the individual blobs used by the Billow noise type. When it is close to 0, all the cells are the same size. As you increase Size Rand, some cells are smaller than others, in a random fashion.

Randomness

Controls how the cells for the Billow noise type are arranged relative to one another. Set to 1.0 for a more natural random distribution of cells.

If set to 0, all the spots are laid out in a regular pattern. This can provide interesting effects when used as a bump map—for instance, you can make things like insect eyes, or machine-tooled raspy surfaces.

Falloff

Controls the way intensity falls off for individual blobs for the Billow noise type.

Linear	A uniform falloff from the center to a value of zero at the edges of the blobs.
Smooth	More natural looking, using a gaussian falloff. Fast focuses the intensity more towards the center of the blobs.
Bubble	Uses a reverse falloff, fading to zero at the blob center.

Reference > Ocean

Num Waves

Determines how many waves to generate for the Wave noise type. The larger the number, the more random-looking and slower the texture.

Ocean

Find this texture in the Create bar. For information about Ocean, see "Ocean shader and texture" on page 169 in the Fluid Effects guide.

Ramp

Creates a gradation through a series of colors. The default Ramp texture is

- to create different types of effects, such as stripes, geometric patterns, or mottled surfaces
- as a two-dimensional background

blue/green/red. Use this texture:

- as the source file for an environmental sphere texture to simulate a sky and horizon
- as the source file for a projection texture to simulate wood grain, marble, or rock

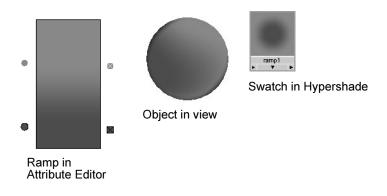
Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Note Very complex ramp textures may experience aliasing during an animation. If this occurs, convert the ramp texture into an image file (see "Convert a texture or shading network to a File Texture" on page 83 for details).

Туре

The direction of the color ramp. The default is V Ramp. The following shows what happens when you select the Circular Type and adjust the colors of the Ramp swatch in the Attribute Editor (see also "Ramp" next).

Reference > Ramp

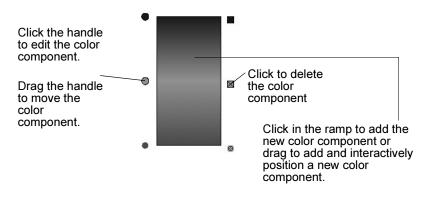


Interpolation

Controls the way colors blend in the ramp. The default setting is Linear. In the above example, because the surface is spherical, a Smooth Interpolation type works well.

Ramp

Each color component in the ramp has a circular color handle on the left side, and a square color icon on the right side. The active color has a white border around its color handle and icon.



Note Only changes in Type, Interpolation, Selected Position, and Selected Color are displayed in the ramp. Changes in all attributes are displayed in the Hypershade swatch.

Selected Color

The active color component. This attribute applies to the active color only.

Reference > HSV Color Noise

Selected Position

Position of the active color component in the ramp. This attribute applies to the active color only. The range is 0 (bottom of ramp) to 1 (top of ramp).

U Wave, V Wave

Controls the amplitude of a sine wave offset of the texture in the U and V directions. Increasing the U Wave or V Wave increases the display of the texture's waviness. The range is 0 (no wave) to 1. The default is 0.

Tip To increase the number of waves in the texture, increase the Repeat UV values in the 2D texture placement node.

Noise

Offset amount in the U and V directions by 2D noise. If the texture repeats (Repeat UV values are greater than 1), the noise does not repeat (each instance of the texture is unique). The range is 0 (no noise) to 1. The default is 0.

Noise Freq

Controls the noise granularity (if the Noise value, above, is non-zero). The range is 0 to 1. The default is 0.5.

HSV Color Noise

Randomize a Ramp texture's color using three separate 2D noises which affect the color's Hue, Saturation, and Value.

Hue Noise

Offsets the color hue. Use to mark the color with specks of different colors. The range is 0 to 1. The default is 0.

Sat Noise

Offsets the color saturation (or whiteness). Use to create a weathered look. The range is 0 to 1. The default is 0.

Val Noise

Offsets the color value (or blackness). The range is 0 to 1. The default is 0.

Reference > Water

Hue Noise Freq, Sat Noise Freq, Val Noise Freq

Controls the granularity for hue, saturation, and value noise. The range is 0 to 1. The default is 0.5. (For each non-zero Freq value, additional calculations may slow down rendering.)

Water

Water

Simulates linear water waves, concentric water ripples (like an object falling into water), or a combination of waves and ripples. Use as a bump or displacement map to simulate water, or as a color map to simulate light reflections or refractions from a water surface.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Number Of Waves

The number of linear waves in the texture. The valid range is 0 to 100. The slider range is 0 to 32. The default is 8.

- Tips For water ripples with no linear waves, set Number Of Waves to 0.
 - To combine linear waves with concentric ripples, set Number Of Waves to a low number (1 to 3).

Wave Time

Controls the appearance of the waves over time. The range is 0 to 1. The default is 0.

The wave effect is similar to the waves produced from a boat—the waves start at a point with a certain velocity and amplitude. This is time zero. As time increases, the waves travel to shore and the appearance changes (velocity and amplitude decrease). To simulate moving waves, animate the Wave Time value. The waves move as this value increases. Maya determines the wave speed by the Wave Velocity value and the rate at which you animate the Wave Time value.

Wave Velocity

The wave speed. The valid range is 0 to infinity. The range is 0 to 1. The default is 1.

Reference > Concentric Ripple Attributes

Wave Amplitude

Scales the wave height. The valid range is 0 to infinity. The range is 0 to 1. The default is 0.05.

Fast

An optimization for the Water texture. When on, Maya computes the color tables once per frame. When off, Maya computes the color tables for every sample.

Tip The only time you might turn this off is when water is viewed close-up in the final scene.

Wave Frequency

Controls the distance between primary waves. The higher the value, the shorter the distance. The valid range is 0 to infinity. The slider range is 0 to 20. The default is 4.

Sub Wave Frequency

Controls the distance between secondary waves that ride on top of primary waves (for example, white caps). The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.125.

Smoothness

Controls the intensity of secondary waves. The valid range is 0 to infinity. The slider range is 0 to 5. The default is 2.

Wind UV

The strength of wind in the U and V directions (which determines the overall direction of the linear wave pattern). The range is from -1 to 1. The default for U is 1. The default for V is 0.

Concentric Ripple Attributes

Control the appearance of concentric water ripples. The Concentric Ripple attributes do not affect the linear wave component of the texture.

Ripple Time

Controls the appearance of ripples over time. The range is 0 to 1. The default is 0.

Reference > Concentric Ripple Attributes

Example

• Imagine a water droplet falling into a glass of still water—at time 0 there is no ripple since the droplet has not touched the surface of the water. As the time attribute increases to a value greater than 0, the droplet has fallen onto the water surface and the ripple wave effect simulates the effect on the water in the glass at that point in time. When time has reached a value of 1, the effect of the droplet on the water surface is nearly complete and the water in the glass becomes still again.

Example

To simulate moving water ripples, animate the Ripple Time value. The ripples move as this value increases. The actual speed of the ripples is determined by the Group Velocity value and the rate at which you animate the Ripple Time value.

Ripple Frequency

Controls the distance between individual ripples. The higher the value, the shorter the distance. The valid range is 0 to infinity. The slider range is 0 to 20. The default is 25.

Ripple Amplitude

Scales the height of the ripples. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.05.

Drop Size

The mass of the droplet that starts the water ripples. A Drop Size value of 0 produces no ripple effect because the droplet has no mass. As the Drop Size value increases, the mass of the drop increases, causing a greater ripple effect. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.3.

Ripple Origin

The location of the center of the ripples along U and V directions. The range is from 0 to 1. The default is 0.5.

Group Velocity

The speed of the primary ripple. The valid range is 0 to infinity. The slider range is 0 to 10. The default is 1.

Reference > Shared 2D texture attributes

Phase Velocity

The speed of sub-ripples. The valid range is 0 to infinity. The slider range is 0 to 10. The default is 2.5.

Spread Start

Degree of effect a droplet has on a still water surface at time 0. A concentric ripple starts as a point of disturbance in space (defined by the Ripple Origin values) when the Ripple Time value is 0. The size of the disturbance at time 0 is determined by the Spread Start value. The greater the value, the greater the effect of the disturbance at time 0. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.005.

Spread Rate

Rate at which the primary ripple breaks into sub-ripples. (As a ripple expands outward, it breaks up into sub-ripples.) The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.3.

Reflection Box

Activates an imaginary reflective bounding box ripples can reflect off. Reflection Box is off by default. (This effect can slow down the render speed.)

Box Min, Box Max

Defines the bounding box in the U and V directions. If Reflection Box. is off, these attributes have no effect. The range is 0 to 1. The default for Box Min is 0; the default for Box Max is 1.

Shared 2D texture attributes

For texture-specific attributes, see the 2D texture name: Bulge, Checker, Cloth, File, Fluid Texture 2D, Fractal, Grid, Mountain, Movie, Noise, Ocean, Ramp, Water.

Color Balance

Corrects the color or intensity of a texture.

Default Color

If you map a texture to a material in such a way that it that does not cover the entire surface, the file node's Default Color shows through. To select a different color, click the color bar to open the Color Chooser. To change the texture's coverage, use the placement options.

Reference > Effects

Color Gain

Scaling factor applied to the texture's outColor channel. For example, you can color-correct a texture that appears too green by setting the Color Gain to a shade of blue. The default color is white (no effect).

Color Offset

Offset factor applied to the texture's outColor channel. For example, you can brighten a texture that appears too dark by setting the Color Offset to a shade of gray. The default color is black (no effect).

Alpha Gain

Only has an effect if the texture is used as a bump or displacement. Scaling factor applied to the texture's outAlpha channel. The default value is 1 (no effect).

Alpha Offset

Only has an effect if the texture is used as a bump or displacement. Offset factor applied to the texture's outAlpha channel. For example, if the Alpha Gain value is -1 and the Alpha Offset value is 1, the outAlpha channel is inverted. The default value is 0 (no effect).

Alpha is Luminance

Off by default. The alpha (mask) output depends on the luminance of the color channels. Bright areas of the texture are more opaque when compositing, and dark areas are more transparent.

Note You cannot use Alpha as Luminance for Cloth, Ramp, or Stencil textures.

Effects

Filter

Filter attributes scale the size of the filter and let you specify the amount of blur in the texture map. Use it as an anti-aliasing technique used to refine file textures, reduce flickering, or to achieve special effects.

By default, Filter is set to a value of 1.0 to help prevent such aliasing effects. The effect of Filter is related directly to eye space. As the object moves further away from the eye, the more the texture blurs.

For more information, see "Texture filtering" on page 29.

Reference > Effects

Filter Offset

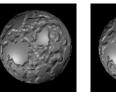
Controls the texture blur in texture space (not eye space). Use Filter Offset for a blurred effect instead of anti-aliasing. Maya adds a constant value to the Filter setting. The default value is 0. Increasing the value increases the texture blur. For example, 1.00 completely blurs the texture.

Tip A Filter and Filter Offset of 0.00 results in no blur effect, however a small amount of blur can help reduce moiré and aliasing effects in texture maps.

Invert

Reverses all texture colors (black becomes white, white becomes black, etc.). Invert is off by default. For example, you can change a bump or displacement map's raised regions to depressions and vice versa by setting Invert on or off.

Stucco texture bump mapped



Invert on

Invert off

Color Remap

Applies a color map to the texture and lets you add or subtract colors from a texture's default settings. Maya maps the U value to the original texture's hue, and the V value to the original texture's intensity. (Color Remap is similar to the "Shading Map" on page 135 material and uses the HSV to RGB Color Utility.)

To remap a texture

Click the Color Remap button. The texture colors change and a Remap Ramp Attribute Editor appears. Adjust the Ramp texture colors and attributes if necessary.

UV Coord

The current UV coordinate values of the current sample point.

Reference > Brownian

3D textures

Brownian

Resembles thickly painted metal.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Lacunarity

Defines the gap between the frequencies (Octaves) you add to form the texture. By default, Lacunarity for noise-based textures is set to 2.0, but you can adjust the value to create interesting effects.

Increment

Determines the ratio for the fractal noise. Results in a crisper texture when close to zero, and a smoother texture when close to 1.

Octaves

Sets the upper limit for noise frequencies (the repeat value of the fractal). See also "Depth".

Weight3d

Determines how wavy the image appears when projected by controlling the scale of the frequency of any fractal used in the procedure.

Cloud

Simulates clouds.

- You should only map the Cloud texture to a sphere. You can combine several spheres to create complex cloud arrangements. If you map the Cloud texture to any other type of surface, the results may be unpredictable.
- The area surrounding the cloud is always transparent, regardless of the map type.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Color1, Color2

The two colors blended together to form the cloud. To select different colors, click the color bars to open the Color Chooser.

Reference > Cloud

Contrast

The contrast between Color1 and Color2. For example, if the Contrast value is -1, Color1 and Color2 are reversed. The range is from - infinity (the two colors are averaged over the entire texture) to + infinity. The default is 0.5.

Amplitude

Controls the strength of the fractal noise used to generate the Cloud texture. The valid range is 0 (no noise) to + infinity (strong noise). The default is 1.

Depth

Controls the granularity of the texture. Values represent the minimum and maximum number of iterations used to calculate the texture pattern. The range is 0 to + infinity. The defaults are 0 and 8.

Ripples

Determines the texture's waviness in the X, Y, and Z directions. The values represent the frequency scale of the fractal used to generate the texture. The range is from 0 to + infinity on X, Y and Z. The default is 1.

Soft Edges

Simulates natural looking clouds. Gradually increases the transparency of the texture as the surface it is mapped to turns away from the camera. If Soft Edges is off, the texture is entirely opaque, and looks similar to the Fractal texture. Soft Edges is on by default.

Edge Thresh, Center Thresh

If Center Thresh is low and Edge Thresh is high, the texture resembles a dense cotton-ball. If Center Thresh is high and Edge Thresh is low, the texture resembles a wispy cloud. The range is from - infinity to + infinity. The default is 0 for Center Thresh and 1 for Edge Thresh.

Transp Range

The range over which the texture becomes transparent. The value controls the sharpness/softness of the cloud's edges. The valid range is 0 to infinity. The slider range is 0 (sharp edges) to 1 (very soft edges). The default is 0.5.

Ratio

Controls the frequency of the fractal noise used to generate the Cloud texture. The range is 0 (low frequency) to + infinity (high frequency). The default is 0.707.

Reference > Crater

Crater

Creates the appearance of both plateaus and craters by mixing normal disturbance and 3D disturbance, such as color or transparency. The Crater texture provides a three component attribute (Out Color RGB) and a Normal output (Out Normal X, Y, and Z).

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Shaker

Increase this value to add more detail to the default Shaker texture (as though it has been shaken up). If used as a bump map, increase the value to increase the number of craters and valleys.

Channel1, Channel2, Channel3

The three channels through which information such as color values passes. You can also supply information to the channels using a three-channel (RGB) mapping.

Melt

Controls the edge softness between the colors in the texture. Increase this value to display the borders between the colors smoother and wider.

Balance

Controls the ratio of the three shaken (or disturbed) colors.

Frequency

Controls the frequency of how many times the texture colors are shaken.

Normal Options (Crater)

Note Norm Depth, Norm Melt, Norm Balance, and Norm Frequency only has an effect if the Out Normal attribute is connected to the Normal Camera attribute of a shader.

Norm Depth

Controls the depth of the craters when the texture is used as a bump map. Increasing Norm Depth deepens the craters.

Reference > Fluid Texture 3D

Norm Melt

Controls the softness of the crater edges when this texture is used as a bump map. Increase Norm Melt to make the edges softer. Animate this texture to make the cratered surface look like it is melting.

Norm Balance

Controls the ratio between the low and high normal's disturbance when this texture is used as a bump map.

Norm Frequency

Norm Frequency controls the amount of rough detail when this texture is used as a bump map. Increase Norm Frequency to make the texture rougher, with finer detail. Decrease it to make the roughness larger-grained.

Fluid Texture 3D

Find this texture in the Create bar. For information on Fluid Texture 3D, see "Apply a fluid texture to an object" on page 170 in the Fluid Effects guide.

Granite

Simulates granite.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Tips	•	The Granite texture is the same as the Leather texture except that there are three cell colors instead of one.
	•	The Granite texture can take a long time to render. To save time when rendering, convert the granite texture into an image file (see "Baking illumination and color" on page 299).

Color1, Color2, Color3, Filler Color

The color of the three different types of cells (Color1, Color2, Color3) and the color surrounding the cells (Filler Color). Click any of these color bars to select a different color from the Color Chooser.

Cell Size

Represents the individual cell size. This value scales the entire texture. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.15.

Reference > Leather

Density

Controls the cell spacing. The valid range is 0 to infinity. The slider range is 0 to 1 (fully packed). The default is 1.

Mix Ratio

Determines which color is dominant. The range is 0 (Color1 is dominant) to 1 (Color3 is dominant). The default is 0.5 (Color2 is dominant).

Spottyness

Randomizes the cell color intensity. The range is 0 to infinity. The slider range is 0 to 1. At 0 all cells have the same intensity. At 1 the cell intensity is entirely random. The default is 0.3. The Threshold value also influences the cell color intensity.

Randomness

Randomizes the cell position. The valid range is 0 to infinity. The slider range is 0 to 1. At 0 cells are arranged in a regular 3D lattice. At 1, cell location is entirely random. The default value is 1.

Threshold

Controls how cell colors and filler color mix into each other. The valid range is 0 to infinity. The slider range is 0 to 1 (if no mixing occurs, cells display as solid color dots). The default value is 0.5.

Creases

Creates boundaries between cells. If off, the cells diffuse uniformly into each other. Creases is on by default.

Leather

Simulates leather. Can also be used to simulate materials such as snake or alligator skin, styrofoam, or concrete.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Reference > Leather

To create concrete, apply a bump map to the material and adjust the color and cell size as well as the bump map's Bump Depth attribute.

To create an alligator skin-type texture, turn Creases off and adjust the cell size and color.





- For many situations, a real leather image file (File texture) produces a good leather simulation; however, it is often difficult to map a file texture to a surface without distortions and discontinuity. Chord Length or Worldspace texture mapping may eliminate distortions, but require some effort and do not always work. In these cases, use the Leather texture.
 - The Leather texture uses a three-dimensional array of spheres to simulate two-dimensional leather. This is unlike real leather because real leather is a surface, not a solid. However, the Leather texture usually produces very realistic results. The exception is if the surface is deformed during an animation because the surface may seem to move through the solid texture. In this case, convert the texture into an image file (see "Baking illumination and color" on page 299).

Cell Color, Crease Color

The color of individual cells (Cell Color) and the color surrounding the cells (Crease Color).

Cell Size

The size of individual cells. The Cell Size value scales the entire texture. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.5.

Density

Controls the spacing of cells in the texture. The valid range is 0 to infinity. The slider range is 0 to 1 (fully packed). The default is 1.

Reference > Marble

Spottyness

Randomizes the cell color intensity. The range is 0 to infinity. The slider range is 0 to 1. At 0 all cells have the same intensity. At 1 the cell intensity is entirely random. The default is 0.1. The Threshold value also influences the cell color intensity.

Randomness

Randomizes the cell position. The valid range is 0 to infinity. The slider range is 0 to 1. At 0 cells are arranged in a regular 3D lattice. At 1, cell location is entirely random. The default value is 0.5.

Threshold

Controls how the cell color and crease color mix into each other. The valid range is 0 to infinity. The slider range is 0 to 1 (if no mixing occurs, cells display as solid color dots). The default value is 0.83.

Creases

Creates boundaries between cells resembling creases in leather. If off, the cells diffuse uniformly into each other. Creases is on by default.

Marble

Simulates marble. Maya uses a *vein* material sandwiched between layers of *filler* material.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Filler Color, Vein Color

The color of the filler material and the vein material. Click a color bar to select a different color from the Color Chooser.

Vein Width

The thickness or width of the veins. The range is 0 to 1. The default is 0.1.

Diffusion

Controls the amount of Vein Color that blends into the Filler Color. The range is 0 (no blending) to 1 (smooth blending). The default is 0.5. (The Contrast value also affects how the two colors blend.)

Contrast

The contrast between the Vein Color and Filler Color. The range is 0 to 1. The default is 0.5.

Reference > Noise Attributes (Marble)

Noise Attributes (Marble)

The Marble texture creates a 3D texture by projecting a 2D texture. The Noise Attributes control the randomization (using fractal noise) of the texture in the direction the texture is projected.

Amplitude

A scaling factor applied to all values in the fractal noise about the average value. The valid range is 0 to infinity. The slider range is 0 (no noise) to 1 (strong noise). The default is 1.5.

Ratio

Controls the fractal noise frequency. The valid range is 0 (low frequency) to 1 (high frequency). The default is 0.707.

Ripples

Determines the texture's waviness in the X, Y, and Z directions. The values represent the frequency scale of the fractal used to generate the texture. The range is from 0 to + infinity for X, Y, and Z. The default is 1.

Depth

The minimum and maximum number of iterations used to calculate the texture pattern. Controls the texture's granularity. The range is from 0 to 20. The default values are 0 and 20.

Rock

Simulates rock using a random 3D distribution of two different grain material types.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Tip Assign this texture to the material's bump map to achieve a coarser simulated texture.

Color1, Color2

The color of the two grains in the texture. To select different colors, click the color bars to open the Color Chooser.

Grain Size

Specifies the grain size and scales the entire texture. The valid range is 0 to infinity. The slider range is 0 (no grains) to 0.1 (large grains). The default value is 0.01.

Reference > Snow

Diffusion

Controls the amount Color1 blends into Color2. The range is 0 to infinity. The slider range is 0 (no blending) to 1 (smooth blending). The default is 1.

Mix Ratio

Determines the dominant color. The valid range is 0 to infinity. The slider range is 0 (Color1 is totally dominant) to 1 (Color2 is totally dominant). The default is 0.5.

Snow

Simulates snow on a surface.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Гірs	•	To display snow on all objects in the scene, apply the Snow texture as a transparency map on a white material and then layer this material onto other shaders.
	•	Try combining a Fractal bump map with a Snow color map. The snow only appears on the peaks and valleys of the bump mapped surface. For best results, set the Fractal bump map's Alpha Gain and Filter values to a low number.
	•	To simulate windswept snow, rotate the Snow texture by rotating the 3D Placement Object about a horizontal line.

Note If you assign Snow to geometry whose surface normals and tangents are constant (for example, those of a primitive cone), the Snow texture appears as a uniform color, and the difference between the Snow Color and Surface Color is nonexistent.

Snow Color

The color of the snow on the top of the surface.

Surface Color

The color of the surface on which the snow lies.

Reference > Solid Fractal

Threshold

Determines the maximum slope that holds snow. The range is 0 (90 degrees from horizontal) to 1 (0 degrees from horizontal). The default is 0.5 (45 degrees from horizontal).

Depth Decay

The rate at which the snow color blends into the surface color. The range is 0 to 10. The default is 5.

Thickness

The apparent depth of the snow. Thickness controls the opacity of the snow (deeper snow is more opaque). The range is 0 (transparent) to 1 (opaque). The default is 1.

Solid Fractal

Represents a 3D random function with a particular frequency distribution (fractal).

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Tip Assign this texture to the material's bump map to achieve a coarser simulated texture.

Threshold

Offset factor applied to all values in the texture. The valid range is 0 to infinity. The slider range is 0 to 1. The default is 0.

Amplitude

Scaling factor applied to all values in the texture. The valid range is 0 to infinity. The slider range is 0 (no noise) to 1 (strong noise). The default is 1.

Ratio

Controls the frequency of the fractal noise. The range is 0 (low frequency) to 1 (high frequency). The default is 0.707.

Frequency Ratio

Determines the relative spacial scale of noise frequencies. If not a whole number, the fractal does not repeat at the UV boundaries. For instance, a cylinder with default placement would display a seam.

Reference > Stucco

Ripples

Determines the texture's waviness in the X, Y, and Z directions. The values represent the frequency scale of the fractal used to generate the texture. The range is 0 to infinity. The default is 1.

Depth

The minimum and maximum number of iterations used to calculate the texture pattern. This parameter controls how fine grained the texture is. The range is 0 to 20.

The following attributes let you swirl the noise pattern in a Solid Fractal texture to create interesting effects.

Bias

Attracts the -1 to 1 noise towards either 1 or 0. Values greater than zero result in a more contrasting fractal while values less than zero make it more flat and spiky.

Inflection	Applies a kink in the noise function. This can be useful when creating puffy or bumpy effects. Inflection is off by default.
Animated	Turn on to access the Time and Time Ratio attributes (see next).

Time

Determines the relative time scale of noise frequencies. If not a whole number, the animation does not repeat when Time = 1.

Time Ratio

Default is equal to the Frequency Ratio setting, which means higher frequency noises move faster in direct proportion to the frequency. For example, to create more natural-looking effects, such as water waves, if the Frequency Ratio is 2, set the Time Ratio to 1.4.

Stucco

Randomly disturbs the material by mixing two input attributes, Channel1 and Channel2, to create an effect resembling stains or clouds. Stucco includes Normal Options attributes you can use to control the effect. See also "Crater" on page 190.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Reference > Volume Noise

Shaker

Increase this value to add more detail to the default Shaker attribute setting (as though it has been shaken up). If used as a bump map, increase the value to increase the number of craters and valleys.

Channel1, Channel2

The two channels through which information such as color values passes. You can also supply information to the channels using a three-channel (RGB) mapping.

Normal Options (Stucco)

Note Normal Depth and Normal Melt only have an effect if the Out Normal attribute is connected to the Normal Camera attribute of a shader.

Normal Depth

Controls the depth of the craters when the texture is used as a bump map. Increasing Normal Depth deepens the craters.

Normal Melt

Controls the softness of the crater edges when this texture is used as a bump map. Increasing Normal Melt softens the edges. Animate this texture to simulate a melting cratered surface.

Volume Noise

Can be used to create many different types of effects.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Threshold

The number added to the whole fractal, making it uniformly brighter. If some parts of the fractal are pushed up out of range (greater than 1.0), they are clipped to 1.0. If the Volume Noise is used as a bump map, it appears as plateau regions.

Amplitude

Scaling factor applied to all the values in the texture, centered around the texture's average value.

• When you increase Amplitude, the light areas get lighter and the dark areas get darker.

Reference > Volume Noise

- If Volume Noise is used as a bump map, increasing Amplitude results in higher bumps and deeper valleys.
- If set to a value greater than 1.0, the parts of the texture that scale out of range are clipped. On a bump map, they display as plateau regions.

Ratio

Controls the fractal noise frequency. Increase this value to increase fractal detail and make it finer.

Frequency Ratio

Determines the relative spacial scale of the noise frequencies. If not a whole number, the fractal does not repeat at the UV boundaries. For instance, a cylinder with default placement appears a seam.

Depth Max

Controls how much calculation is done by the Volume Noise texture. Since the Fractal texture process produces a more detailed fractal, it takes longer to perform. By default, the texture chooses an appropriate level for the volume being rendered. Use Depth Max to control the maximum amount of calculation for the texture.

Inflection

Applies a kink in the noise function. Useful for creating puffy or bumpy effects.

Time

Used to animate the Volume Noise texture. You can keyframe the Time attribute to control the rate and amount of change of the texture.

Frequency

Determines the fundamental frequency for the noise. As this value increases the noise becomes more detailed. It has the inverse effect of the scale parameter.

Scale

Determines the scale of the noise in the local X, Y, and Z directions. This is similar to scaling the transform node for the texture. When you increase Scale, the fractal detail seems to smear out in the direction you choose.

Origin

The zero point for the noise. Changing this value moves the noise through space.

Reference > Volume Noise

Noise Type

Determines which noise to use during the fractal iteration.

Perlin Noise	The standard 3D noise used in the solidFractal texture.
Billow	A puffy, cloud-like effect.
VolumeWave	A sum of 3D waves in space.
SpaceTime	A 4-dimensional version of the Perlin noise, where time is the 4th dimension.

Density

Controls how many cells are embedded in the medium used by the Billow noise type.

At 1.0, the medium is completely packed with cells. Reduce this value to make the cells sparser. If the texture is used as a bump map, low values for Density results in smooth looking surfaces with occasional bumps.

Spottyness

Controls the density randomization of individual cells used by the Billow noise type.

When set close to 0, all the cells are the same density. As you increase Spottyness, some cells are randomly denser or thinner than others.

Size Rand

Controls the randomization of the size of the individual blobs used by the Billow noise type. When it is close to 0, all the cells are the same size. As you increase Size Rand, some cells are smaller than others, in a random fashion.

Randomness

Controls how the cells for the Billow noise type are arranged relative to one another. Set to 1.0 for a more natural random distribution of cells.

If set to 0, all the spots are laid out in a regular pattern. This can provide interesting effects when used as a bump map—for instance, you can make things like insect eyes, or machine-tooled raspy surfaces.

Falloff

Controls the way intensity falls off for individual blobs for the Billow noise type.

Reference > Wood

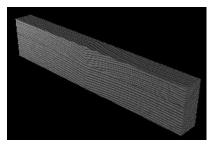
Linear	A uniform falloff from the center to a value of zero at the edges of the blobs.
Smooth	More natural looking, using a gaussian falloff.
Fast	Focuses the intensity more towards the center of the blobs.
Bubble	Uses a reverse falloff, fading to zero at the blob center.

Num Waves

Determines how many waves to generate for the Volume Wave noise type. The larger the number, the more random-looking and slower the texture.

Wood

Т



Simulates wood by projecting a 2D pattern. This pattern consists of concentric ring layers defined by *veins* and *filler*. When you map the Wood texture to a surface, the surface seems to be carved out of wood. When you map it to several surfaces, they seem to be carved from a single block of wood.

Find this texture in the Create bar. To apply this texture as a texture map, see "Map and position textures" on page 76.

Tips	•	There are four Wood attributes that are frame constant,
		meaning that mapping them with textures or other nodes
		that produce different values from point to point may lead
		to unpredictable results. These attributes are: Grain Spacing,
		Layer Size, Randomness, and Age. You can key all of these
		attributes to make their appearance change over time in an
		animation sequence.

• If you use the Wood texture as a bump map, lower the Grain Contrast setting to reduce the potential for texture artifacts during animation.

Reference > Wood

Filler Color

The color of the space between veins. The vein color diffuses into the filler color. Double-click the color bar to choose a different color from the Color Chooser.

Vein Color

The vein color of the wood. The vein color diffuses into the filler color. Double-click the color bar to choose a different color from the Color Chooser.

Vein Spread

The amount of vein color that diffuses into the filler color. The valid range is 0 to infinity. The slider range is 0 to 3. The default is 0.25.

Layer Size

The average thickness of each layer or ring. The valid range is 0 to infinity. The slider range is 0 to 0.5. The default is 0.02. (The thickness of individual layers or rings is also influenced by the Randomness and Age values.)

Randomness

Randomizes the thickness of individual layers or rings. The range is 0 to 1. The default is 0.5.

Age

The age of the wood (in years). This value determines the total number of layers or rings in the texture, and influences the relative thickness of central and outer layers. The valid range is 0 to infinity. The slider range is 0 to 100. The default is 20.

Grain Color

The color of the random grain in the wood.

Grain Contrast

Controls the amount of Grain Color that diffuses into the surrounding wood color. The range is 0 to 1. The default value is 1.

Grain Spacing

The average distance between grain spots. The range is 0.002 to 0.1. The default value is 0.01.

Center

The location of the center of the texture's concentric rings in the U and V directions. The range is -1 to 2. The default values are 0.5 and -0.5.

Reference > Shared 3D texture attributes

Tip Do not set the Center values less than -3 or greater than 3.

Noise Attributes (Wood)

The Wood texture creates a 3D texture by projecting a 2D pattern. The Noise Attributes control the randomization (using fractal noise) of the texture in the direction the pattern is projected.

Amplitude X, Amplitude Y

An average scaling factor applied to all values in the fractal noise in the texture's X and Y directions. The valid range is 0 to infinity. The range is 0 (no noise) to 1 (strong noise). The default value is 0.1.

Tip The Wood texture renders faster if the Amplitude X and Amplitude Y values are both 0.

Ratio

Controls the fractal noise frequency. The range is 0 (low frequency) to 1 (high frequency). The default is 0.35.

Ripples

Determines the texture's waviness in the X, Y, and Z directions. The values represent the frequency scale of the fractal used to generate the texture. The range is 0 to 20. The default is 1.

Depth

The minimum and maximum number of iterations used to calculate the texture pattern. This parameter controls how fine grained the texture is. The range is 0 to 25. The default values are 0 and 20.

Shared 3D texture attributes

For texture-specific attributes, see the 3D texture name: Brownian, Cloud, Crater, Fluid Texture 3D, Granite, Leather, Marble, Rock, Snow, Solid Fractal, Stucco, Volume Noise, Wood.

Color Balance

Corrects the color or intensity of a texture.

Reference > Effects

Default Color

If you map a texture to a material in such a way that it that does not cover the entire surface, the file node's Default Color shows through. To select a different color, click the color bar to open the Color Chooser. To change the texture's coverage, use the placement options.

Color Gain

Scaling factor applied to the texture's outColor channel. For example, you can color-correct a texture that appears too green by setting the Color Gain to a shade of blue. The default color is white (no effect).

Color Offset

Offset factor applied to the texture's outColor channel. For example, you can brighten a texture that appears too dark by setting the Color Offset to a shade of grey. The default color is black (no effect).

Alpha Gain

Only has an effect if the texture is used as a bump or displacement. Scaling factor applied to the texture's outAlpha channel. The default value is 1 (no effect).

Alpha Offset

Only has an effect if the texture is used as a bump or displacement. Offset factor applied to the texture's outAlpha channel. For example, if the Alpha Gain value is -1 and the Alpha Offset value is 1, the outAlpha channel is inverted. The default value is 0 (no effect).

Alpha is Luminance

Off by default. The alpha (mask) output depends on the luminance of the color channels. Bright areas of the texture are more opaque when compositing, and dark areas are more transparent.

Note You cannot use Alpha as Luminance for Cloth, Ramp, or Stencil textures.

Effects

Filter

Filter attributes scale the size of the filter and let you specify the amount of blur in the texture map. Use it as an anti-aliasing technique used to refine file textures, reduce flickering, or to achieve special effects.

Reference > Effects

By default, Filter is set to a value of 1.0 to help prevent such aliasing effects. The effect of Filter is related directly to eye space. As the object moves further away from the eye, the more the texture blurs.

For more information, see "Texture filtering" on page 29.

Filter Offset

Controls the texture blur in texture space (not eye space). Use Filter Offset for a blurred effect instead of anti-aliasing. Maya adds a constant value to the Filter setting. The default value is 0. Increasing the value increases the texture blur. For example, 1.00 completely blurs the texture.

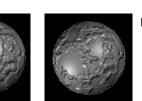
Tip A Filter and Filter Offset of 0.00 results in no blur effect, but a small amount of blur can help reduce moiré and aliasing effects in texture maps.

Invert

Reverses all texture colors (black becomes white, white becomes black, etc.). Invert is off by default. For example, you can change a bump or displacement map's raised regions to depressions and vice versa by setting Invert on or off.

Invert off.

Stucco texture bump mapped.



Invert on.

Local, Wrap

Wrap repeats or tiles the texture completely over the object. If off, everything outside the 3D placement cube displays the texture's default color. Wrap is on by default.

Tip Some nodes, such as the Reverse utility, repeat themselves to achieve the effect of Wrap, so that it extends infinitely. Others, such as a "Marble" texture, extend outwards without repeating.

To adjust texture placement on all objects at once, turn Local on, transform the texture placement icon, then turn Local off to see the results. Turning on Local also means that if you transform any of the objects during an animation, the 3D texture transforms accordingly.

Reference > Common Environment texture attributes

Blend

Controls how much of the texture's Default Color is mixed into the texture Color. A value of 0 means the Default Color does not affect the texture Color. As you increase the Blend value, more and more of the Default Color mixes in. *This attribute does not work unless Wrap is turned off and Local is turned on*.

To blend colors and textures using the Blend slider

- 1 Change the Default Color (in the Color Balance section of the texture's Attribute Editor), or map another texture to the Default Color.
- **2** Make sure Invert and Wrap are off and turn Local on.
- **3** Drag the slider to change the Blend value.

Color Remap

Applies a color map to the texture and lets you add or subtract colors from a texture's default settings. Maya maps the U value to the original texture's hue, and the V value to the original texture's intensity. (Color Remap is similar to the "Shading Map" on page 135 material and uses the HSV to RGB Color Utility.)

To remap a texture

Click the Color Remap button. The texture colors change and a Remap Ramp Attribute Editor appears. Adjust the Ramp texture colors and attributes if necessary.

UV Coord

The current UV coordinate values of the current sample point.

Environment textures

Common Environment texture attributes

Color Remap

Color Remap applies a color map to the texture. It is the only common Effects Environment texture attribute. The U value of the Color Remap texture is mapped to the original texture's hue, and the V value is mapped to the original texture's intensity (the value defined by [R+G+B]/3). The Color Remap attribute acts similar to the Shading Map material (see Shading Map).

Reference > Env Ball

Env Ball

Uses an image of a highly reflective chrome ball in an environment (real world or computer generated) to re-create that environment. This is possible because the reflections in the chrome ball provide a (nearly) 360 degree view of the environment.

An Env Ball texture background renders faster than a procedural texture background or a background modeled with surfaces. You can therefore replace a complex background with an Env Ball texture (by rendering an image of a chrome ball in that environment) to reduce rendering times.

Find this texture in the Create bar. To use this texture, see "Simulate reflections with Env Ball" on page 285.

Image

The texture used by the Env Ball texture. To use a single image of a highly reflective chrome ball in an environment, map a File texture to the Env Ball texture's Image attribute, and then specify an image file for the File texture's Image Name attribute.

Inclination

The rotation (in radians) of the ball image about the vertical axis. The valid range is 0 to 3.142. The slider range is 0 to 3.142. The default setting is 0.

Set the Inclination value to the inclination of the camera (the angle between the camera's view and the environment's YZ plane) used to generate the image file (by photographing or rendering a reflective ball in an environment). For example, if the camera is parallel to the YZ plane, set the Inclination value to 0. When creating the ball image, a camera inclination and elevation of zero provides the best resolution for the view you intend to use.

Elevation

The rotation of the ball image about the horizontal axis. The valid range and the slider range are both -1.571 to 1.571. The default setting is 0.

Set the Elevation value to the elevation of the camera (that is, the angle between the camera's view and the environment's grid plane: XZ plane for a Y-up scene) used to generate the image file (by photographing or rendering a reflective ball in an environment). For example, if the elevation of the camera is 90 degrees (that is, it is directly above the ball), set the Elevation value to 1.571. If the camera is parallel to the grid plane, set the Elevation value to 0. When creating the ball image, a camera inclination and elevation of zero provides the best resolution for the view you intend to use.

Reference > Env Ball

Eyespace

Causes the position of the Env Ball texture's Image file to be defined relative to the window, not the camera view.

If Eyespace is on, the Env Ball texture's Image file automatically matches the environment's Backdrop image file (provided they were both originally photographed/rendered from the same point of view), even if the camera view changes. Reflections, however, are based on the background being infinitely far away; that is, the reflection planes are ignored (see "Projection Geometry"). Rendering is faster when Eyespace is on. The default setting is off.

Reflect

Causes the Image file to be reflection mapped onto the background.

If Reflect is off, the Image file is mapped using a solid texture spherical projection. This allows you to model the geometry of the background image and then map the background image to this geometry, for example, to add shadows, lighting effects, or fog to the scene. The default setting is on.

Projection Geometry

The Projection Geometry attributes controls the appearance of reflections from an Env Ball texture. They define the location of the sky and/or room walls of the original environment so that Maya can calculate reflections on surfaces in the re-created environment.

For example, if the original environment consisted of a grid plane and a sky, then you would set the Sky Radius value to the radius of the sky, and the Bottom value to the distance between the grid plane and the reflective ball. If the original environment consisted of a room, then you would set the Bottom, Top, Left, Right, Front, and Back values to the distance between each wall and the reflective ball.

In some cases you may want to use values different than the original environment. For example, instead of using the Bottom, Top, Left, Right, Front, and Back values to define the walls of a room, you may simply use the Sky Radius attribute. Because Sky Radius defines a sphere, reflections on surfaces in the simulated environment are smoother and less likely to become blurred. You can also combine Sky Radius with Bottom, Top, Left, Right, Front, and/or Back.

Sky Radius

The radius of the sky of the original environment. The valid range is 0 to infinity. The slider range is 0 to 20. The default value is 0.

Reference > Env Chrome

Bottom, Top, Left, Right, Front, Back

The distance between the reflective ball and each wall of the original environment. The valid range is 0 to infinity. The slider range is 0 to 20. The default value is 0.

Env Chrome

Simulates a showroom environment. The texture consists of a plane and a sky plane (with fluorescent style light rectangles), and provides a simple but effective environment to simulate reflections off chrome surfaces.

The Environment Chrome Attributes control the size and placement of the simulated fluorescent lights in an Env Chrome texture. (These "lights" produce reflections in surfaces, but they do not actually illuminate surfaces.)

Find this texture in the Create bar.

Light Width, Light Depth

The width and depth of each light. These parameters also determine spacing between lights. The valid/slider range is 0 to 1. The default Light Width value is 0.5 and the default Light Depth value is 0.1.

Light Width Gain, Light Width Offset

The number of lights per unit length. The valid/slider range is 0 to 1. The default Light Width Gain value is 1 and the default Light Width Offset value is 0.

Light Depth Gain, Light Depth Offset

The light displacement. The slider range is 0 to 1. The default Light Depth Gain value is 1 and the default Light Depth Offset is 0.

Sky Attributes

Sky Color

The color of the sky at the horizon. Overall sky color is linearly interpolated between Sky Color and Zenith Color.

Zenith Color

The color of the sky at the zenith (straight up). Overall sky color is linearly interpolated between Sky Color and Zenith Color.

Light Color

The color of the simulated fluorescent lights. These "lights" produce reflections in surfaces, but they do not actually illuminate surfaces.

Reference > Env Cube

Floor Attributes

Floor Color, Horizon Color, Grid Color

The color of the floor, the floor's horizon and the floor's grid.

Real Floor

If Real Floor is off, the environment's floor is located at infinity, so reflections on moving objects and/or reflections viewed from a moving camera are incorrect.

If Real Floor is on, the floor is located relative to the grid plane (based on the Floor Altitude value), so reflections on moving objects and/or reflections viewed from a moving camera are correct. If Real Floor is on, make sure surfaces and/or the camera do not go below the grid plane. Real Floor is on by default.

Floor Altitude

The height of the floor relative to the grid plane. Floor Altitude has no effect if Real Floor is off. The slider range is -1 to 1. The default value is -1.

Note If you set the Floor Altitude too high, the texture swatch becomes red, indicating that the camera is looking under the floor, which you probably do not want. Lower the Floor Altitude until the red color disappears.

Grid Placement

Grid Width, Grid Depth

The width and depth of the grid lines. These attributes also determine the spacing between grid lines. The valid/slider range is 0 to 1. The default value is 0.1.

Grid Width Gain, Grid Depth Gain

The number of grid cells per unit length. The valid/slider range is 0 to 1. The default value is 1.

Grid Width Offset, Grid Depth Offset

The grid displacement. The slider range is 0 to 1. The default value is 0.

Env Cube

Simulates an environment by mapping six image files onto the inner surfaces of a large (or infinitely large) cube.

Reference > Env Sky

Use Env Cube to make reflections on a moving surface during an animation if you do not have time to raytrace because it treats the texture placement box as the geometry of the environment. This means changes in the relative size and position of camera, surface, and environment are respected.

For example, you can fake a nice reflection on the surface of an animated shiny car as it drives down a road. This process is known as *reflection mapping*.

Find this texture in the Create bar. To use this texture, see "Simulate reflections with Env Cube" on page 287.

Infinite Size

When on, the images in the cube are reflected as though the sides of the cube were infinitely far away. If you are using images with distance, such as the horizon or a starfield, turn on Infinite Size. If the images are of the interior of a room, or nearby objects, leave Infinite Size off.

Right, Left, Top, Bottom, Front, Back

The image files mapped to the right, left, top, bottom, front, and back inner surfaces of an infinite cube. (The front of the cube faces the front orthographic view.)

Env Sky

Simulates a planetary environment viewed from the surface of a planet.

Find this texture in the Create bar.

Note If the eye point or view drops below the floor, the Env Sky texture swatch turns red as a warning. If you render the scene, the floor appears red. To avoid this, make sure the eye point is always above the floor (the grid plane).

Environment Sky Attributes

Total Brightness

The overall brightness of the environment. The valid range is 0 to infinity. The slider range is 0 to 5. The default is 1.

Sun Attributes

Sun Brightness

The color and brightness of the sun. The default color Value is 0.5.

Reference > Env Sky

Halo Brightness

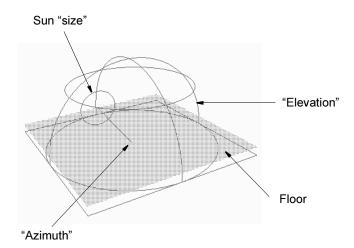
The color and brightness of the halo around the sun. The default color value is 0.1.

Interactively adjusting Sun attributes

The following attributes relate directly to the Sky's texture placement object. You can use the Maya transform tools, such as Scale and Rotate to place the manipulator, or use the Show Manipulator tool.

As you change the settings for Elevation, Azimuth, and Size attributes, notice how the various manipulators adjust in the View. IPR render to watch the texture change on the object.

The following indicates which manipulators correspond to which attribute.



Elevation

The angle (in degrees) of elevation of the sun relative to the floor. The valid range is -90 to 90. The slider range is 0 (sunrise/sunset) to 90 (midday). The default value is 45.

Azimuth

The angle (in degrees) of the sun in the sky about a vertical vector. The valid range is 0 to 360. The slider range is 0 to 360. The default value is 145.

Size

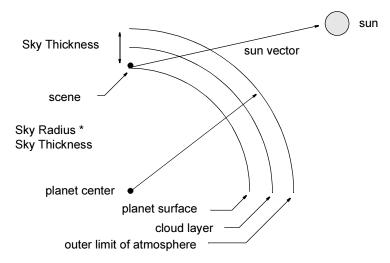
The size (radius) of the sun. The valid range is 0 to 10000. The slider range is 0 to 20. The default value is 0.531

Reference > Env Sky

Blur

The size (radius) of the halo around the sun. The valid range is 0 to 1000. The slider range is 0 to 20. The default value is 1.

Atmospheric Settings



Sky Brightness

A scaling factor applied to the sky color. The default color Value is 0.5.

Air Density

The density of the air in the atmosphere. The denser the air, the more light is scattered.

Air density represents low and high altitudes. High altitude skies are almost black straight up and blue near the horizon (the Air Density value less than 1). Low altitude skies are blue straight up and white near the horizon (the Air Density value greater than 1). The slider range is 0 to 3. The default value is 1.

Dust Density

The density of dust in the atmosphere. The slider range is 0 to 3. The default value is 0.

Sky Thickness

The thickness of the atmosphere. The valid range is 0 to infinity. The slider range is 0 to 10000. The default value is 1000.

Sky Radius

The outer radius of the sky as a multiple of Sky Thickness.

Reference > Env Sky

Sky Thickness and Sky Radius values determine the planet radius, and planet radius influences the appearance of sunsets. A planet with a large radius results in very red (and very dark) sunsets (you can adjust Sky Bright to compensate for sunsets that are too dark). The valid range is 0 to infinity. The slider range is 0.01 to 300. The default value is 50.

For example, if Sky Thickness is 1000 and Sky Radius is 50, the outer radius of the sky is $1000 \times 50 = 50\ 000$ units, and the radius of the planet is $(1000 \times 50) - (1000 \times 1) = 49\ 000$ units.

Floor Attributes

Has Floor

Turns the floor on or off. If Has Floor is off, the environment below the horizon is a mirror image of the environment above the horizon.

Floor Color

The color of the floor. The default color value is 0.392.

Floor Altitude

The height of the floor relative to the grid plane. Floor Altitude has no effect if Has Floor is off. The slider range is -100 to 100. The default value is -10.

Cloud Attributes

Use Texture

Controls whether or not Env Sky pays attention to the Cloud Texture attribute. If you attach a Cloud or other fractal texture node to the Cloud Texture attribute, then you must turn on Use Texture to see the results.

Cloud Texture

The texture that determines cloud distribution in the sky. For example, the Fractal texture creates very realistic clouds. By default, there is no cloud texture map (and no clouds).

Cloud Brightness

The brightness and color of cloud illumination from ambient scattered light in the atmosphere. (The amount of ambient light depends on the Elevation value.) The default color Value is 0.5.

Sunset Brightness

The brightness and color of cloud illumination when the sun is below the horizon and the clouds are front lit (for example, when the sun's Elevation value is 0 and its Azimuth value is 180).

Reference > Env Sky

This is a very subtle effect and occurs only briefly in nature during a sunrise or sunset. The effect is more noticeable with high altitude clouds. The default color Value is 1.

Density

The density of individual clouds. The valid range is 0 to infinity. The slider range is 0 (no clouds) to 5 (heavy clouds). The default value is 1.

Threshold

A threshold value for the Cloud texture that controls how much of the sky is covered with cloud.

As the Threshold value increases, darker areas of the texture do not produce clouds. The valid range is 0 to infinity. The slider range is 0 (entire sky is cloudy) to 1 (no clouds). The default value is 0.5.

Power

The clouds are scaled and positioned by adjusting the Power value.

The cloud density is achieved by subtracting the Threshold from the pixel value clipping to 0, then multiplying the result with Density. To control the amount of de-focusing of the Cloud Texture, adjust the Blur value (under Sun Parameters). The valid range is 0 to infinity. The slider range is 0 to 1. The default value is 1.

Altitude

The height of the clouds.

The Altitude value does not greatly affect the position of the clouds. Instead, it determines how much the atmosphere obscures the clouds near the horizon. Low altitude clouds disappear into haze much more slowly than high altitude clouds. The valid/slider range is 0 to 1. The default value is 0.2.

Halo Size

The size (radius) of cloud illumination from direct back lighting by the sun (for example, when the sun's Azimuth value is 0).

Direct back lighting is most noticeable near the edges of thick clouds or through thin clouds. The valid range is 0 to infinity. The slider range is 0 to 50. The default value is 20.

Calculation Quality

The Calculation Quality attributes control the rendering speed of an Env Sky texture.

The calculations required for curved atmospheres reduce speed. The Calculation Quality attributes do not greatly affect the appearance of the sky, but do affect the speed at which the calculations are computed.

Reference > Env Sphere

Sky Samples

The number of samples used above the cloud layer. Set the Sky Samples value to 1 for maximum speed. The valid range is 0 to 20. The slider range is 0 to 3. The default value is 5.

Floor Samples

The number of samples used by the atmosphere between the eye and the horizon.

Increasing the Floor Samples value increases the effect of the atmosphere along the floor. The valid range is 0 to 20. The slider range is 0 (no atmosphere between the eye and horizon) to 3. The default value is 1.

Cloud Samples

The number of samples used below the cloud layer. The valid range is 0 to 20. The slider range is 0 (clouds do not fade to mist at the horizon) to 3. The default value is 5.

Env Sphere

Simulates an environment by mapping a texture or image file directly onto the inner surface of an infinite sphere.

Find this texture in the Create bar. To use this texture, see "Simulate reflections with Env Sphere" on page 288.

Image

The texture mapped to the inner surface of an infinite sphere.

Shear U

Shears the Image texture in the U direction. For example, horizontal stripes resemble a barber pole when sheared. The slider range is -10 to 10. The default value is 0.

Shear V

Shears the Image texture in the V direction. For example, concentric lines at the poles spiral inward when sheared. The slider range is -10 to 10. The default value is 0.

Flip

Reverses the U and V orientation of the Image texture.

Reference > Layered texture

Other textures

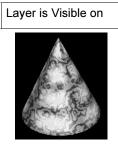
Layered texture

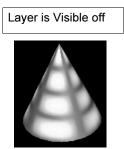
For more information on layered textures, see "Layered textures" on page 26.

Find this texture in the Create bar.

Layer is Visible

Specifies whether the layer should be taken into consideration during computation of the result color and alpha of the layered texture. If off, it is as if the layer does not exist. Use this when you want to isolate a particular layer to see how it looks by itself.





Alpha is Luminance

Lets you determine whether the Alpha should be the luminance of the Out Color, as with other 2D textures, such as a File texture.

Automatic Alpha for File and Layered Texture nodes

Hardware Color

Specifies which color objects using this texture display in the view while in hardware shading mode (not hardware texturing mode).

Blend modes

Layers can be blended with those below them using the Texture Blend attribute in the Layered Texture's Attribute Editor. The Blend Mode specifies how the selected layer blends with the below it. The following lists the blend modes:

None

Edits or paints each pixel to make it the result color. This is the default. (Normal mode is called Threshold when you're working with a bit mapped or indexed-colored images).

Reference > Layered texture

Over	The top layer is applied like a decal to the following layer. The shape of the decal is determined by the top alpha.
In	The background texture is cut in the shape of the foreground alpha.
Out	The result is the opposite of In. It is as if the shape of the foreground layer has been cut out of the background alpha.
Add	The result color is the foreground color added to the background color as if being projected on the background through a slide projector. The result color is then applied over the background color using the foreground alpha to define the opacity of the result.
Subtract	The result color is the foreground color subtracted from the background color. The result color is then applied over the background color using the foreground alpha to define the opacity of the result.
Multiply	Looks at the color information in each layer and multiplies the bottom color by the blend color. The result color is always a darker color. Multiplying any color with black produces black. Multiplying any color with white leaves the color unchanged.
Difference	Looks at the color information in each layer and subtracts either the blend color from the bottom color or the bottom color from the blend color, depending on which has the greatest brightness value. Blending with white inverts the bottom color values; blending with black produces no change.
Lighten	Looks at the color information in each layer and selects the bottom or blend color, whichever is lighter, as the result color. Pixels darker than the blend color are replaced, and pixels lighter than the blend color do not change.
Darken	Looks at the color information in each layer and selects the bottom or blend color, whichever is darker, as the result color. Pixels lighter than the blend color are replaced, and pixels darker that the blend color do not change.
Saturate	Creates a result color with the luminance and hue of the bottom color and the saturation of the blend color.

Reference > Place 2d Texture

De-saturate The result color is the background color with saturation decreased in proportion to the foreground color scaled by foreground alpha. If the foreground color is red, for example, the resulting color is the background color with desaturated reds.
 Illuminate Creates a result color with the hue and saturation of the bottom color and the luminance of the blend color. This mode creates an inverse effect from that of the Color mode.

Placement nodes

Place 2d Texture

Defines a texture frame—a rectangular area on a surface (in the UV coordinate space) in which the texture appears. You can control the position, size, and rotation of this frame on the surface using the "Coverage", "Translate Frame", and "Rotate Frame" attributes. You can also control how the texture is tiled within the frame using the "Repeat UV", "Rotate UV", "Offset", "Mirror U, V", "Stagger", and "Wrap U, Wrap V" attributes.

The two columns of boxes in the Attribute Editor represent U and V values.

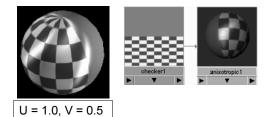
Interactive Placement

Displays the texture placement manipulator. Either click this button from the Attribute Editor, or click the Texture Placement Tool icon in the main window and select the surface. Middle-drag the manipulator handles to place the texture.

Coverage

Specifies what ratio of the surface the texture map covers. The valid range is 0 to + infinity for NURBS surfaces. A value of 1 (the default) covers the entire surface in either the U or V direction.

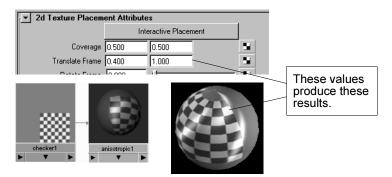
For example, to cover half the surface, set the value at 0.5 in both the U and V directions.



Reference > Place 2d Texture

Translate Frame

The Translate attributes position the texture map on the surface and move the coverage area across the surface. The range is from - infinity to + infinity.

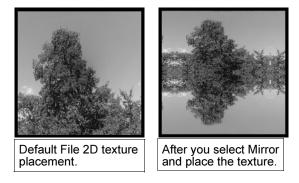


Rotate Frame

Rotates the texture map on the surface. This attribute is represented in degrees.

Mirror U, V

Only works when U Repeat or V Repeat attributes are greater than 1. Mirror in the U and V direction separately. When on, the repeat areas are mirrored—rows of images display as mirrored images of themselves. This helps to disguise the effect of seams between repeat areas.



Stagger

Maya offsets repeats of maps making alternate rows of repeats offset exactly by half (like brick walls). When off, the repeats line up horizontally and vertically.

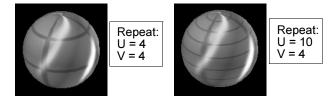
Reference > Place 2d Texture

Wrap U, Wrap V

Wrap U and Wrap V attributes control whether a map is repeated in U or V directions, or both U and V. Both the Wrap attributes are on by default. Turn these off to prevent seams from showing on a closed surface, such as a cylinder or sphere, or to prevent the texture from duplicating itself when you use Translation and Coverage attributes to limit the mapping to a very specific surface area.

Repeat UV

Specifies how many copies of the texture map are mapped within the coverage area along either the U or V directions (depending on the texture). By default, Maya maps one copy of the texture. Values greater than 1 result in more copies of the map displayed in the same coverage area. Values less than 1 result in only a portion of the map displayed.



Offset

Offsets the pattern of the texture map. This can be particularly useful when fine-tuning the placement of a pattern on a surface. U Offset offsets the texture pattern along the U direction and V Offset along the V direction. Each value ranges from - infinity to + infinity.

Rotate UV

Since you cannot use the interactive tool to rotate surface placement, use this attribute. Rotate UV is calculated in degrees. The valid range is 0 to 360 degrees.

Noise UV

2D noise for U and V. Displaces the colors of the texture map.

Fast

When on, Fast checks if the placement is the default and all shadingtime evaluations perform less computations. Turn Fast on to slightly improve rendering speed. Fast is off by default.

Reference > Texture Map

Texture Map

Texture Map

Provides you with various adjustable attributes as well as a way to fix texture warp on objects with 2D textures. This is especially useful, for example, waving fabric, like a flag.

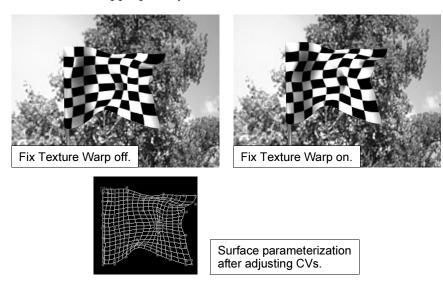
Fix Texture Warp

Note Convert to File Texture does not support Fix Texture Warp If the surface uses Fix Texture Warp, it is ignored when converting the material.

The Texture Map attributes only apply to NURBS surfaces.

Fix Texture Warp adjusts a texture's UV parameters so the texture does not rely on a NURBS object's UV parameterization, which alleviates texture warp on objects with 2D textures. For example, if you want to create and animate a flag with a Checker texture, you can create a NURBS plane on which to map the Checker texture, transform the CVs, and turn Fix Texture Warp on in the object's Attribute Editor.

When you animate the flag by moving some of the CVs to simulate the wind blowing the flag, the checker pattern on the flag expands and shrinks appropriately.



Reference > mental ray for Maya nodes

- Tips To see the textured surfaces update, you must view them in Render View (Render > Render Current Frame). Re-render the scene to see the fixed texture.
 - Because computing exact arc-lengths is very expensive, Fix Texture Warp is a compromise used to achieve well spaced UV texture values with chord length (which measures the length of a line drawn between two points on the surface). Use this feature to apply textures more evenly on surfaces with uneven parameterization.
 - Fix Texture Warp is applied on a per-NURBS surface basis.

Setting the grid size

When Fix Texture Warp is on, Maya texture maps a 2D NURBS surface based on the chord length of a grid placed on the surface. You can determine the size of the grid by the value you specify in the Grid Division Per Span U and Grid Division Per Span V, and the corresponding number of spans on the surface. The default grid size is 4, and the result is a multiple of 4.

Grid Div Per Span U	Specifies the number of divisions per span of the Chord Length grid along the U parameter.
Grid Div Per Span V	Specifies the number of divisions per span of the Chord Length grid along the V parameter.

mental ray for Maya shaders

mental ray for Maya nodes

For more information about mental ray for Maya nodes (shaders), see "mental ray for Maya Shaders" on page 36.

Materials

dgs_material

This shader can simulate mirrors, glossy paint or plastic, anisotropic glossy materials such as brushed metal, diffuse materials such as paper, translucent materials such as frosted glass, and any combination of these.

Reference > Materials

Note This shader cannot be used as a shadow shader.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

dielectric_material

This shader is a physically based material shader that can be used to simulate dielectric media such as glass, water, and other liquids.

The shader uses Fresnel's formulas for dielectric interfaces. This means that most light is transmitted through the surface for perpendicular incident directions while most light is reflected by the surface for grazing incident angles, simulating the behavior of real dielectric materials.

The shader also uses Beer's law for absorption of light that passes through a medium. This means that the light is subject to an exponential falloff as it is transmitted between two surfaces with dielectric material.

Two types of dielectric interfaces are supported: dielectric-air simulates the interface between a dielectric material and air (such as glass-air), and dielectric-dielectric simulates the interface between two dielectric materials (such as glass-water). To achieve physically correct simulations it is important to use the correct surface interfaces.

This shader cannot be used as a shadow shader.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_blinn

Perform Blinn illumination, which is a like Cook-Torrance illumination (see "mib_illum_cooktorr" on page 225) but without the color shift with angles. It only requires one index of refraction.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_cooktorr

Perform Cook-Torrance illumination, given ambient, diffuse, and specular RGB colors, a roughness, index of refraction for three wavelengths, and a light list. With this, you can produce silk-type highlights.

Cook-Torrance illumination has an off-specular peak and a color shift with angles.

Reference > Materials

mib_illum_hair

This has a fine-tuned sheen-like specular highlight that produces sub-pixel antialiasing, which helps to render high-quality thin strips, such as hair.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_lambert

Perform Lambertian illumination, given ambient and diffuse RGB colors (alpha is ignored).

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_phong

Perform Phong illumination, given ambient, diffuse, and specular RGB colors, a specular exponent.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_ward

Perform Ward illumination, given ambient, diffuse, and glossy RGB colors, two shinyness parameters, two direction vectors (from a texture). Useful to produce anisotropic effects. See also "mib_illum_ward_deriv" on page 226.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

mib_illum_ward_deriv

Perform Ward illumination, given ambient, diffuse, and glossy RGB colors, two shinyness parameters. Differs from mib_illum_ward in that the brushing directions are taken from the surface derivatives.

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Path_material

For a full description of this node's attributes, see the *mental ray Shaders Guide* in the Maya Help.

Transmat

This doesn't alter the ray; instead the ray passes through the material (the material is invisible). Use it to create volumetric or participating media effects.

Reference > Shadow shaders

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Shadow shaders

Shadow shaders determine the appearance of shadows cast from an object. This is similar to the Shadow Color attribute on Maya light sources.

Shadow shaders can only be attached to the appropriate input in the Shading Group. Shadow shaders are special in that their result color is also an input color, which means that the output cannot be attached to another shader parameters because such attachments are one-way, output-to-parameter only.

They are referenced when a shadow ray hits an occluding object; the shadow shader of the occluding object controls how much light is transmitted.

In a Phenomenon, shadow shaders can only be attached to a material inside the Phenomenon, or to the Phenomenon root if the Phenomenon is attached to a material's shadow shader.

mib_shadow_transparency

The transparency shadow shader can be used to assign a (possibly transparent) color to an object, and to make it transparent for shadow rays. Either a color alpha < 1 or a nonzero transparency cause shadow rays to be transmitted through the object.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Volumetric Materials

Volume shaders can be assigned to particular objects by connecting to the object's Shading Group.

This controls the appearance of fog or other volumetric effects inside those objects. In mental ray for Maya you can also specify a global volume shader to control the appearance of fog outside of the objects in the scene (corresponds to Maya's Environment Fog). In mental ray for Maya, the global volume shader is assigned by connecting to the Volume Shader attribute in the mental ray section of the camera's Attribute Editor.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_ray_marcher

The ray marcher casts light rays from points on a given ray, and approximates the volumetric contribution from light sources sending light through the volume.

Reference > Displacement Shaders

Instead of using shader interface functions like mi_sample_light, it calls a shader given as an input parameter of type shader. Ray marching consists of calling the shader for regular points between the start point and end point of the ray, and adaptively subdividing each of these intervals until a given subdivision limit is reached if the color returned by two adjacent samples is smaller than a given contrast threshold. The total weighted sum is returned.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_volume

A simple volume shader that simulates volume in a linear direction by receiving samples from the ray marcher.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

parti_volume

This is an advanced volume shader for simulating volume, such as fog, clouds, silty water, and similar media by scattering, absorbing, transmitting as the light travels through the volume.

The volume shader parti_volume can simulate homogeneous (uniform density) and nonhomogeneous participating media with isotropic (diffuse) or anisotropic scattering. parti_volume and parti_volume_photon use a two-lobed scattering model, which means that light scatters both forward and back in the incoming light direction.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Displacement Shaders

These shaders (not supplied with Maya) can be used to add new details to a surface prior to rendering.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Photonic Materials

Photon shaders control the reflection, transmission (refraction), and absorption of light for caustics and global illumination.

Advanced users can use these materials to simulate physically correct lighting situations.

Reference > Textures

dgs_material_photon

dgs_material_photon is the photon shader that matches dgs_material. It has the same parameters; however, it respects photons and uses global illumination to illuminate objects.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

dielectric_material_photon

dielectric_material_photon is the photon shader that matches dielectric_material. It has the same parameters; however, it respects photons and uses global illumination to illuminate objects.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_photon_basic

This is the basic photon shader that supports diffuse reflection and specular reflection and transmission/refraction. Use it to reflect, transmit, and absorb photons for global illumination and caustic effects.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

parti_volume_photon

parti_volume_photon is the photon shader that matches parti_volume. It has the same parameters; however, it respects photons and uses global illumination to illuminate objects.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

transmat_photon

transmat_photon is the photon shader that matches transmat. It has the same parameters; however, it respects photons and uses global illumination to illuminate objects. It simply traces a photon further in the direction it came from.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Textures

Use texture shaders to apply image files on materials, generate procedural textures, or determine texture placement.

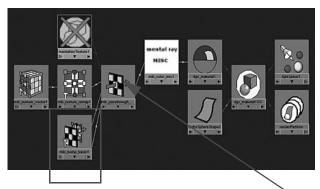
All textures in this section are File Texture based.

Reference > Textures

mib_bump_basis

Defines the normals to be used by mib_bump_map or mib_passthough_bump_map.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.



Defines the normals to be used by this node \sum

mib_bump_map

Apply a File Texture with mib_bump_basis o the normal vector by evaluating the texture at multiple points to compute U and V gradients that are multiplied with the basis vectors, combined with the original normal, normalized, and written back.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_passthough_bump_map

This is the same as mib_bump_map, but the normals return to the original values after the bump mapping is complete.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_texture_checkerboard

Divide the unit cube into eight subcubes, each with a separate RGBA color. Use it to generate stripes and two- or three-dimensional checkerboards.

Reference > Textures

mib_texture_filter_lookup

Looks up of texture image using elliptical filtering. Use it to reduce flickering (moire patterns) or aliasing on a specific surface that has a texture.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_texture_lookup

Looks up a texture image.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_texture_polkadot

A procedural texture to generate polkadots.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_texture_polkasphere

A procedural 3D texture to generate 3-dimensional polkadots.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_texture_remap

Accepts a texture vertex and scales, rotates, translates, crops, and joins textures. The order of operations is transform first, then repeat, alternate, torus (wrapping), and finally min/max crop.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_texture_rotate

An angle is used to rotate the surface orientation around the surface normal. An orthogonal vector pair is returned that, together with the normal which both are orthogonal to, define the rotated orientation. This is especially useful for anisotropic reflection.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_texture_turbulence

Create a turbulent scalar pattern in a unit cube. One, two, or all three texture vector components may be computed in polar coordinates, causing spherical mapping.

Reference > Environments

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_texture_vector

Return a texture vector derived from orthographic projections of the 3D point in space (XY, XZ, YZ), non-orthographic projections (spherical or cylindrical); or return a numbered texture vector from the texture vector list. Optionally, this shader can base its calculations on object, camera, world, or screen space.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_texture_wave

Create cosine waves in U, V, and W directions, each with a programmable amplitude. (Frequency and offset can be controlled using a texture remapping base shader.) The result is a grayscale color, R=G=B=A, that can be remapped using a color map base shader.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Environments

These are shaders that catch rays leaving the scene, similar to Environment textures.

These shaders return colors from color textures that have been mapped to finite or infinite distances. Use them for background or foreground plates. Environments must be used for environment shaders; overlays must be used for lens shaders; and textures must be used for texture or material shaders on a plane or other objects in the scene.

They can be used either globally or on an object-specific basis.

mib_lookup_background

Use this to insert background plates, like image planes.

Given one of the following texture shaders, place it in the background of the scene so that it matches the size of your image resolution:

- Environment shaders can place the background plate at infinity.
- Lens shaders can place the plate in front of the entire scene by evaluating the background shader first then casting an eye ray only if the returned alpha is less than 1, and blending the results.

Reference > Lights

• Material shaders on an XY-axis-aligned-plane in the scene insert the plate at the Z coordinate of the plane if they first evaluate the background shader, then cast a transparency ray only if the returned alpha is less than 1, and blend the results.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_lookup_cube1

A cube mapping with one image on all six planes.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_lookup_cube6

A cube mapping with six images, one for each plane.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_lookup_cylindrical

A cylindrical mapping that uses one image.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_lookup_spherical

A spherical mapping that uses one image.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Lights

Light shaders specify the amount of light that a light source contributes to a particular surface point, taking into account the intensity and directional properties of the light source.

When a light shader is connected to a native Maya light source, all the settings on the Maya light source (color, intensity, shadows, etc.) are ignored, with the exception of the position and orientation (the light shader takes settings from the native Maya light source).

mib_light_infinite

Infinite (directional) lights cast parallel rays in the light direction. The origin is infinitely far away (and left unspecified), and there is no decay.

Reference > Photon Emitter Shaders

mib_light_photometric

Uses a vendor-supplied light profiles (IES or Eulumdat) This supplies a full description of the physical behavior of the specific light.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_light_point

A point light shader emitting light uniformly in all directions.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_light_spot

The spot light is similar to the point light, except that it also supports angle attenuation based on the light direction. It takes the light direction and the spread from the light definition.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

physical_light

This models physically correct light sources. The light energy decreases quadratically.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Photon Emitter Shaders

These shaders (not supplied with Maya) can be used to specify the intensity and directional distributions of the photons emitted by a light source

Light Maps

Use these shaders to bake surface shading effects to image texture files on disk.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_lightmap_sample

The lightmap illumination sampling shader is a simple color shader that samples the surface light influx density. It gathers direct illumination and (optionally) indirect illumination. Assign it not to a material, but instead to the input parameter of the mib_lightmap_write node.

Reference > Lenses

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_lightmap_write

This is the main lightmap shader. It gathers geometric information and texture coordinates on the triangle vertices and then writes a triangular region of texture for each triangle. For each pixel of the texture that the triangle covers, a sampling function is called and the results are written to the shader. The lightmap shader is attached to the appropriate input in the Shading Group.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Lenses

These shaders determine how rays of light bend as they leave the camera, and can be used to simulate various lens effects such as depth of field.

Currently the UI only supports connection of a single lens shader to the camera. In general, the mental ray render core supports a series of lens shaders that are executed in succession.

Mib_lens_clamp

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Mib_lens_stencil

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Oversampling_lens

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

physical_lens_dof

Simulates depth of field by casting multiple eye rays into the scene so that an object at the focal distance is sharp and in focus, while objects at other distances are blurred.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Output Shaders

Output shaders, which are used to postprocess rendered images, are connected to the camera using the Output Shader attribute in the mental ray section of the camera's Attribute Editor.

Reference > Geometry shaders

The Framebuffers attributes in that section (color, alpha, depth, etc.) control which image channels are passed to the shader and in what format. For example, a 2D blur output shader might require 8-bit color, floating-point alpha, and motion vectors.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Geometry shaders

These shaders can be used to introduce new pieces of geometry into the scene at render time.

Geometry shaders are connected to transform nodes, which are used to determine the position and orientation of the geometry.

Note Even if this option is enabled (in the transform node's Attribute Editor, ... Enable Geometry Shader check box), you don't see anything in the Scene Views; you see the geometry only when you render.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_geo_add_uv_texsurf

This shader returns a copy of the input object, which must be of freeformsurface type. It loops over all faces and adds a Bézier texture surface of degree 1 to each face as the last texture surface. The parameters and control points of the texture surfaces so that the texture coordinates of the triangle vertices are the uv coordinates of the triangle vertex positions.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_geo_cone

This is a sample geometry shader to be used with mib_geo_add_uv_texsurf.

It generates a polygonal cone centered on the Z axis with the apex at Z=0 and the base at Z= -1. The cone has a radius of 1 at the bottom and a height of 1. The cone bottom disc is subdivided into u_subdiv subdivisions, the cone side in v_subdiv subdivisions in the Z axis direction.

Reference > Geometry shaders

mib_geo_cube

This is a sample geometry shader to be used with mib_geo_add_uv_texsurf.

It generates an axis-aligned unit cube with volume 1 centered on the origin.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_geo_cylinder

This is a sample geometry shader to be used with mib_geo_add_uv_texsurf.

It generates a polygonal cylinder centered on the Z axis with the bottom at Z=-1 and the top at Z=0. The cylinder has a radius of 1 and a height of 1. The two cylinder discs are subdivided in u_subdiv subdivisions, the sides in v_subdiv subdivisions in the Z axis direction.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_geo_instance

This constructs an instance of one of a geometry shader that translates, scales, and rotates the geometry, and returns a group with the instance of the source geometry as its only member. If the result was nonzero because the base shader is part of a list, a new group is not created; instead the instance is added to the result group.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_geo_instance_mlist

Same as mib_geo_instance, but accepts a material array, which is converted into a material list in the new instance if the array has more than one member. Material lists are useful if the instanced object is tagged, meaning its polygons or surfaces carry integers that index into the material array.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_geo_sphere

Generates a polygonal sphere with a given number of U and V subdivisions, centered on the origin. The sphere is subdivided with v_subdiv subdivisions in the Z axis (longitude) and u_subdiv subdivisions in the XY plane (latitude).

Reference > Contour store

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_geo_square

Generates a square with area 1 centered on the origin, with the normal pointing up the positive Z axis.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_geo_torus

Generates a polygonal torus lying in the XY plane, centered at the origin. The torus is defined by two circles: the smaller one revolves around the center of the larger circle.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Contour store

Contour store shaders decide what kind of information to store at an image sample location. This information allows the contour contrast shader to decide whether two samples are different enough to place a contour line between them.

contour_store_function

This shader returns the intersection point, normal, material tag, object label (tag), triangle index, color, and the refraction and reflection level.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_store_function_simple

This contour store function only stores the material tag. It can be used for very fast contour computations if only the outlines of objects need to have simple contours.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Contour contrast

contour_contrast_function_levels

This lets you to modulate a threshold within a sample range. It draws a contour between two samples, if their sample values differ more than the specified threshold.

Reference > Contour shader

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_contrast_function_simple

This uses a default contrast definition.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Contour shader

These shaders can be used to generate cartoon-like renderings. After the contour contrast shaders decide where contours should be drawn, contour shaders decide on the contour color and width (and optionally motion, normal, material tag, and label).

contour_shader_combi

This is a combination of the depthfade, layerthinner, and widthfromlight contour shaders.

The width of the contour fades into the background (from near_width to far_width), and the color fades from near_color to far_color. The contour width and color changes with a ramp function between distances near_z and far_z. For each layer the ray has passed through, a factor is multiplied onto the width. If no factor is specified, the width will not depend on the layer. If a light source is specified, the width also depends on the surface normal relative to the light source direction.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_shader_curvature

This shader draws contours whose width depends on the curvature (the difference in surface orientation).

If two normals are in nearly opposite directions, there is a contour of width close to max_width between them. When the angle between them decreases, the width of the contour decreases down to nearly min_width. (The width will never reach min_width completely, since the contour contrast function will not create any contours where the surface curvature is less than ndelta degrees, and ndelta cannot be set to zero without getting contours in the interior of all objects.)

At the edge of an object, where the depth difference is large, the maximum contour width is used. The minimum width would theoretically occur at 0 degrees and the maximum width at 180 degrees.

Reference > Contour shader

contour_shader_depthfade

Contours are drawn whose color and width are linearly interpolated between two values as specified with the near and far parameter sets.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_shader_factorcolor

This shader draws a contour whose color matches the color of the object being contoured, only with a different brightness (usually much darker).

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_shader_framefade

This shader draws contours with a color and width that depends linearly on the frame number. Two frame numbers, colors, and widths are specified. If the frame number is less than the first frame number, the first color and width is used. If the frame number is higher than the last frame number, the last color and width are used. If the frame number is in between, a linear interpolation of the two colors and widths are used.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_shader_layerthinner

With this contour shader, the width of a contour will change depending on how many levels of materials are on top of it. If the material is on top, its contour will be of a width specified by a parameter. For each material on top of it, its width will decrease by a factor that is also controllable with a parameter.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_shader_randomtransparency

Contours are drawn with a random transparency, based on the specified value.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_shader_randomwidth

Contours are drawn with a random width, based on the specified value.

Reference > Contour output

contour_shader_simple

A simple contour of constant color and width is applied when contour_shader_simple is used.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_shader_widthfromcolor

With the contour_shader_widthfromcolor contour shader, a material gets contours whose thickness depends on material color. The thickness depends on the maximum of the red, green, and blue color bands (the maximum is clamped to 1 if it is larger than 1). When the color is bright no contour is visible, and when the color gets darker the contour gets wide. The minimum width is used at bright colors and the maximum width is used at black.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_shader__widthfromlight

Contours are drawn whose width depends on the angle between the surface normal and the direction to a light source. The thickness increases gradually from min_width when the surface is directly facing the light direction to max_width when the surface is facing exactly opposite the light direction.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_shader_widthfromlightdir

This shader is a variation of the contour_shader__widthfromlight. It accepts a direction explicitly, instead of a light that implicitly provides the direction.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Contour output

Contour output shaders are called after the regular image has been computed.

Reference > Sample Compositing

contour_only

This generates a contour image with a given background color in the color frame buffer, discarding the rendered color image. See also Hide Source in the mental ray tab in the Render Globals Settings window.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_ps

The contour output shader contour_ps creates PostScript code with black contours. The PostScript code can be written to a file with a separate output statement that specifies the file type ps. This shader does not touch the rendered color frame buffer.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

contour_composite

This layers contours on top of a given source.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

Sample Compositing

mib_dielectric

Another variation of refraction, with the addition of specularity (Snell's law). This shader does only the refraction part of a dielectric material; highlights are left to other illumination nodes.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_opacity

Casts a transparency ray of a given intensity and merges the result with an input color.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib-reflect

Casts a reflection ray of a given color and merges the result with an input color. Use it to add a reflection effect to a base shader that provides illumination, possibly in conjunction with refractions or transparency added by other base shaders. If no reflection ray can be cast (because the

Reference > Sample Compositing

trace depth has been exceeded, or the reflection ray caused a shader to be called that failed, or the notrace parameter is set), sample the environment if there is one.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_refract

Casts a refraction ray of a given color with an index of refraction and merges the result with an input color. The indices of refraction can be computed with another base shader, such as mib_refraction_index, which is also stored back into the appropriate state variables. Use this to add a refraction effect to a base shader that provides illumination.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_refraction_index

Decide whether the ray is entering or leaving the object it has hit, based on a scan of parent rays (not based on the normal vector). The index of refraction ratio (outgoing divided by incoming) is returned. As a side effect, both incoming and outgoing indices of refraction are stored in the state (ior_in and ior, respectively), and the current volume shader becomes the refraction volume if the ray is entering.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_transparency

Casts a transparency ray of a given color and merges the result with an input color.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_twosided

Choose one or the other input color, depending on which side of the geometry was hit. This is commonly used as a multiplexing material shader, with two other material shaders assigned to the front and back parameters.

Reference > Data conversion

Data conversion

mib_color_alpha

Convert a color to RGBA grayscale, either by extracting the alpha component, by averaging RGB, or by weighting RGB according to a physiological color model that emphasizes green and deemphasizes red. The resulting grayscale value can also be used as a scalar. The returned R, G, B, and A components all have the same value.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_color_average

See "mib_color_alpha" on page 244.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_color_intensity

See "mib_color_alpha" on page 244.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_color_interpolate

Given a scalar or a color, perform a lookup and interpolation of a multicolor map. The map is a set (not array) of up to 8 colors. The actual number of colors is specified by a parameter.

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_color_mix

Accepts a base color and up to 8 inputs (the exact number is determined by a parameter), each of which consists of an input color, a weight scalar, and a mode. The inputs are evaluated in sequence, each operating on the result of the previous one (the first begins with the base color, which defaults to transparent black)

For a full description of this node's attributes, see the mental ray Shaders Guide in the Maya Help.

mib_color_spread

Reference > Miscellaneous

Miscellaneous

mentalrayPhenomenon

When you create and load Phenomenon, the nodes appear here. See "Phenomena" on page 38.

Reference > Miscellaneous

About

2

Surface relief

Surface relief is the depressions (low relief) and elevations (high relief) in the surface of an object. Examples include the peaks, valleys, and plateaus of a planet, or a dimples of a golf ball.

Although you could model surface relief into an object's geometry, usually it is faster and easier to achieve the same look with textures used as bump maps (which create the illusion of relief) or displacement maps (which create true surface relief by changing the topology of the object).

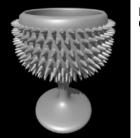


Image by Christine Beaumont

Related topics

- ✤ "Bump maps" on page 247.
- ✤ "Displacement maps" on page 249.
- *

Bump maps



Image by Matt Dougan

Bump maps are grayscale textures you map to objects to create the illusion of surface relief (elevations and depressions) on an otherwise flat object.

About > Related topics

With bumps maps depressions and elevations look real, but are not, because they don't alter the geometry of the surface the way Displacement maps do. Bump maps just change the direction of the surface's normals based on the bump map's Alpha Gain value.

Use bump maps to create very shallow reliefs. For example, you can make objects look like they are embossed, have shallow rolling hills, etc.

Because bump maps are not true surface relief, they:

- cannot cast or receive shadows
- cannot be seen if you silhoutte the mapped object
- take less time to render than displacement maps
- •

Note Although scratches are like little depressions, you can more easily achieve them with 2D texture.

Related topics

- ✤ "Surface relief" on page 247.
- ✤ "Texture mapping" on page 30.
- ✤ "Map a 2D or 3D texture" on page 76.
- Tip Map surface relief (bumps or displacements) to the Blinn surface material to reduce highlight roping or flickering.

The soft highlights on Blinn surfaces are less likely to cause roping or flickering than the harder highlights on Phong surfaces.

Displacement maps



Image by Christine Beaumont

Displacement maps are grayscale textures you map to objects to create true surface relief (elevations and depressions) on an otherwise flat object.

With Displacement maps, depressions and elevations become part of the geometry of the object, changing the topology, unlike Bump maps that only create the illusion of surface relief.

Note Because displacement changes the geometry of an object, displacement mapped objects usually require further tessellation (more triangles, which the renderer uses to approximate the smoothness of the surface).

By default, Maya uses Feature-based displacement mapping to automatically add more triangles where required.

Displacement maps move an object's vertices. By default, the height of the displacement is determined by the Alpha Gain value in the displacement map's Attribute Editor. If you turn on Alpha is Luminance, the height result is based on the intensity of the pixels instead.

Use displacement maps to create shallow or deep surface relief. For example, you can create embossing, mountain peaks and valleys, spikes, etc.

Because Displacement maps create true surface relief, they:

- can cast or receive shadows
- can be seen if you silhoutte the object
- take more time to render than bump maps, which create the illusion of surface relief
- ٠

Displacement Bounding Box

Because displacement mapping changes the volume of an object, it's bounding box may become too small or too large.

Bounding boxes, which represent the bounding volume of an object, can be used to speed up Maya operations and can make a significant difference for complex models. See "Change bounding box scale" on page 255.

Related topics

- ✤ "Surface relief" on page 247.
- "Texture mapping" on page 30.
- ✤ "Map a 2D or 3D texture" on page 76.

About > mental ray for Maya displacement

mental ray for Maya displacement

You can displacement map all mental ray for Maya geometry types (polygon meshes, free-form objects (NURBS curves/surfaces), and subdivision surfaces.

mental ray uses an adaptive tesselation approach to better fit the details of the displacement map. The initial tesselation (for NURBS: after surface approximation) is further subdivided to fit secondary criteria, controlled by the displace approximation settings. By default, mental ray for Maya creates appropriate settings that lead to curvature dependent subdivision of the triangles, one form of feature-based displacement mapping. You can change these settings by creating or selecting a custom displace approximation node in the Approximation Editor (mental ray > Approximation Editor).

Feature-based displacement

By default, Maya uses feature-based displacement mapping to attain high quality displacement mapping with the lowest impact on rendering resources. Displacement *features* are parts of the texture used as the displacement map that provide the information for the height variations (depressions or elevations).

This technique detects the density of the features in the displacement texture (that is, the more detailed areas) and adds triangles to the tessellation only where needed, keeping the triangle count to a minimum.

When using this technique, the tessellation attributes do not have to be set high, just high enough to capture the surface shape.

Non-feature based displacement

Note We do not recommend that you turn off Feature-based displacement to use non-feature-based displacement.

With non-feature-based displacement the software renderer does not add vertices to the geometry being displaced. As a result, many of the features in the displacement map may be lost if there are not enough vertices in the model.

Maya tries to alleviate the potential loss by bump mapping (in addition to displacement mapping) the displacement map to perturb the normals to create the features where there are not enough vertices. In this case, the bump map's Filter Size and Filter Offset attributes (if they have them) are automatically adjusted for optimal results.

How Do I? >

If the material cannot be bump mapped (for example, Layered Shaders cannot be bump mapped), the texture is instead connected as a displacement texture and no bump mapping occurs. You should connect this texture as a bump map where it makes sense. For example, use the displacement texture as a bump map on the various materials connected to the Layered Shader. Attach the bump node to all Normal Camera attributes in the shading network you have just displacement mapped. Also, if you drag a texture onto a displacement node manually within Hypershade instead of dragging from Hypershade onto the Displacement Material area in the Attribute Editor, no bump map is connected, and the displacement may not look right.

How Do I?

Connect a texture as a displacement map

For more information about displacement, see "Displacement maps" on page 249.

Note Avoid using Environment textures for displacement mapping. The basic characteristics of environment mapping preclude accurate calculations when used for displacement mapping.

Note During bump or displacement mapping, if an image file contains a mask channel, the mask channel is used for displacement and bump mapping. If the mask channel is absent, the luminance of the RGB is used to displace and/or bump map.

If you prefer to use the luminance information as the alpha, turn on the Alpha Is Luminance attribute (in the Color Balance section of the file texture's Attribute Editor).

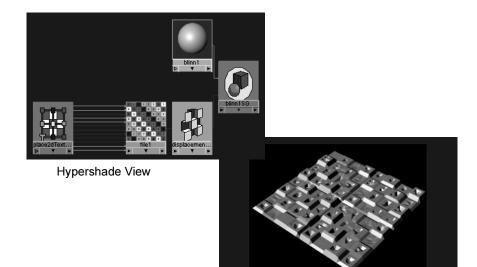
To create a displacement map

- **1** Create a material in the Hypershade and middle-drag the material swatch onto the object in the view.
- **2** Select the material swatch in the Hypershade and click the Input and Output Connections button to display its shading group swatch.

How Do I? > Connect a texture as a displacement map

- **3** Double-click the shading group swatch to open the Attribute Editor.
- **4** Click the box beside Displacement Mat. to open the displacement shader's Attribute Editor and click the box next to Displacement to map a texture.
- Tips Displacement mapped texture results do not display in hardware texturing mode (the view) unless temporarily mapped to a material's channel.

You can also use Modify > Convert > Displacement to Polygons.



Result in Render View

Set displacement map tessellation

Connect a displacement map

Тір	Because displacement maps alter the geometry of the surface, the textures you use as the map should not contain jagged edges (aliasing) or noise.
	To, filter out aliasing and noise before you displacement map a surface, see "Texture filtering" on page 29.
	If you must use a texture with a small amount of noise for displacement mapping, use Feature-based Displacement mapping, and adjust the Texture Threshold attribute.

Tip Occasionally when you map a texture with distinct features to an object, the volume, or size, of the object could change.

Preserve the object's volume (size)

To adjust this problem, use a negative Alpha Offset value for the texture to bring the size of the geometry back down (such as -2). You may also have to adjust the file texture to get the desired result.

Preview the displacement results

To preview the displacement map

Map the displacement texture temporarily to a material's channel, such as Color, which displays the results in the view (with Hardware Texturing turned on).

Adjust displacement sampling rates

To determine how to set the Initial and Extra sample rates

- **1** Make sure the displacement mapped object is selected and its Attribute Editor appears.
- **2** Display the tessellation triangles of the object.
- **3** "Preview the displacement results" on page 254.

2 | Surface Relief

How Do I? > Convert a displacement to polygons

- **4** For each tessellation triangle, look at how much texture height variation is in the triangle, then (in the Displacement section of the object's Attribute Editor), adjust the Initial Sample Rate:
- **5** For each tessellation triangle, notice how sharp the features are and how many curvy features there are. The sharper the features, the higher the Extra Sample Rate needs to be; adjust accordingly

Convert a displacement to polygons

To convert a displacement to polygons

If the displacement isn't changing over the course of an animation, convert the displacement to a polygon mesh to speed up rendering time.

For any surface, after estimating the sampling rates, use the Create Texture Reference Object tool to create a mesh (see "Create Texture Reference Object" on page 82 in the Shading guide for more details). This mesh is made from the displaced tessellation.

- If not enough texture details are included, try increasing the Initial Sample Rate.
- If the mesh is too jagged, try increasing both the Initial Sample Rate and Extra Sample Rate. You should always set the Extra Sample Rate *lower* than the Initial Sample rate.

Change bounding box scale

Warning

Be careful if you have an animation that changes the relationship between the displacement and the size of the surface being displaced. Choose the most extremely-displaced frame to perform the Calculate Bounding Box Scale operation. Alternatively, animate the value manually.

To change the bounding box scale

- 1 In the Memory and Performance Options section of the Render Global Settings window, turn on Use Displacement Bounding Box (it is on by default).
- **2** Estimate how much the surface will grow when it is displacement-mapped.

What went wrong? > Troubleshoot:Displacement textures 'pop'

- If the bounding box of the displaced surface will be more than 50 percent larger than the bounding box for the original surface in World Space, open the surface's Attribute Editor and enlarge the bounding box scale.
- If the bounding box of the displaced surface will be less than 50 percent larger than the bounding box for the original surface in World Space, open the surface's Attribute Editor and reduce the bounding box scale to optimize the rendering speed and memory.
- If you choose to let Maya automatically compute the proper bounding box scale for the displaced object, click Calculate Bounding Box Scale in the Attribute Editor and Maya automatically sets the bounding box scale for the surface.
- **3** Render.

If the estimated bounding box scale is too small, a warning message appears in the render log with instructions on how to set the bounding box scale correctly. An example message:

Warning: The bounding box is too small for shape "surbsSphereShape1". Reset the bounding box scale to: 1.56778 1.56778 1.56778. You can use the following mel commands: setAttr nurbsSphereShape1.boundingBoxScale type double3 1.56778 1.56778;

- **4** Adjust the bounding box scale as recommended in the render log message.
- **5** Render again.

What went wrong?

Bumps and displacements

Troubleshoot:Displacement textures 'pop'

To prevent a displacement texture "popping," make sure the surface's Use Min Screen attribute is turned off in the Secondary Tessellation Attributes section of its Attribute Editor.

Use Min Screen tessellates a surface based on its distance from the camera and uses the screen space to determine how much tessellation is required (as opposed to object or world space). If the surface is moving toward or away from the camera and Use Min Screen is on, the tessellation changes over time, and the displaced texture pops.

2 | Surface Relief

Reference > Troubleshoot:My blurred file texture looks crisp, not blurred

Troubleshoot: My blurred file texture looks crisp, not blurred

Maya's file texture node provides controls for blurring the texture (filter size and filter offset), but these controls behave differently when the texture is applied to a color channel versus a displacement map, so that extremely fine details can be captured.

So, though you can bring (for example) a photograph into Maya, use the filter size/offset controls to blur it out, and map it to the color of an object to see blurry texture on your object when you render, you won't get the same result if you apply that blurred texture as a displacement map. Instead, the embossed image looks very crisp.

You have two options to blur the image suitably for displacement mapping:

- Increase the filter values, possibly into the hundreds before you begin to see blurring of the displacement map
- Make use of the Pre Filter control to blur the image file before it is used for rendering. This applies an image-space filter of a specified radius (in pixels) to the image before any operations are done on it.

Reference Nodes

Feature-based displacement map attributes

- "Connect a displacement map" on page 253
- "Adjust displacement sampling rates" on page 254

Feature Displacement

Turn on (default) Feature-based Displacement.

Note We do not recommend that you turn off Feature-based displacement to use non-feature-based displacement.

Initial Sample Rate

This rate is used to check the texture values to determine the difference between displacement heights and where to introduce new vertices. It defines a regular sampling grid in each original tessellation triangle. For example, with the default value of 6, the sample grid is 6x6.

Reference > Feature-based displacement map attributes

Try to keep this sample rate to a reasonable value since it does take longer to render the higher the value.

For each tessellation triangle, notice how much texture height variation is in the triangle and estimate how many initial samples are required to include these features when displacement mapping.

- If the original triangle is large and the feature in the triangle is fine, then the Initial Sample Rate has to be large to include the fine features.
- If the original triangle is small and the features are sparse, the Initial Sample Rate does not have to be very large. The default of 6 may be enough.

Extra Sample Rate

This rate is used to take extra samples to refine the new vertices introduced during displacement mapping. Maya adjusts the vertices to align with the displacement.

For each tessellation triangle, notice how sharp the features are and how many curvy features there are. The sharper the features, the higher the Extra Sample Rate needs to be; adjust accordingly

Always try to set this value at 0 first if the result looks too jagged, then increase the value to get the results you need. The default value is 5. A value of 20 is usually enough.

In the following examples, the displaced surface on the left only needs an Extra Sample Rate value of 0, but the surface on the right needs an Extra Sample Rate of 5.



Image by Christine Beaumont

> Image by Matt Dougan



Texture Threshold

This value is used to eliminate vertices that do not significantly contribute to the displacement. This is a threshold of the percentage of the maximum height variation. Any vertex where the variation is smaller than this value is not considered. The default value is 0.

2 | Surface Relief

Reference > Feature-based displacement map attributes

Note It is recommended that you pre-process the texture so that it contains as little noise as possible and leaving this value at the default of 0.

If render times are high, you can increase default value slightly.

- If you have black and white (embossing), the default setting of 0 is optimal.
- If you have smooth displacement, like a bulge, specify small values (as close to 0 as possible).

Normal Threshold

Determine the angle threshold of the normal difference between two adjacent triangles (the angular value is in degrees). If the normal difference is higher than the threshold, the edge between these two triangles is recognized as a sharp edge. If lower, the normals are averaged which produces smooth edges. The default value is 30 degrees.

Note It is recommended that you leave this value at the default of 30.

Bounding Box Scale

Warning

Be careful if you have an animation that changes the relationship between the displacement and the size of the surface being displaced. Choose the most extremely-displaced frame to perform the Calculate Bounding Box Scale operation. Alternatively, animate the value manually.

Determines the bounding box scale for a displacement map and helps to compute the bounding box scale automatically by tessellating the object.

Bounding Box Scale lets you estimate the size of a displaced object's bounding box. It is in world space because the displacement is applied to vertices in world space. Based on the bounding box scale, Maya calculates the new bounding box for the displacement-mapped object.

When you scale the bounding box, make sure it is not too small or the displacement may look cut-off or look as though it has holes. The default bounding box scale (1.5 in world space) should be adequate in

2 | Surface Relief Reference > Feature-based displacement map attributes

most situations; however, if you want large-scale displacement, increase the bounding box scale significantly. If you do not increase the size enough, artifacts result in the rendered image, but if the estimate is too large, Maya may use more memory to render the object.

2 | Surface Relief

Reference > Feature-based displacement map attributes

About Backgrounds

Backgrounds

Typically you render the objects in a scene against a black background and composite the rendered images later with an appropriate background using compositing software. However, you can insert a background:

- to avoid having to model background objects or scenery, but want them represented, two-dimensionally, in your scene (especially if you don't have access to compositing software).
- as a temporary reference (especially for rotoscoping or motion matching) for modeling or animating objects in the scene.

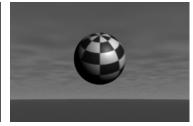
To create a background, see "Create backgrounds" on page 265.

Note When you create a background in Maya, you create it for a specific camera. When you render a scene from that camera, the background is included in the rendered image. If you render the scene from a different camera, the background is not included. For more information on cameras, see "Maya camera types" on page 27 the Lighting guide.

Basic color and texture backgrounds



Color backgrounds flood the background with a solid color.



Texture backgrounds use a 2D, 3D or Environment texture to simulate a threedimensional environment.

About > Color backgrounds

Color backgrounds

A color background floods the background of the scene with a solid color (for example, black, white, or red). To create a color background, see "Create a basic color background" on page 265.

Texture backgrounds

A texture background uses a 2D, 3D, or environment texture on an image plane to simulate a three-dimensional background, or *environment*.

To create a texture background, see "Create a texture background" on page 265.

Image file backgrounds



Image file background use an image file, a series of image files, or a movie file as a background.

You can import an image, a series of image files, or a movie file and map them to an image plane to act as a backdrop for your scene. You can use this backdrop in the following ways:

- As a reference while you build your scene.
- As the background for your scene instead of you having to build it all.
- To catch shadows and reflections with the Use Background material (see "Shadow catching" on page 35 in the Lighting guide.
- To produce environments with Environment textures.

Image planes are automatically created at the camera's far clipping plane. They are perpendicular to the camera and parented to it so that even when a camera moves or changes the point of interest, the image plane is still covers the entire view behind your scene.

You can create multiple image planes per camera for interesting backgrounds, ordered by depth. To create, edit, or position an image plane, see "Create, edit, or position an image plane" on page 265.

The Image Plane Attributes control the appearance and placement of an image plane. For a detailed description of image plane attributes and guidelines on how to change them, see "Image plane" on page 271.

About > Image plane syntax

Image plane syntax

When you import an image as an image plane, the syntax must be as follows:

- name.# (or name.#### for multiple frames)
- name.#.ext (or name.###.ext for multiple frames)

Static image file backgrounds

A static image file background uses a single image file as a background. The background image does not change during an animation.

To create a static image file background, see "Create a static image file background" on page 266.

Animated image file backgrounds

You can create an animated image file background using either a series of image files or a movie file. (A movie file updates in the views much faster than a series of image files.)

To create an animated image file background, see "Create an animated image file background" on page 267.

Note If a moving camera was used to record the original image files or movie file that you want to use as a background, then you must match the camera's motion using Maya Live. See the *Maya Live*.

3D background simulations

An image file background is a two-dimensional image that exists behind the objects in the scene. You can, however, simulate a three-dimensional background by creating "stand-in" surfaces that represent objects in the background image. An object in the scene can then:

- move behind an object in the background image
- cast shadows onto objects in the background image
- · receive shadows from objects in the background image
- be accurately reflected by the objects in the background image.

To simulate a 3D background, see "Create a 3D image file background" on page 268.

About > 3D background simulations

This background image contains a fence. You want a CG character to appear behind the fence.



create a stand-in surface for the fence, then position the CG character behind the stand-in surface



To create a static image file background, see "Create a static image file background" on page 266.

- "Create an animated image file background" on page 267.
- "Create a 3D image file background" on page 268.

Important

Before you create an image file background, you should set up the camera, and the camera's view so that it matches the camera used to record the background image. For more information about setting up cameras, see "Maya camera types" on page 27 in the Rendering guide.

Note It is also possible to create a 3D image file background so that the objects in the scene accurately reflect the objects in the background image.

How Do I? > Create a basic color background

How Do I? Create backgrounds

Create a basic color background

For more information on basic color backgrounds, see "Basic color and texture backgrounds" on page 261.

To create a color background

 In the Environment section of the camera's Attribute Editor (View > Camera Attribute Editor), set the Background Color attribute.

For more information on a camera's Attribute Editor, see "Attribute Editor" on page 189 in the Lighting guide.

Create a texture background

For more information on texture backgrounds, see "Basic color and texture backgrounds" on page 261.

To create a texture background

 In the Environment section of the camera's Attribute Editor (View > Camera Attribute Editor), click the Create button to the right of the Image Plane attribute.

Maya creates an image plane and connects it to the camera.

- **2** Set the Type attribute for the image plane to Texture.
- **3** Click the texture button for the Texture attribute.

The Create Render Node window appears.

4 Select the texture you want to use as a background (for example, an Environment Texture).

Maya creates the texture and connects it to the image plane.

Create, edit, or position an image plane

For more information about image planes, see "Image plane" on page 271.

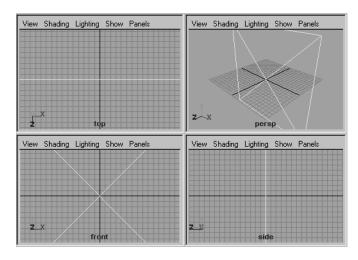
To create an image plane

- **1** Select View > Image Plane > Import Image from the current view.
- **2** Browse to the file you want and click Open.

A placement icon appears in either the current view or all views, depending on the Display mode you set (in all views by default), and the Image Plane Attribute Editor opens.

How Do I? > Create a static image file background

3 Select an Image File or Texture from the Type drop-down list, then click the folder icon next to Image Name to load an image plane into the view.



For a description of image plane attributes, see "Image plane" on page 271

To edit an existing image plane

Tip Right-click on the arrow key of the image plane attribute in the camera to display a list of the image planes per camera.

• Select View > Image Plane > Image Plane Attributes from the current view and choose any of the camera's image planes you want to edit.

The selected image plane's attributes display in the Attribute Editor (unless the Attribute Editor has been hidden)

To position an image plane

- Use the Placement attributes to position an image plane relative to the camera. See "Placement" on page 274.
- Use the Placement Extras attributes to control which portion of an image file is visible on the image plane. See "Placement Extras" on page 280.

Create a static image file background

For more information on image file backgrounds, see "Image file backgrounds" on page 262.

How Do I? > Create an animated image file background

To create a static image file background

Do one of the following:

- 1 In the Scene View, click View > Image Plane > Import Image. An image plane is automatically created and connected to the camera and you are promted to choose the image.
- 2 In the Environment section of the camera's Attribute Editor (View > Camera Attribute Editor), click the Create button to the right of the Image Plane attribute.

Maya creates an image plane and connects it to the camera.

- Tip Multiple image planes can be created per camera for interesting backgrounds, ordered by depth. right on the arrow key of the image plane attribute in the camera to display a list of the image planes per camera.
 - Make sure that the Type attribute for the image plane is set to Image File (the default setting).
 - Click the folder button for the Image Name attribute. The file browser appears.
 - Select the image file you want to use as a background, and click Open. Maya connects the image file to the image plane.

Create an animated image file background

For more information on image file backgrounds, see "Image file backgrounds" on page 262.

To create an animated image file background

- 1 Create a static image plane. "Create a static image file background" on page 266.
- **2** In the image planes' Attribute Editor, turn on Use Image Sequence.
- 3 Maya automatically enters the expression =frame on the Image Number attribute, ensuring that the frame number from the image sequence used is synchronised with the current frame on the Maya timeline. For example, when current time is at frame 24, the 24th image from the image sequence will be used.
- **4** If needed enter a Frame Offset value to offset the frame number from the image sequence used to the current frame on the Maya timeline. For example, if you want the 24th image from the image sequence to correspond to the first frame in the timeline, enter a value of 24.

How Do I? > Create a 3D image file background

If more non-standard animated image sequence logic is desired, you can either edit the expression on the Image Number attribute (rightclick on Image Number and select Edit Expression) and enter the desired changes. For example, if you wanted to slow down the image sequence to "playback" at half speed you could add a divide by 2 to the expression.

Alternately, you can remove the expression from the Image Number attribute and set key frames on the Image Number attribute just like animating any other attribute. This allows for complex image sequence logic, for example reversing the image sequence or holding the first frame, then "playing" then holding the last frame.

Create a 3D image file background

For more information on image file backgrounds, see "Image file backgrounds" on page 262.

To create a 3D image file background

- Create an image file background for the perspective camera you plan to render from (see "Create a static image file background" on page 266 or "Create an animated image file background" on page 267).
- **2** Use the background as a reference to create a relatively simple surface or group of surfaces to act as stand-ins for the objects in the background image that you want to interact with the objects in the scene.

For example, if you want an object in the scene to cast a shadow onto the floor in the background image, create a plane as a stand-in for the floor.

- **3** Scale and/or position the stand-in surfaces so that they are directly over the correct areas of the background image.
- **4** In Hypershade, select Create > Materials > Use Background, and assign the new material to the stand-in surfaces. The stand-in surfaces have the same color as the objects in the background image that they represent.
- 5 You can now make objects in the scene appear to move behind objects in the background image by moving them behind the stand-in surfaces.

The objects in the scene also appear to cast shadows onto the objects in the background image by casting shadows onto the stand-in surfaces.

• To make objects in the background image appear to cast shadows onto objects in the scene, in the Render Stats section of the stand-in surfaces' Attribute Editor, turn on Cast Shadows.

How Do I? > Size and position an image file background

• To make the objects in the scene appear to accurately reflect objects in the background image, in the Render Stats section of the stand-in surface's Attribute Editor, turn on Visible in Reflections. Visible in Reflections is on by default.

To make objects in the scene accurately reflect the objects in the background image

- 1 Do not use a Use Background material. Instead, assign a Blinn or Phong material (for example) to the stand-in surfaces.
- 2 Map a File projection texture to Color—select As projection when applying the texture in the Create Render Node window, or if importing a file, select As Projection from "File > Import Selected Image Files" on page 102.
- **3** Map the background image to the Image attribute, set Proj Type to Perspective, and set Link To Camera to the camera with the background image.

The stand-in surfaces now have the same color as the objects in the background image they represent *and* the objects in the scene accurately reflect the objects in the background image. However, it also means you have to illuminate the stand-in surfaces properly to make them look identical to the objects in the background image that they represent.

Size and position an image file background

How you position a texture or image file background depends on whether the background's Image Plane attribute is Attached to Camera or Fixed.

When you create a background for a perspective camera, Image Plane is Attached to Camera by default. When you move the camera, the image plane also moves. You use this setting when you are using the image plane as a reference for animating objects in the scene (that is, motion matching or rotoscoping), or if you plan to render the image plane as a background.

When you create a background for an orthographic camera, Image Plane is Fixed by default. When you move the camera, the image plane does not move. You use this setting when you are using the image plane as a reference for modeling objects in the scene.

For more information on image file backgrounds, see "Image file backgrounds" on page 262.

What went wrong? > Remove or hide a background

Remove or hide a background

For more information on image file backgrounds, see "Image file backgrounds" on page 262.

To remove a color background

• In the Environment section of the camera's Attribute Editor (View > Camera Attribute Editor), set the Background Color to black.

To temporarily turn off a texture or image file background

• In the Image Plane Attributes section of the image plane's Attribute Editor (View > Camera Attribute Editor), set Display Mode to None.

To permanently remove a texture or image file background

• In Hypershade, select the image plane swatch and either press Delete or select Edit > Delete.

What Backgrounds went wrong? Troubleshoot:Grainy or jagged background image

Do either of the following:

- Render the scene without a background image then composite the rendered image with the background image using compositing software.
- Increase Shading Samples and Max Shading Samples (to the *lowest* values that produce acceptable results) for the image plane.

3 | Backgrounds Reference > Image plane

Reference Nodes

Image Planes

Image plane

The Image Plane's Attribute Editor automatically disables the attributes for procedural textures when image files are used, and disables the attributes for image planes when procedural textures are used.

Display

Looking through camera	The image plane only appears in the camera view in which the image plane is connected.
In all views	The image plane appears in all views. Display is set to In all views by default.

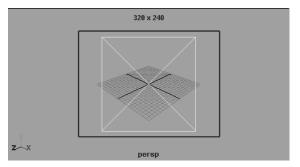
Display Mode

Controls how the image plane appears in views and in the rendered image. The default setting is RGBA.

None No display in views or rendered image.

Outline

A rectangle with diagonal lines in views; full 24 bit color image and transparency (alpha) in rendered image.



RGB

RGBA

Full 24 bit color image in views; full 24 bit color image and transparency (alpha) in rendered image.

Full 24 bit color image and transparency (alpha) in views and rendered image. (If the image file does not contain an alpha channel, set Display Mode to RGB instead of RGBA.)

Reference > Image plane



Luminance

Grayscale image in views; gray-scale image and transparency (alpha) in rendered image.

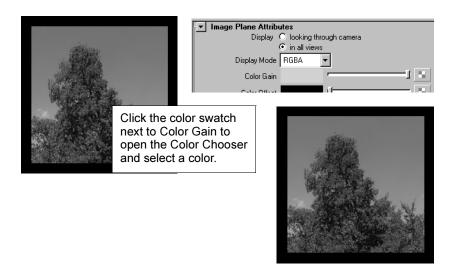


Alpha

Transparency (alpha) in views and rendered image.

Color Gain

A scaling factor applied to all colors in the image plane. Maya multiplies all colors in the image plane by the Color Gain color. For example, you can color correct an image plane that appears too green by setting the Color Gain color to a shade of blue. The default color is white (no effect).



Result with new Color Gain color.

Color Offset

An offset factor applied to all colors in the image plane. Maya adds the Color Offset color to all colors in the image plane. For example, you can brighten an image plane that appears too dark by dragging the slider to set the Color Offset color to a shade of grey. The default color is black (no effect).

Alpha Gain

A scaling factor applied to the alpha channel (transparency) of the image plane. Maya multiplies all alpha values in the image plane by the Alpha Gain value. The slider range is 0 to 1, but you can type in higher values. The default value is 1 (no effect).

Image Plane

Attached to Camera	Maya attaches the image plane to the camera. When you move the camera, the image plane also moves. Use this setting when you want to use the image plane as a reference for animating objects in the scene (such as motion matching or rotoscoping), or if you plan to render the image plane as a background.
Fixed	Maya fixes the image plane in space. When you move the camera, the image plane does not move. Use this setting when you want to use the image plane as a reference for modeling objects in the scene.

Reference > Placement

The default setting is Attached to Camera for perspective cameras, and Fixed for orthographic cameras.
If set to Fixed, you can adjust the image plane using the "Placement Extras" attributes.

Type

The default setting is Image File.

lmage File	If set to Image File, the image plane uses the image file assigned to Image Name.
Texture	If set to Texture, the image plane uses the texture assigned to Texture.

Image Name

The path and name of the image file or movie file that the image plane uses when Type is Image File. Image files can be in any Maya-supported image file format.

Use Frame Extension

If off, the image plane uses the single image file indicated by Image Name (the file name and extension).

If on, at each frame the image plane uses the single image file indicated by Image Name (the file name) and Frame Extension (the file extension number). Use Frame Extension is off by default.

Frame Extension

If Use Frame Extension is on, the image plane uses the single image file indicated by Image Name (the file name) and Frame Extension (the file extension number). By setting keys for Frame Extension, you can use a sequence of image files or a movie file as an animated image plane.

Texture

The texture the image plane uses when Type is Texture. A texture assigned to an image plane does not display in the views.

Placement

Use the Placement attributes to position an image plane relative to the camera.

Fit

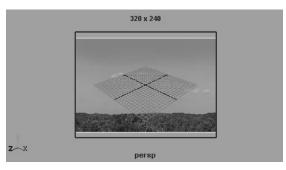
Controls the size of the image plane relative to the film gate and resolution gate. You can choose a Fit option from the drop-down menu. Best is the default Fit.

See also *"Turn scene view guidelines on or off" on page 36* in the Rendering guide.

Fit is not available if Image Plane is Fixed.

Fill

By default, or if you select Fit to Film Gate, the image plane fills the film gate.



If you select Fit to Resolution Gate, the image plane fills the resolution gate.



Maya maintains the aspect ratio of the image on the image plane. If the aspect ratios of the image and the film gate (or resolution gate) are different, the image extends beyond the film gate (or resolution gate) and is cropped.

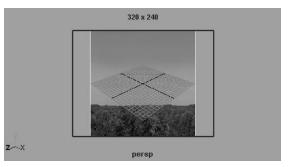
By default, or if you select Fit to Film Gate, the image plane fits horizontally or vertically within the film gate.

Best

Reference > Placement



If you select Fit to Resolution Gate, the image plane fits horizontally or vertically within the resolution gate.



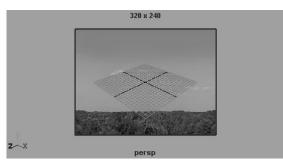
The aspect ratio of the image on the image plane is maintained. If the aspect ratios of the image and the film gate (or resolution gate) are different, the film gate (or resolution gate) extends beyond the edge of the image.

Horizontal By default, or if you select Fit to Film Gate, the image plane fits horizontally within the film gate.



If you select Fit to Resolution Gate, the image plane fits horizontally within the resolution gate.

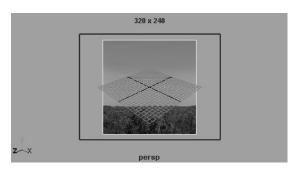
3 | Backgrounds Reference > Placement



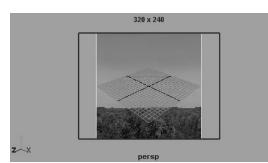
The aspect ratio of the image on the image plane is maintained. If the aspect ratios of the image and the film gate (or resolution gate) are different, the image extends vertically beyond the film gate (or resolution gate) and can be cropped.

Vertical

By default, or if you select Fit to Film Gate, the image plane fits vertically within the film gate.



If you select Fit to Resolution Gate, the image plane fits vertically within the resolution gate.

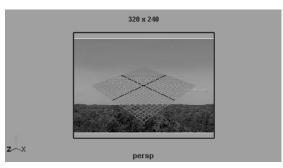


The aspect ratio of the image on the image plane is maintained. If the aspect ratios of the image and the film gate (or resolution gate) are different, the image extends horizontally beyond the film gate (or resolution gate) and can be cropped.

Reference > Placement

To Size

By default, or if you select Fit to Film Gate, the image plane fills the film gate.



If you select Fit to Resolution Gate, the image plane fills the resolution gate.



The aspect ratio of the image on the image plane is *not* maintained. If the aspect ratios of the image and the film gate (or resolution gate) are different, the image stretches to fit within the film gate (or resolution gate).

Fit to Resolution Gate

Scales the image plane so that it is the same size as the resolution gate of the camera. Fit to Resolution Gate has no effect if Image Plane is Fixed.

See also *"Turn scene view guidelines on or off" on page 36* in the Rendering guide.

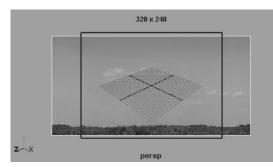
Fit to Film Gate

Scales the image plane so that it is the same size as the film gate of the camera. Fit to Film Gate has no effect if Image Plane is Fixed.

See also *"Turn scene view guidelines on or off" on page 36* in the Rendering guide.

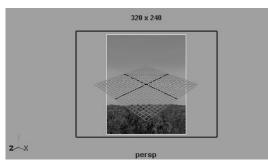
Size

The height and width of the image plane, measured in inches. If the image plane is Fit to Film Gate, the Size of the image plane is the same as the Camera Aperture. Size is not available if Image Plane is Fixed.



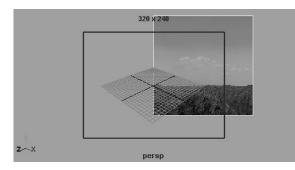
Squeeze Correction

Scales the image plane horizontally when Fit is To Size. If the Pixel Aspect Ratio for the scene is different than the pixel aspect ratio of the image plane's image file, adjust the Squeeze Correction attribute to compensate for any distortion. The default value is 0.





Offsets the image plane horizontally and vertically relative to the film gate. Offset is not available if Image Plane is Fixed. Offset is measured in millimeters. The default values are both 0.



Reference > Placement Extras

Depth

The distance of the image plane from the camera, measured in the scene's linear working unit. Depth is not available if Image Plane is Fixed.

Placement Extras

The Placement Extras attributes control which portion of an image file is visible on the image plane. If Image Plane is Fixed, the Placement Extras attributes also control the position and size of the image plane.

Coverage X, Coverage Y

The number of horizontal and vertical pixels of the image file displayed on the image plane. The default values for Coverage X and Coverage Y are the horizontal and vertical resolution of the image file. By decreasing these values, you can limit the portion of the image file that is displayed.

Coverage Origin X, Coverage Origin Y

The horizontal and vertical value of the pixel in the image file displayed in the bottom left corner of the image plane. By changing the Coverage Origin X and Coverage Origin Y values, you can scale and offset the image file on the image plane. The default values are both 0.

The following diagram shows what happens to the image plane placement when you adjust Coverage attributes:



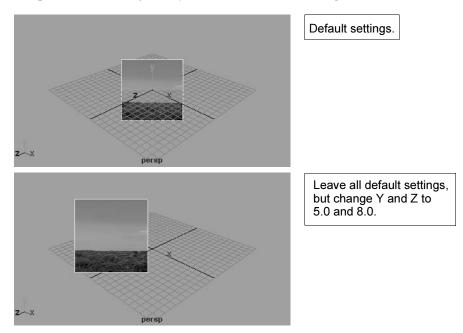
Center

The position of the center of the image plane (measured in the scene's linear working unit). Center is not available if Image Plane is Attached to Camera.

Width, Height

The width and height of the image plane (measured in the scene's linear working unit). Width and Height are not available if Image Plane is Attached to Camera.

The following diagramS shows what happens to the image plane placement when you adjust center, width, and height attributes:



Reference > Placement Extras

About Reflection

True reflections

To create true (photorealistic) reflections, you must raytrace the scene, a process which can take a significant amount of time, depending on the complexity of your scene. To optimize raytracing to reduce rendering times you can limit the number of reflections per surface and which surfaces reflect.

Raytracing is a type of shadow rendering where the path of individual light rays are calculated from their source (the light) to their destination (the camera). For more information on raytracing, see "Depth map and raytraced shadows" on page 32 in the Lighting guide.

To create true reflections, see "Create true reflections" on page 284.

Simulated reflections

To simulate reflections, which can significantly reduce rendering time, you must use a texture as a reflection map. You apply the map to the Reflected color attribute of the object's material to specify how the reflected environment looks on the object.

For more information on maps, see "Texture mapping" on page 30.

Note Reflectivity vs. reflected color

Reflectivity determines the degree to which a surface reflects its surroundings; reflected color (if raytracing is not used) determines what is reflected.

Environment textures

Environment textures simulate three-dimensional spaces using a series of image files (Env Ball, Env Cube, Env Sphere) or using a computer graphic procedure (Env Chrome and Env Sky).

You can use them to create reflections.

You can simulate reflections using the following environment textures: Env Ball, Env Cube, and Env Sphere. To simulate reflections:

- see "Simulate reflections with Env Ball" on page 285.
- see "Simulate reflections with Env Cube" on page 287.

How Do I? > Create true reflections

• see "Simulate reflections with Env Sphere" on page 288.

When used to map image planes, environment textures do not use the reflected direction; they use the camera view direction. This means, for example, that in an Env Sky texture, if you want to see the sun on the background, it must appear in the view in front of the camera. Use the Env Sky manipulator and rotate or scale it until the line representing the sun is pointing to the background (you can achieve the same result by changing the sun elevation and azimuth). (For more information on image planes, see "Create, edit, or position an image plane" on page 265.)

Note Do not map an environment texture to a material's Bump or Displacement parameter. The basic characteristics of environment mapping preclude accurate calculations when used for displacement mapping. An environment texture mapped to Bump produces unpredictable results; Maya ignores an environment texture mapped to Displacement. For more information on displacement mapping, see "Surface relief" on page 247.

How Do I? Create reflections

Create true reflections

For more information about true reflections, see "True reflections" on page 283.

Note To create true (photorealistic) reflections, you must raytrace the scene, a process which can take a significant amount of time. For more information about raytracing, see "Depth map and raytraced shadows" on page 32 in the Lighting guide.

You must have at least two surfaces to create true reflections (or a surface that somehow curves around so one part of its surface can reflect onto another part of its surface).

You can control which surfaces appear in reflections and which don't by turning Visible in Reflections on or off in each surface's Attribute Editor. (Visible in Reflections is on by default when you create new surfaces.)

How Do I? > Simulate reflections with Env Ball

To create true reflections (example)

- 1 Create a sphere and a plane, and position the sphere over the plane. Create a light to illuminate both surfaces.
- **2** Create a specular material (a Phong or PhongE) and assign it to the sphere. The sphere is reflected in the plane.
- **3** Create a second material and assign it to the plane. The plane reflects the sphere.
- **4** Make each surface a different color so you can see the reflection of one in the other.
- **5** In the Raytracing Quality section of the Render Global Settings window, turn on Raytracing.

This tells Maya to raytrace any surface whose Visible in Reflections/ Refractions is toggled on. These attributes are on by default for all surfaces, but raytracing only works when you turn on Raytracing in the Render Global Settings window.

To learn more about the Render Global Settings, see "*Render Global Settings window*" on page 159 in the Rendering guide.

6 Perform a test render to visualize the results. If you want the sphere to reflect the plane, open the plane's Attribute Editor and turn on Render Stats > Visible in Reflections.

To test iterations of a scene, see "Visualize interactively with IPR" on page 107 in the Rendering guide.

Simulate reflections with Env Ball

For more information about this texture, see "Env Ball" on page 208.

To use the Env Ball environment texture, you must map the texture's Image attribute with the image of a reflective chrome ball in the environment you want to re-create. You should also create an image plane for the camera and map the image plane's Image Name attribute with the image of the environment without the chrome ball.

To create an image of a chrome ball

- 1 Place a highly reflective chrome ball (sphere) in the environment (real world or computer generated) that you want to re-create.
- **2** Place the ball at the exact location (in the original environment) where you want the model to appear (in the re-created environment), and take note of the ball's distance from any floor/walls/ceiling or large objects.

How Do I? > Simulate reflections with Env Ball

3 Photograph (or render) the ball using a telephoto lens, and take note of the camera's elevation (the angle between the camera's view and the environment's grid plane), and the camera's inclination (the angle between the camera's view and the environment's YZ plane).

The photo essentially contains a compressed sample of the entire environment, except for the area directly behind the ball. The highest resolution is in the direction of the camera, so the image provides the best data compression for that point of view.

To re-create environments using Environment Ball

The Env Ball texture can best re-create environments that have no objects in their center (that is, near the chrome ball). For example, rooms and interiors should not contain furniture, and outdoor scenes should not have trees or cars near the chrome ball. (In general, outdoor scenes can contain buildings.)

To use a single image of a chrome ball using Environment Ball

- Map a File texture to the Env Ball texture's Image attribute, and then map the image file of the ball in the environment to the File texture's Image attribute.
- **2** Map the image of the environment without the chrome ball to the image plane's Image attributes.
- **3** Set the Env Ball texture's Inclination and Elevation attributes to the inclination and elevation of the camera used to photograph the ball.

To obtain accurate reflections for the Environment Ball texture

For accurate reflections of the re-created environment on the model, set the Environment Ball texture's Projection Geometry attributes to values corresponding to the distance between any floor/walls/ceiling or large objects and the chrome sphere when it was photographed.

To position the image planes's image for the Environment Ball texture

To simplify positioning the image plane's Image, set the Env Ball texture's Eye Space on.

To model background geometry when using the Environment Ball texture

To model background geometry (for example, so you can add shadows, lighting effects, or fog to the scene), set the Env Ball texture's Reflect attribute off.

How Do I? > Simulate reflections with Env Cube

Simulate reflections with Env Cube

For more information about this texture, see "Env Cube" on page 211.

To make reflections using the Env Cube material

- **1** Create a material, and map an Env Cube to its Reflected Color attribute.
- **2** Make the Env Cube's texture placement object visible in the modeling views and scale, rotate, translate it, or even animate the transformations.

Reflections of the Env Cube are rendered as if the six images in the texture were mapped directly onto the six faces of the placement box.

Note A hardware rendered environment cube map matches the textured 3D view, but compared the software rendered result, the front and back images will be swapped.
If you want the hardware rendered result to match the software rendered result (which won't match the hardware textured scene view, however), open the Attribute Editor for the cube map and swap the images for the front and back.

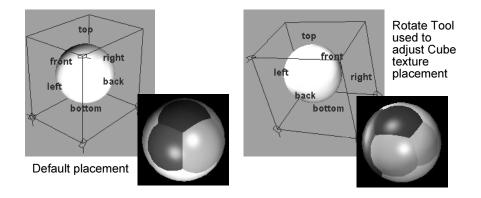
Note About backward compatibility

To achieve an infinite cube effect for backwards compatibility, turn on Infinite Cube.

To use the Cube's texture placement object

Use Maya's transform tools with the Cube's texture placement object to adjust the placement of the texture on the object. To see the results, IPR render the surface.

What went wrong? > Simulate reflections with Env Sphere

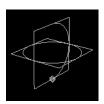


Simulate reflections with Env Sphere

For more information about this texture, see "Env Sphere" on page 217.

To use the Sphere's texture placement object

The Sphere environment texture provides a texture placement object to adjust the texture on the surface. Use Maya's transform tools to scale, move, or rotate the texture placement object.



You can also interactively place the texture, or fit it to the object. Select either Interactive Placement, which provides you with a special manipulator, or Fit to group bbox from the Sphere's place3dtexture attributes.

What
went
wrong?Maya materials and texturesTroubleshoot:Cube maps swa

Troubleshoot:Cube maps swap front and back images

A hardware rendered environment cube map matches the textured 3D view, but compared the software rendered result, the front and back images will be swapped.

4 | Reflection and Environment

What went wrong? > Troubleshoot:Cube maps swap front and back images

If you want the hardware rendered result to match the software rendered result (which won't match the hardware textured scene view, however), open the Attribute Editor for the cube map and swap the images for the front and back.

4 | Reflection and Environment

What went wrong? > Troubleshoot:Cube maps swap front and back images

Shading 290

Atmosphere

About

5

Fog, smoke, dust, and silt

Maya's volumetric materials and mental ray for Maya's volumetric materials let you simulate fog, smoke, dust, or other atmospheric effects.



mental ray for Maya's participating media

You can create atmospheric effects such as fog, smoke, dust in the following ways:

- For basic spherical, conical or cubicle effects, create the appropriate Maya volume primitive, then assign a Maya volumetric material to it, then render with Maya sw.
- For more complex shapes, create any geometrical object, then assign a Maya volumetric material to it, then render with mental ray for Maya
- Use mental ray for Maya's participating media. The workflow involves assigning a transfer material to acheive physically accurate light participation, with the potential to generate shadows and caustics.

(Alternatively, you can create the effect in post production (that is, outside Maya).)

How Do I? Create fog, smoke or dust

Simulate fog, smoke, or dust

To simulate fog, smoke, dust, or other atmospheric effects with Maya software rendering, you create a volumetric primitive (shape) and assign one of Maya's volumetric materials to the shape.

5 | Atmosphere

How Do I? > Change the visual effect of fog, smoke, or dust

Important!

Environment fog cannot cast shadows. If you want to cast shadows, use Light Fog.

To create environment fog

• In the Render Options section of the Render Global Settings window, click the map button beside the Environment Fog attribute. Maya automatically creates an environment fog node and an environment fog light node (an ambient light).

To adjust the depth range for environment fog

• To make environment fog fill a specific region (between two distances from the camera), set Distance Clip Planes to Fog Near/Far and adjust the Fog Near Distance and Fog Far Distance attributes.

To adjust the vertical range for environment fog

• To make environment fog fill a specific vertical region, turn on Use Height and adjust the Min Height and Max Height attributes. To make the edges of the region gradually blend, adjust the Blend Range attribute.

To create variations in environment fog's density and color

• To create variations in the density and color of environment fog across the camera's view, turn on Use Layer and assign a texture to the Layer attribute. (You may need to limit the Depth Range, and increase Volume Samples for the environment fog shape to see the effect.)

Change the visual effect of fog, smoke, or dust

For more information about volumetric materials that let you simulate fog, smoke, and dust, see "Volumetric materials" on page 147.

The Volume Shader lets you connect other attributes and effects directly to its color, transparency, and matte opacity. The Volume Shader can be used with a Spot Light, Point Light, Environment Fog, and particles.

Try this simple example. By mapping a Volume Shader to a Spot Light's Light Fog, you can map textures to the Volume Shader's attributes and change the fog's visual effects.

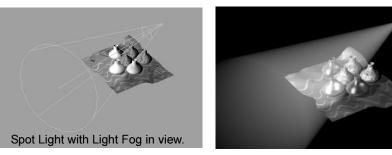
To use the Volume Shader with Light Fog (example)

Use a spot or point light in the scene. This example uses a spot light.

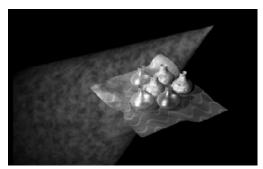
How Do I? > Change the visual effect of fog, smoke, or dust

1 In the spot light's Attribute Editor's Light Effects section, click the Light Fog map button to map it to the light.

The spot light's icon increases in size. If necessary, bump up the Fog Spread and Fog Intensity values.



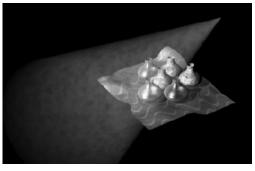
- **2** In the Hypershade, create a Volume Shader material.
- **3** Middle-drag the Volume Shader material swatch over the Spot Light swatch and select an attribute, such as color, with which you want to map the Volume Shader.
- **4** Open the Volume Shader's Attribute Editor and map a texture, such as cloud, to the Out Color attribute. The following shows the rendered result.



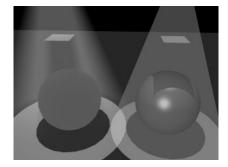
Change the Cloud texture's attributes to change the fog effects if necessary.

5 | Atmosphere

What went wrong? > Troubleshoot:Environment Fog problems



In the next example, the sphere on the left appears flat (twodimensional) because it is shaded by a Surface Shader. Notice the absence of shadow on this sphere compared to the one on the right. The light fog on the right appears flat because it is shaded by a Volume Shader. Notice the absence of volume shadows compared to the light fog on the left.



Fog, smoke, and dust

Image by Kelvin Sung

What went wrong?

Troubleshoot:Environment Fog problems

You may notice the following problems in environment fog in a rendered image.

Transparent surfaces look incorrect



Set Ambient Shade to 0 for the environment fog light.

5 | Atmosphere

What went wrong? > Jagged surface edges in environment fog

Jagged surface edges in environment fog



Do one of the following:

- Turn on Shading Samples Override for the environment fog shape. Increase Shading Samples and Max Shading Samples (to the *lowest* value that produces acceptable results).
- Increase Edge Anti-aliasing in Render Global Settings window (to the *lowest* setting that produces acceptable results).

Outlines around 2D motion blurred surfaces



Do one of the following:

- Remove any transparent objects, fog, and/or glow, and set the background color to black. Render the scene, then composite the elements you removed with the rendered image using compositing software.
- In the Render Global Settings window, set Smooth Value to 0 and turn on Smooth Color.

Grainy or flickering environment fog

Do one of the following:

- Turn on Shading Samples Override for the environment fog shape, and increase Shading Samples and Max Shading Samples (to the lowest value that produces acceptable results).
- Turn on Volume Samples Override for the environment fog shape, and increase Volume Samples (to the *lowest* value that produces acceptable results).

Reference Menus

Create

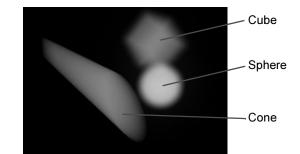
Create > Volume primitives

You can use Volume Primitives in conjunction with lights and Volume Fog to produce foggy atmospheric volume effects. For information on Volume Fog, see "Volume Fog" on page 154.

Tip When rendering shadow maps with volumes (with mental ray), increase the volume samples settings on the volume shape. Also try turning on depth jittering and tuning up mental ray shadow map settings, such as Softness and Samples, on light sources.

s

5 | Atmosphere Reference > Menus





Sphere, Color applied

Cube Dropoff Shape



Fractal mapped to Cube's Incandescence



Sphere Dropoff Shape



Scale Opacity decreased

Volume Noise mapped to Cone's Transparency



Dropoff Shape Off Sphere Shape Off

Off Core Sh



Cone Shape Off

Shading 297

5 | Atmosphere

Reference > Menus

Shading 298

About Baking illumination and color

In a typical scene, you shade, texture, and light objects to create the look you want, then you render. You can instead pre-render materials, textures and illumination in a process called baking (by render experts) or prelighting (by modeling experts).

Baking effectively freezes the illumination (and shadow and surface color, if wanted) of baked objects into an image file (if you bake to textures) or data (if you bake to vertices) that you can later apply to objects.

After you bake objects and apply the prerendered illumination to objects, you can simplify the scene by removing lights, materials, and textures (shading networks). Instead of computing illumination at render time, the renderer instead obtains it quickly from the applied file image or data that is produced (depending on what you bake to -- textures or vertices).

When to bake objects

- To accelerate time- and processor-intensive renders, particularly for complex shading networks or if mental ray for Maya's global illumination features are involved.
- To optimize renders for use on simpler display devices (such as a console game rendering engine).
- To achieve lighting effects that would otherwise be difficult to achieve in other ways.
- Export to a platform that does not support certain shading effects. For example, some graphic APIs only support a limited number of lights, and many platforms have a limited amount of texture memory available. If you bake the effects of the lights and textures onto the geometry, the lights and textures can then be removed from the scene.

Note In Maya, baking is called Convert to File texture. See "Convert a texture or shading network to a File Texture" on page 83.

Related topics

✤ "Bake-sets" on page 301.

Baking to textures and vertices

You can bake to textures and vertices in mental ray for Maya.

About > Baking to textures

Note Selecting a surface (A) and baking it, then selecting another surface (B) and baking it is not the same as selecting two surfaces (A and B) and baking them together.

This is more noticeable with global illumination, where objects bounce and absorb the light of other objects in a scene. Once an object is baked it's assigned a surface shader and it no longer reflects light within the scene.

Baking to textures

When you bake to textures (as opposed to vertices) an image file called a light map is created. You can use this light map, which contains the material(s), texture(s), and illumination of the baked objects, as a file texture to apply to the object.

Find this light map image file (by default) here: Maya\projects\mentalray\lightMap

Baking to vertices

When you bake to vertices (as opposed to a texture) data is created and automatically stored in the polygon mesh's vertex colors.

A sample can either be stored as color-per-vertex, or used to displace the position of a vertex.

- If stored as a color-per-vertex-per-face color, RGB color and alpha (transparency) is stored.
- For displacement, the X,Y,Z coordinates of the vertex position changes. Since a sample contains four channels (RGBA), the displacement uses the luminance value of the color.

You can export this data as a texture map.

Baking with global illumination

For limitations of baking with global illumination, see "Troubleshoot:Global illumination baking limitations" on page 306.

Final Gather

To bake scenes with Final Gather turned on, decrease the Max Radius setting to at least 1/10th of the size of the object being baked. This ensures a smooth lightmap (although you may need to adjust to even smaller values).

About > Bake-sets

In regular rendering, Final Gather precomputes Final Gather points based on the current view of the camera to achieve good quality for the particular view you are rendering.

This precomputation step does not happen during baking. Instead, the Final Gather points are determined by the Final Gather Accuracy settings and the Min Radius and Max Radius settings in the Final Gather section of the mental ray Render Global Settings window. These accuracy settings are by default set to 0, which means mental ray for Maya automatically determines the correct values using the scene size. This is critical for scenes that contain a surrounding sphere to model an environment, typical for rendering with Final Gather.

This forces much more Final Gather points to be calculated during rendering, therefore raising the quality, but results in longer baking and rendering times.

Bake-sets

Though you can perform a simple bake without bothering with them, bake-sets are convenient way for those who require more flexibility to perform complex baking options (such as game developers).

A bake set is a type of set in Maya. Bake sets define parameters for a collection of polygon or NURBS objects. A Maya scene can use multiple bakesets to vary the result of baking. There are two types of bake sets in Maya. Vertex bake-sets (see "Vertex Bake Set" on page 306) contain polygon objects, and Texture bake-sets (see "Texture Bake Set" on page 306) can contain NURBS or polygon objects. The type of bakeset used determines the available parameters.

Bake-sets let you:

• Easily apply different settings to different objects and bake them all at once.

For instance, you can texture-bake objects with different UV ranges or output resolution, or vertex-bake objects with different color blending or clamping.

- Group objects to be baked with the same settings, then bake the groups all at the same time.
- Override any number of bake settings and save the overrides as a preset with a meaningful name. This lets you compare and contrast settings, re-baking as needed, without having to manually change individual settings.

How do I? > Assigning objects to bake-sets

Assigning objects to bake-sets

By default, any object in your scene is automatically assigned to the initial vertex bake-set or the initial texture bake-set (depending on what you choose to bake to) as soon as you bake the object. The initial bake-set lets you bake objects with the same settings easily without having to set up additional bake-sets.

If you want to bake objects with different settings, create bake-sets and assign objects to them. An assigned object is baked according to the attributes of the bake-set to which it is assigned, whether it is the default initial bake-set, a texture bake-set, or a vertex bake-set.

How do I? Render textures and vertices

Bake textures and vertices with mental ray for Maya

Create lightmaps by baking textures and vertices

Note When baking light maps using mental ray some of the built-in texture filtering features in Maya can be of great help. For example, when a texture bake operation has been performed, go to the File Texture node in the shader network (by default connected to the outColor channel of the assigned SurfaceShader) and under the Effects tab in the Attribute Editor adjust interactively using the Filter and Filter Offset controls (the Filter Offset control is very sensitive and is effective with values in the 0.05 range) to get the required smoothness. This may then be converted to an unfiltered texture by using the ConvertToFileTexture procedure.

Note Typically, you don't change the attributes of the initial bake-set, but if you need to modify one or two of the default settings, see "Adjust bake-set attributes" on page 304.

How do I? > Bake vertices

Bake vertices

To bake vertices with mental ray for Maya

- **1** Select the objects for which you want to bake vertices.
- **2** Do either of the following:
 - In the Rendering menu set, click Lighting/Shading > Batch Bake

 I
 - In the Modeling menu set, click Edit Polygons > Color > Polygon Prelight (mental ray) > □
- **3** Adjust any attributes, then click Convert and Close or Convert.

For a description of the options, see "Lighting/shading > Batch Bake (mental ray) > \Box " on page 307.

Bake textures

To bake a texture

- **1** Select one or more objects you want to bake.
- 2 Click Lighting/Shading > Batch Bake (mental ray) > □
- **3** Set any options, then click Convert or Convert and Close.

For a description of the options, see "Lighting/shading > Batch Bake (mental ray) > \Box " on page 307.

Create a bake-set

You can create your own bake-sets to be able to bake objects in different ways. To create a bake-set, you must have an object in your scene that you want to assign to the bake-set.

To create a bake-set

- **1** Selected one or more objects for which you want to create a bake-set.
- **2** Use *one* of the following methods to assign the bake-set:
 - Click Light/Shading > Assign New Bake-Set > Texture Bake-set (to create a Texture bake-set) *or* Vertex Bake-Set (to create a Vertex bake-set).
 - Right click the object, then select Baking > Assign New Bake-Set > Texture Bake-set *or* Vertex Bake-Set.
 - Use the MEL command:

createNode [textureBakeSet|vertexBakeSet]

How do I? > Adjust bake-set attributes

The new bake-set's attributes appear in the Attribute Editor (unless the Attribute Editor has been hidden).

3 Adjust the bake-set's attributes, see "Adjust bake-set attributes" on page 304.

Adjust bake-set attributes

To adjust the attributes of a bake-set

- **1** Do one of the following:
 - If the bake-set's attributes are shown in the Attribute Editor, proceed to the next step. (If you can't see the Attribute Editor, make sure it is not hidden.)
 - If the bake-set's attributes are not shown in the Attribute Editor, right-click the object, the select Baking Attributes.
 - To select a bake-set without selecting an object, you can select it from the tab that contains bake-sets in the Hypershade. If you do not see a tab that contains bake-sets, you must create one. See "Create a Bake-set tab in Hypershade" on page 305.
- **2** Adjust the attributes.

For a description of the attributes, see "Texture Bake set" on page 308 or "Vertex Bake set" on page 310

Assign objects to existing bake-sets

After you create a bake-set, you can assign any additional objects you create to that bake-set.

To assign objects to existing bake-sets

- Assign each object, instance, or group to be baked to a bake-set, using one of the following methods:
 - The Maya Relationship Editor
 - Lighting/Shading menu > Assign Existing Bake-Set > then choose from the list of existing bake-sets.
 - Right-click the bake-set node in the Hypershade, then click Assign Selection to Bake Set.
 - Right-click the object, then select Baking > Assign Existing Bake-Set > then select the Bake-Set.
 - Use the MEL command. For example,

sets -add myBakeSet nurbsSphere2;

What went wrong? > Create a Bake-set tab in Hypershade

To change the attributes of the initial bake-set

- **1** Select any object in your scene.
 - The object's attributes appear in the Attribute Editor.
- **2** Select the initial bake-set tab.
- **3** Set any of the attributes.

To change the attributes of the initial texture bake-set, see "Texture bake-set attributes" on page 308.

To change the attributes of the initial vertex bake-set, see "Vertex bake-set attributes" on page 310.

Create a Bake-set tab in Hypershade

You can create bake-set tab in the Hypershade to be able to view and select bake-sets.

To create a Bake-set tab

- **1** In the Hypershade, click Tab > Create New Tab.
- 2 In the Create New Tab window, type in the New Tab Name field a name, such as Bake-sets.
- **3** In the Show Nodes Which Are field, select Bake Sets.
- 4 Click Create.

What went wrong?

Troubleshoot:Global illumination baking limitations

The following limitations apply when baking global illumination:

- motion blur may not appear in light maps
- volumes and fog are not recognized in light maps
- the alpha channel is always rendered into file textures

Reference > Menus

Reference Menus

Rendering menu set

Lighting/shading

Lighting/shading > Assign New Bake Set

Creates a new bake-set and assigns selected objects to it.

Items

Texture Bake Set

Creates a new texture bake-set and assigns selected objects to it so that you can creates light maps with mental ray for Maya.

For more information, see "Bake-sets" on page 301.

Vertex Bake Set

Creates a new vertex bake-set and assigns selected objects to it so that you can create light maps with mental ray for Maya.

For more information, see "Bake-sets" on page 301.

Lighting/shading > Assign Existing Bake Set

Assigns selected objects to existing bake-sets.

For more information on bake-sets, see "Bake-sets" on page 301.

Lighting/shading > Batch Bake (mental ray)

Bakes selected objects with their respective bake-set settings.

For more information on bake-sets, see "Bake-sets" on page 301.

Lighting/shading > Batch Bake (mental ray) >

Objects to Bake

Select from this list to bake all objects, or only selected objects.

Skip objects in initialBakeSets

If you select Select All from the Objects to Bake option, then all objects that are not assigned to the initial bake-sets are baked.

For information about initial bake-sets, see "Assigning objects to bake-sets" on page 302.

Reference > Nodes

Bake To

Bake either textures or vertices. The default is Texture when you access this window through the Lighting/Shading menu. If you select vertices, vertices are baked in the same manner as "Bake vertices" on page 303.

Color Mode

Lets you bake only incoming illumination, incoming global illumination, or a fully lit and shaded (that is, with surface color) object(s). This is the converse of Maya's Bake Shading Group Lighting option, which allows you to bake only surface color vs. surface color with illumination.

Bake Shadows

Turn this checkbox on to bake shadows.

Orthogonal Reflection

This option is off by default, which is useful if you are baking in order to accelerate software rendering and the reflections are only viewed from the baked position. However, the textures or vertex colors it generates are not for use as textures in a game engine. When turned on, the Orthogonal Reflection option causes all reflection rays to be orthogonal to the surface being baked. They are no longer true reflection rays, pointing instead parallel to the surface normal vectors, but the resulting baked texture or vertex colors are meaningful when viewed later from any direction.

Use Face Normals

mental ray for Maya lets the user specify the use of face normals for baking instead of interpolated vertex normals, as usually used for rendering.

Normal Direction

Determines in which direction the normals of the object to be baked should be pointing.

Nodes

Bake-set nodes

Texture Bake set

For more information on bake-sets, see "Bake-sets" on page 301.

Reference > Texture bake-set attributes

Texture bake-set attributes

Filename Prefix

Any bitmaps generated by this bake-set are prefixed with what is typed in this box. When Bake to One Map is checked, what you type in this box becomes the filename.

x resolution, y resolution

The horizontal and vertical resolution of the image file, measured in pixels. The slider range is 1 to 512. The default value is 256.

File format

Lets you choose a format in which to save the file texture. The default is IFF.

Bits per channel

Specifies the number of bits per channel to use in the output bitmap.

Bake to One Map

Any objects assigned to this bake set is baked to the map. (Make sure the object's UVs are not overlapped.)

Bake Alpha

Turn this on to bake the alpha channel (equivalent to Maya's Bake Transparency option) and then select an Alpha Mode.

Alpha mode

When Bake Alpha is turned on, the Alpha Mode specifies how it's computed. Select one of the options, which include Pass Through (alpha as output from shading network) Surface Transparency, Luminance of Surface Color, and Coverage.

Not e

The Pass Through option is mainly for custom shader usage within Maya. The returned baked color alpha component is retained and is not further affected by Maya's matte channel. Custom shaders usually set the fourth component of a mental ray color to provide the alpha channel.

UV range

Specifies the amount of the surface to sample in UV space. For example, if you select one or more faces on a polygonal object, instead of sampling the whole surface, only the selected faces are sampled.

Reference > Vertex Bake set

U min, U max

Slider values specify how much to stretch the sampling range of U or V components. Maya stretches the sample region to fit the output image size within the [0,0] to [1,1] sampling range.

V min, V max

Minimum V and maximum V for baking.

Fill texture seams

If the selected UV space contains boundaries, these boundaries may appear as black stripes in renderings that use the baked textures. This occurs when the texture is sampled so close to a boundary that the filter picks up values (generally black) from outside the desired space.

This setting artificially extends the boundaries by a small amount to alleviate this problem. It is measured in texels (pixels of texture). Typically, the filter is only a few texels in diameter and can only reach as far as its radius into these boundary spaces, so a value of 1 or 2 is usually enough.

Fill scale

This option carries out a boundary detection in the UV space to be baked. If UVs are normalized to the unit square and the mesh is finely tessellated, accuracy problems (such as zero-size triangles) can occur. Temporary up-scaling the UVs helps in this case.

Override mesh UV set assignments

Activate this option to bake meshes as if they were in the specified UV set instead of the UV sets to which they are currently associated.

UV set name

The UV set to use for the meshes in this textureBakeSet.

Vertex Bake set

For more information on bake-sets, see "Bake-sets" on page 301.

Vertex bake-set attributes

Bake Alpha

Turn this on to bake the alpha channel (equivalent to Maya's Bake Transparency option) and then select an Alpha Mode.

Scale Rgba

Scale vertex colors by the specified value.

Reference > Vertex Color Filtering

Clamp Min, Clamp Max

Turn on these options to clamp the minimum and maximum RGBA values so that the values are forced to be within the range you set.

Min Color

The lower limit to which to clamp vertex color.

Max Color

The upper limit to which to clamp vertex colors.

Vertex Color Filtering

Filter Size

If final gathering is baked to vertices and the scene contains high frequency information, discontinuities in the color channel may become visible. This artifact becomes especially apparent if low final gather quality settings are used. Filtering baked vertex colors yields the desired smooth look.

Provide a small positive filter size as argument to this parameter (it is multiplied by the object's bounding box size to obtain the absolute size). Set the Filter Size value to -1 to turn filtering off. Set the value to 0 or larger to turn it on.

Start with values in the 0.1 range as this value is multiplied by the object's bounding box size to obtain the absolute size. This process also allows smaller values to be used for the FinalGatherRays attribute in the Render Globals Settings Window for faster performance although accuracy of results may need to be taken into account.

Lower final gather quality settings require larger filter sizes to get a smooth look and renders are less accurate. In general, the final gather quality should be raised as long as rendering times are acceptable; then the filter size should be increased until the desired smooth look is obtained. A tiny filter size may suffice; it enforces that baked colors are shared at vertices which have identical positions and normals.

Filter Normal Tolerance

The filter normal tolerance in degrees (0 to 180).

This lets you adjust the angular tolerance for smoothing value across faces.

Vertices whose angular separation is greater than the entered value are not taken into consideration for filtering so that crisp transitions are maintained across hard edges, and undesired color bleed doesn't occur.

Reference > Vertex Color Filtering

After adjusting this option, repeat the prelight operation to test. When a fairly smooth result is obtained, use the Filter Size to adjust further.

Color Blending

Merges existing vertex colors with the ones just baked, if any. The Don't Overwrite option means that no color data is written onto the mesh. If the mesh already has color data, those values remain untouched. If the mesh has no color, it remains colorless.

Alpha Blending

Merges existing vertex alphas with the ones just baked, if any. The Don't Overwrite option means that no color data is written onto the mesh. If the mesh has color data already, those values remain untouched. If the mesh has no color, it remains colorless.

Reference > Vertex Color Filtering

Shading 312

About Render node utilities

7

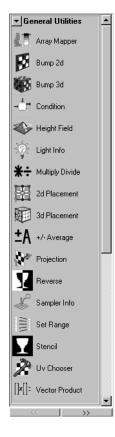
Render node utilities

Maya provides various render node utilities that let you expand the functionality of or obtain information about the way in which some rendering nodes are used.

General utilities

Maya's General utilities are used to add detail and create interesting effects for textures.

For a description of each of the general utilities and what you can use them for, see "General utilities" on page 339.



Shading 313

About > Color utilities

Color utilities

You can expand, enhance, or manipulate colors in applied textures using the Color utilities. For example, you can blend colors, adjust contrast, and convert HSV to RGB.

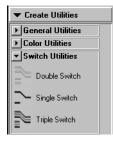
For information on color utilities, see "Color utilities" on page 363.

Switch utilities

Switch utilities let you apply textures, or parts of textures to different patches that make up one object.

Several objects can share shading characteristics and you can define unique characteristics on an object-by-object basis using Maya's Switch utilities.

For a description of each of the switch utilities and what you can use them for, see "Switch Utilities" on page 366.



Note For StudioPaint users

It is common to use Switch utilities when textures have been imported from StudioPaint since each surface has an individual texture assigned to it, but surfaces are in the same shading group.

Particle utilities

For information, see "Particles" on page 15 in the Dynamics guide.

Image planes

Image planes are attached to cameras. For information on image planes, see "Create, edit, or position an image plane" on page 265.

How do I? > Glow

Glow

For information on the Optical FX Glow utility, see "Optical FX Attributes" on page 120 in the Lighting guide.

How do I? Use render node utilities

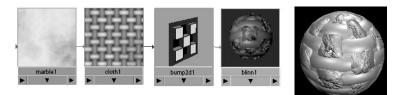
Use General utilities

Use the Bump 2d utility

For a description of the Bump 2D utility, see "Bump 2d" on page 340

To bump map layered textures using Provide3d Info

- **1** Map a 2D texture to a material's Bump Mapping attribute.
- **2** Map a 3D texture to one of the 2D texture's Color attributes (such as V Color).
- **3** Double-click the bump2d swatch in the Hypershade to open the bump2d's Attribute Editor and turn Provide3d Info on. Maya bump maps both textures.

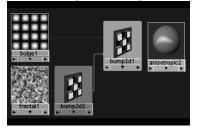


To cascade, or stack, bump maps

- 1 In the Hypershade, create two 2D textures and a material.
- **2** Create a Bump2d utility node.
- **3** Middle-drag the first 2D texture swatch over the Bump2d utility swatch.
- **4** Create another Bump2d node and middle-drag the second 2D texture swatch over the new Bump2d utility swatch.

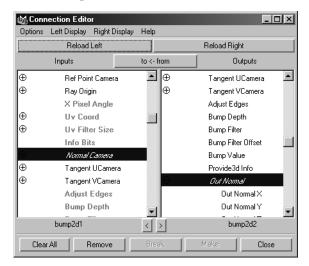
How do I? > Use the Bump 2d utility

5 Middle-drag this Bump2d swatch over the first Bump2d swatch.

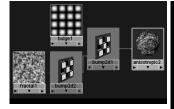


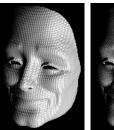
The Connection Editor appears.

- 6 From the Right Display menu, select Show Hidden.
- **7** From the Left Display menu, select Show Hidden.
- **8** Select Out Normal from the Outputs column and the Normal Camera from the Inputs column.



9 In Hypershade, middle-drag the first Bump2d utility swatch over the material swatch to assign both bump maps to a material's attribute.





Bulge

bump map.





Bulge + Fractal bump maps.

Shading 316 Tip If you bump-map a material that uses environment maps, connect the Out Normal attribute of the bump node to the Normal Camera attribute of the Environment texture, as well as to the Normal Camera attribute of the material. Otherwise, the environment does not reflect correctly in bumpy areas.

Maya provides a MEL script that does this for you. After you connect the Out Color of the environment map to the Reflected Color of the material, type cnctBumpProjNormal *shader-name* in the command line (where *shader-name* is the name of the material).

To delete a bump2d map

- **1** Open the material's Attribute Editor.
- **2** Place the cursor over the word Bump Mapping and right-click.
- **3** Select Break Connection from the pop-up menu.

Use the Bump 3d utility

For a description of the Bump 3D utility, see "Bump 3d" on page 341.

To delete a bump3d map

- **1** Open the material's Attribute Editor.
- **2** Place the cursor over the word Bump Mapping and right-click.
- **3** Select Break Connection from the pop-up menu.

Use the Clear Coat utility

For a description of the Clear Coat utility, see "Clear Coat" on page 342

To create a clearcoat node

- 1 First load Clearcoat using the Plug-in Manager (Window > Settings/ Preferences > Plug-in Manager).
- **2** Open the Hypershade (Window > Rendering Editors > Hypershade).
- **3** In Hypershade Create Bar, select Create Utilities from the pop-up menu, then select the Clearcoat plug-in from the General Utilities tab. (Close then re-open the Hypershade or the Create Render Node window, if open, to see the plug-in.
- **4** Middle drag-and-drop the Clearcoat swatch to create new clearcoat nodes.

How do I? > Use the Condition utility

Use the Condition utility

For more information about the Condition utility, see "Condition" on page 343.

To map the Condition utility to four textures (example)

• Create a material, assign it to an object, then map the Condition utility to the material's Color attribute. Adjust the material's attributes if necessary.

In the Condition's Attribute Editor, set the following:

- Map a texture to First Term. This texture represents the Second Term's texture coverage.
- Map a texture to Second Term. This texture represents the pattern of the coverage.
- Map a texture to Color If True. This texture represents the surface color.
- Map a texture to Color If False. This texture represents the color of the overlying texture.

Tip Set the Operation option to Greater Than or Less Than to see the combined results.

- Change the attributes for each texture and use the texture placement object to adjust the texture on the object if necessary.
- Use the Operation drop-down menu items to see the transition between textures.

Use the Height Field utility

For a description of the Height Field utility, see "Height Field" on page 345

To use the Height Field utility

 Create the Height Field utility node (from the Hypershade select Create > General Utilities > Height Field).

A plane is created. Scale it if desired.

- **2** Create a texture and map it to the Height Field utility node's displacement.
- **3** Adjust the displacement of the plane by adjusting the texture's Alpha Gain value.

How do I? > Use the Light Info utility

To improve the appearance of the shading press 6. You can also set the resolution that the Height Field utility uses. It can only display Surface textures or the Ocean Shader.

Use the Light Info utility

For a description of the Light Info utility, see "Light Info" on page 346.

To view and connect Light Data attributes to Light Info attributes

- **1** Once you have created lights in the scene, select Lights from the Hypershade menu bar to view the LightShape swatches in Hypershade.
- **2** Select Light Info from the Create > General Utilities menu.
- **3** Ctrl+middle+drag the LightShape swatch over the Light Info swatch. The Connection Editor appears.
- **4** In the light's column, make sure Show Readable is on in the Filter menu. In the Light Info column, make sure Show Inputs only is on.
- **5** Click to connect the LightShape's World Matrix [0] attribute to the World Matrix attribute of the Light Info node.

Notice the light tab added to the top of the Light Info's Attribute Editor. Click this tab to access the light's information and adjust these values to translate and change the light in X, Y, and Z.

You can also select any one of the Light Data attributes from the Connection Editor. Light Data attributes include the light direction, light intensity, light ambient, light diffuse, light specular, and light shadow fraction.

6 Select the attribute you want to connect from the list.

Use this information as the input to other shading nodes to produce interesting effects. For example, if you connect the Sample Distance attribute to one of the color attributes of a material, the color changes depending on how far it is from the light.

Note You can attach the World Matrix of any object (not just a light) to this node, to get information about the object's position relative to the point being shaded.

Use the Multiply Divide utility

For a description of the Multiply Divide utility, see "Multiply Divide" on page 348.

How do I? > Use the Plus Minus Average utility

To multiply and divide input attributes

- **1** In a material's Attribute Editor, map the Multiply Divide utility to the Color attribute.
- **2** In the Multiply Divide Attribute Editor, map textures to the input attributes. Click the boxes next to Input 1 and Input 2 to and select textures from the Create Render Node window.
- **3** Click the Input 1 and 2 boxes to access the Attribute Editors for the mapped textures and change the attribute settings if necessary.
- Tip To return the focus to the Multiply Divide Attribute Editor, either click the Focus button in the texture's Attribute Editor until you access it, or click the Multiply Divide swatch in the Hypershade panel.

Use the Plus Minus Average utility

For a description of the Plus Minus Average utility, see "Plus Minus Average" on page 350.

You can make several connections to the same attribute using Plus Minus Average based on a number. The last part of the attribute name has a number within square brackets.

Input3D[0] designates the first connection to the Input3D attribute, Input3D[1] designates the second connection to this attribute, Input3D[2] designates the third connection to this attribute, and so on. The first connection is always assigned a 0. Each connection gets its own ID number. For example, the OutColor of Stucco consists of one group of three values that you can connect to the Input3D values, not the Input 2D values or Input1D values.

Use the Projection utility

For a description of the Projection utility, see "Projection" on page 352.

To map a Projection utility node to a texture

1 Create a Projection utility node.

Tip You can re-arrange connections to a higher or a lower number without interfering with the other connections in the list, and you can break connections as you would any connection.

How do I? > Use the Stencil utility

- **2** In the Projection node's Attribute Editor, map a texture to the Image attribute.
- **3** Adjust the texture attributes if necessary, then create a material.
- **4** Middle-drag the Projection swatch over the material swatch and select an attribute from the pop-up menu, such as Color.

You can now use the Projection Attributes (next) to adjust the texture placement on the surface.

Use the Stencil utility

For a description of the Stencil utility, see "Stencil" on page 357.

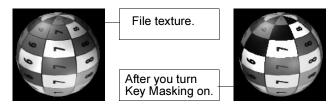
To map a Stencil to an object

- **1** In a material's Attribute Editor, map the Stencil utility to the Color attribute.
- **2** In the Stencil's Attribute Editor, map a 2D texture to the Image attribute.
- **3** Assign the material to the object and adjust the Stencil's attributes as necessary.

Tip IPR-render to view the result as you adjust attributes.

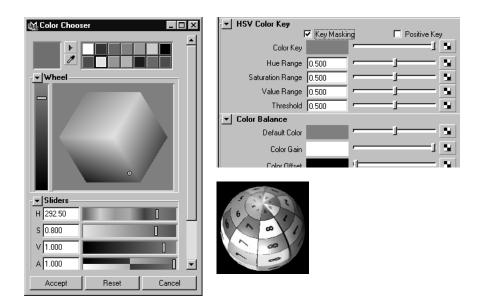
To use the Key Masking attribute

1 Turn Key Masking on. Since the Color Key attribute's default color is black as well as the Stencil's Default Color, Maya masks out only the areas containing the most black.



2 Change the Color Key color in the Color Chooser. In the following, Maya masks out any color containing red or pink and replaces it with the Stencil's Color Balance Default Color.

How do I? > Use the Reverse utility



Use the Reverse utility

For a description of the Reverse utility, see "Reverse" on page 359.

In the following, the color of a Marble texture is reversed. This means that 0.9 is subtracted from 1, making the color value 0.1. The result can be expressed as in the following formula:

Output = 1 - Input

You can enter values for Input to get the effect you want in the Attribute Editor. Reverse outputs and accepts single-component values, two-component values, and all three-component values.

To reverse attributes

- **1** Map a texture to a material's attribute, such as Color.
- **2** In the texture's Attribute Editor, map Reverse to the attribute you want to reverse.

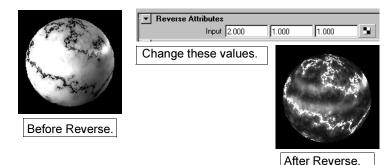
 Marble Attributes 		
Filler Color] •Ð	
Vein Color	<u>ا</u> ا	
Vein Width 0.100		
Diffusion 0.500	•	reverse1
Contrast 0.500	•	
Contrast 10,000		





anisotronic 1

3 Following the above example, in the Marble texture's Attribute Editor, click the box next to Filler Color to open the Reverse Attribute Editor and change the Input attribute values as necessary. The following shows the results.



Use the Sampler Info utility

For a description of the Sampler Info utility, see "Sampler Info" on page 359.

To use the Sampler Info utility

Once you have created and assigned a material and texture to an object, create a Sampler Info utility node.

- Middle-drag the Sampler Info swatch over the texture swatch. The Connection Editor appears.
- **2** Connect a Sampler Info node to any available texture attribute.
- **3** In the Sampler Info Attribute Editor, change the values for the connections to get the desired results.

In this first example, the SamplerInfo's Facing Ratio attribute is connected to the Marble texture's Vein Width.

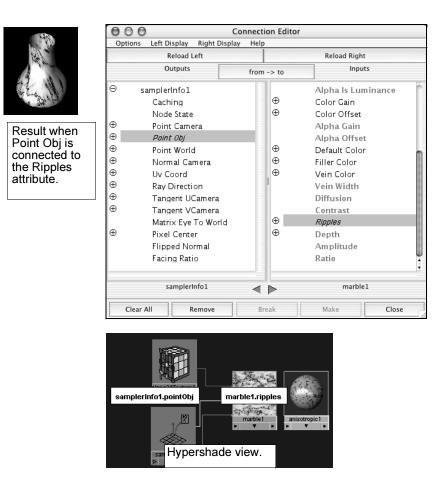
How do I? > Use the Sampler Info utility



In this next example, the SamplerInfo's Point Obj attribute is connected to the Marble texture's Ripple attribute.

Shading 324

7 | Render node utilities How do I? > Use the Set Range utility



Use the Set Range utility

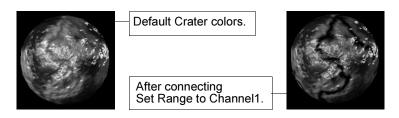
For a description of the Set Range utility, see "Set Range" on page 361.

To set the range using the Set Range utility

1 In a texture's Attribute Editor, map the Set Range utility to an attribute.

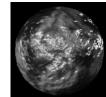
The texture attribute changes as soon as you map it to the Set Range utility.

How do I? > Use the Vector Product utility



2 Click the box you mapped the attribute to. The Set Range Attribute Editor appears. Adjust the values as necessary.

Set Range Attributes					
Value	0.000	1.500	1.000		
Min	0.200	1.000	0.200		
Мах	1.000	1.000	1.000		
Old Min	0.400	0.100	0.000		
Old Max	0.400	0.100	0.000		



Set Range Attributes

Value

Maya maps this value from the old range (Old Min to Old Max) into the new range (Min to Max).

Min/Max

The minimum and maximum value in the new range.

Old Min, Old Max

The minimum and maximum value in old range.

Use the Vector Product utility

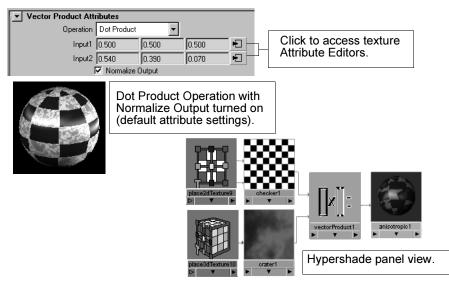
For a description of the Vector Product utility, see "Vector Product" on page 361.

To multiply a vector

- **1** Create a material.
- **2** In the material's Attribute Editor, map Vector Product to an attribute, such as Color.
- **3** In the Vector Product's Attribute Editor, map textures to Input 1 and Input 2.

The following examples show the rendered result when you map Input 1 to a Checker texture and Input 2 to a Crater texture.

How do I? > Use the Blend Colors utility



4 Click the boxes for Input 1 and Input 2 to access the Attribute Editor for the textures and adjust the attributes as necessary.

Use Color Utilities

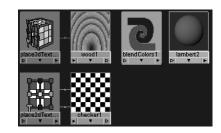
Use the Blend Colors utility

For more information on this utility, see "Blend Colors" on page 363.

To blend colors using the Blend Color utility

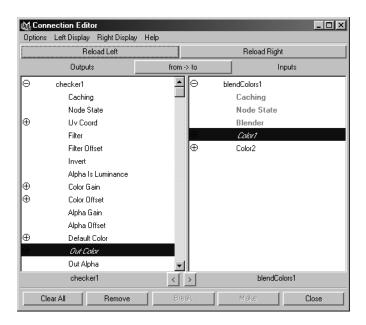
Try the following to get an idea of how this utility works.

1 Create the following—Checker (2D texture), Wood (3D texture), Blend Color (Color Utilities), and a Lambert material.

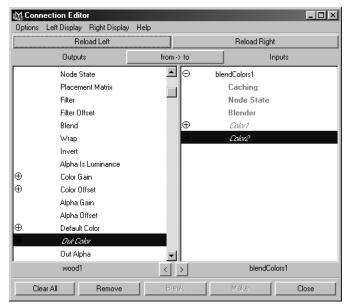


- **2** Ctrl+middle+drag the Checker swatch over the Blend Color swatch. The Connection Editor appears.
- **3** Click to connect the Checker's Out Color to the Blend Color's Color1 node.

How do I? > Use the Blend Colors utility

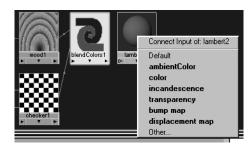


4 Ctrl+middle-drag the Wood texture swatch over the Blend Color swatch, and in the Connection Editor, connect the Wood's Out Color to Blend Color's Color2 node.

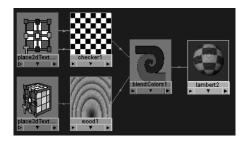


5 Middle-drag the Blend Color swatch over the Lambert material swatch and select color from the pop-up menu.

How do I? > Use the Clamp colors utility



The result is a blend between the wood and checker textures. In the Blend Color's Attribute editor, when you adjust the Blender slider towards 1, more of the checker texture appears and when you adjust the Blender slider towards 0, more of the wood texture appears.



Use the Clamp colors utility

For more information on this utility, see "Clamp" on page 363.

To clamp colors using the Clamp utility

- **1** Map a complex texture, such as Marble, to a material's Color.
- **2** In the texture's Attribute Editor, map the Clamp Color Utility to one of the texture's colors.
- **3** The Clamp utility's Attribute Editor appears.

The Min and Max attribute values determine the amount of Red, Green, or Blue color appears.

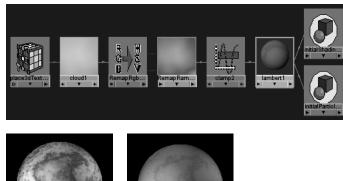
In the following, in the before image the Min and Max values are set from 0.0 to 1.0 for all three color channels (R, G, and B). The after image Min and Max values are:

R Min = 0.4, Max = 0.5

G Min = 0.4, Max = 0.5

B Min = 0.4, Max = 1.0

How do I? > Use the Contrast utility







Before Clamp

After Clamp

Use the Contrast utility

For more information on this utility, see "Contrast" on page 363.

To change the contrast using the Contrast utility

- **1** Map a texture to a material's color.
- **2** Map the colors you want to the Contrast utility.

For example, map the Crease Color of a Leather texture. To do this, click the box next to Crease Color in the Leather texture's Attribute Editor, then select Contrast from the Utilities tab in the Create Render Node window.

3 Change the Contrast attribute settings as necessary.

Use the Gamma Correct utility

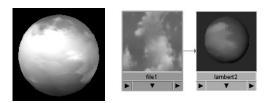
For more information on this utility, see "Gamma Correct" on page 364.

To remap colors using the Gamma Correct utility

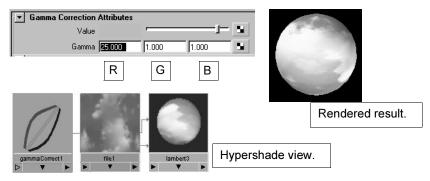
1 Map a texture to a material's Color and assign the material to an object.

In this example, map a File texture to a Lambert material.

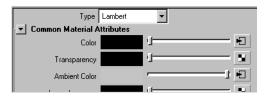
How do I? > Use the Single Switch utility



- 2 Map the Gamma Correct utility to the color you want to adjust, such as the Ambient Color for the Lambert material. To do this, in the Lambert material's Attribute Editor, click the box next to Ambient Color, then select Gamma Correct from the Utilities tab in the Create Render Node window that appears.
- **3** Change the Gamma Correct attribute settings as necessary, as in the following.



After you change the Gamma Correct attributes, the Ambient Color attribute updates in the Lambert material's Attribute Editor.



Use Switch utilities

Use the Single Switch utility

Switches single float attributes, like a Bump Value or Bump Depth.

For more information on this utility, see "Single Switch" on page 366.

How do I? > Use the Single Switch utility

TipYou can IPR Render the scene to see the results. For more
information on IPR rendering, see "Interactive Photorealistic
Rendering (IPR)" on page 67 in the Rendering guide.

To use the Single Switch utility

- **1** Create a material and assign it to all the objects in the scene.
- **2** Map a texture to the material's Bump Mapping attribute. Adjust the texture's attributes and 3D placement if necessary.

Material Sample	Phong Color changed to resemble old brass in	,
Type Phong	Color Chooser.	
Common Material Attributes		
Color		
Transparence Bump Ma Ambient Colo the Gran	apping mapped to ite 3D texture.	(A)
Bump Mapping granite2		
Diffuse 0.800		
Translucence 0.000	1 N	
		Rendered result.

- Tip If Alpha Luminance is on in the Color Balance section of the texture's Attribute Editor, the rendered result is much smoother. Alpha Luminance is on by default.
- **3** In the Bump 3d's Attribute Editor, place the cursor over the Bump Depth attribute, then right-click Create New Texture from the pop-up menu.

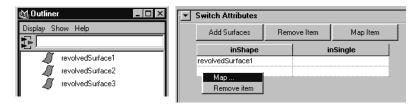


4 Select the Single Shading Switch utility from the Utilities tab in the Create Render Node window.

The Single Shading Switch's Attribute Editor appears.

How do I? > Use the Single Switch utility

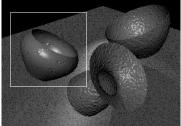
- 5 Open the Outliner (Window > Outliner) and middle-select one of the objects for which you want object-specific bump mapping. Drag it to the inShape column of the Switch Attributes.
- **6** Click the name displayed in the inShape column then click the Map Item button (or right-click over the inSingle column and select Map from the pop-up menu).



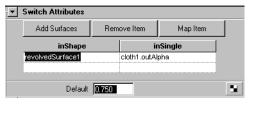
The Create Render Node window appears.

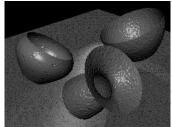
7 Select another texture. The Switch Attributes inSingle column now displays the new texture. Adjust the texture's attributes to get the look you want. Notice in Render View that only one of the object's bump map changes as you adjust the attributes.





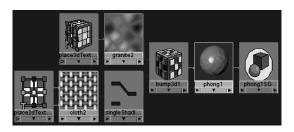
8 Now change the Default attribute in the SingleShading Switch's Attribute Editor. The bump maps on the other objects in the scene adjust according to the value you enter.





The following shows how the connections display in Hypershade:

How do I? > Use the Double Switch utility



Use the Double Switch utility

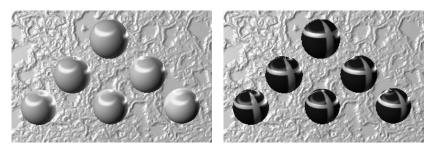
Switches double float attributes on a 2D texture, like Repeat UV or Translate Frame of a 2D texture placement.

For more information on this utility, see "Double Switch" on page 367.

To use the Double Switch utility

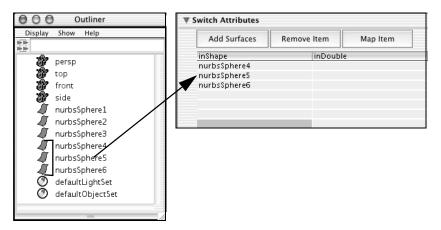
- **1** Create a material and assign it to the objects.
- **2** Map a 2D texture to one of the material's attributes, such as Color. Adjust the texture's attributes if necessary.
- **3** A place2dTexture node is created when you map a 2D texture. Double-click the texture's place2dTexture swatch in Hypershade to open its Attribute Editor.
- **4** Place the cursor over the Repeat UV attribute, and right-click Create New Texture from the pop-up menu.
- 5 Select the Double Shading Switch utility from the Utilities tab in the Create Render Node window. Notice that the spheres seem to have lost their textures.

This is when you can apply a Default setting in the Switch Attributes Editor. You can either map a new texture, or change the values for U and V. In the following the Default value is changed to 1.5 for both U and V.

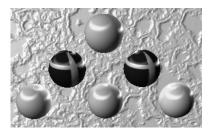


How do I? > Use the Double Switch utility

6 Open the Outliner (Window > Outliner) and use the middle mouse button to select the spheres for which you want to adjust the UV texture placement and drag them to the inShape column of the Switch Attributes.



Notice only the spheres you move into the inShape column lose their textures. These are the spheres you want to change.

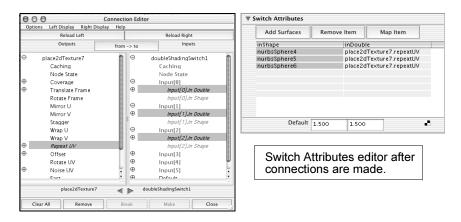


Click to highlight the inShape column then click the "Map Item" button.

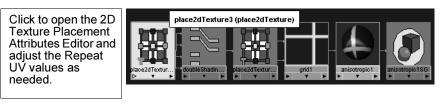
Add Surfaces	Remove Item	Map Item
inShape	inDoubl	e
nurbsSphere4 nurbsSphere5 nurbsSphere6	Edit nurbsSphere4 Map Remove item	

8 Select the Place 2d Texture utility from the Utilities tab in the Create Render Node window. The Connection Editor appears. Click the *Repeat UV* Output node (in the left column), then the Input[0] In Double Input nodes (in the right column).

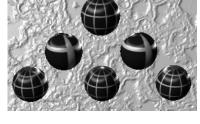
How do I? > Use the Triple Switch utility



Only the spheres you mapped in the Double Shading Switch's Attribute Editor update. Click the place2dTexture swatch in Hypershade to open its Attribute Editor and adjust the Repeat UV values if necessary.



2d Texture Placeme	nt Attribute	5			282	10
	Inte	ractive Plac	ement		1 Sec	29
Coverage	1.000	1.000		· •	8	2
Translate Frame	0.000	0.000		× 1	18	6
Rotate Frame	0.000	—		•	100	
	Mirror U		Mirror V		RA	R
	🗹 Wrap U		🗹 Wrap V		H	t
	🔲 Stagger				10	S
Repeat UV	5.000	5.000		•		



Use the Triple Switch utility

Lets you map different textures to several objects in a scene. You can switch any triple float attribute, such as RGB out colors.

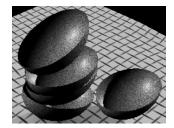
For more information on this utility, see "Triple Switch" on page 368.

In the following, a Rock texture is initially mapped to the objects (simple revolved surfaces that look like bowls) because a grainy texture is required. The other textures you map onto the selected objects retain this grainy texture while displaying their specific texture attributes.

How do I? > Use the Triple Switch utility

To use the Triple Switch utility

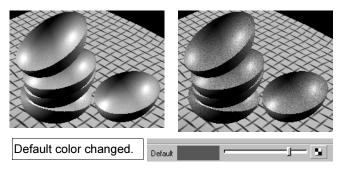
- 1 Create a material and assign it to all the objects in the scene.
- **2** In the material's Attribute Editor, map a texture to the Color attribute.



3 In the texture's Attribute Editor, place the cursor over one of the Color attributes then right-click Create New Texture from the pop-up menu.



4 From the Create Render Node window, select Triple Shading Switch from the Utilities > Switch tab. Notice that the bowls lose their initial color. You can either map another texture to the objects or change the color using the Default attribute in the Switch Attributes Editor.

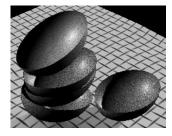


5 Open the Outliner (Window > Outliner), and middle-drag the objects for which you want to display another texture into the inShape column.

How do I? > Use the Triple Switch utility

₩,Outliner	Add Surfaces	Remove Item	Map Item
	inShape revolvedSurface1		nTriple
nurbsPlane1 frevolvedSurface1 revolvedSurface2	revolvedSurface2 revolvedSurface3 revolvedSurface4		
revolvedSurface3			

Only four of the bowls in the following are to be texture mapped. The top bowl retains the Default color setting.

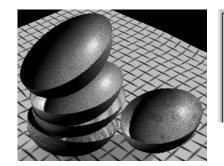


6 To map textures to the other objects, click to highlight the revolved surfaces in the inShape column then select the "Map Item" button.

Add Surfaces		Rem	ove Item	Map Item	
inShape			inTriple		
revolved:	Surface1				
revolve Edit revolv		/edSurfac	:e1		
revolve	Мар				
Remove		em			

7 Select another texture for each object from the Textures tab in the Create Render Node window.

The following shows the four bowls and the textures mapped to them in the Switch Attributes editor.

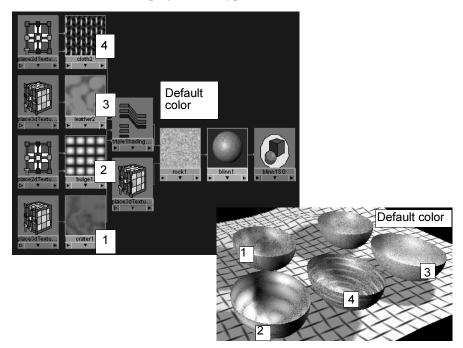


Add Surfaces	Remove Item		Map Item	
inShape		i	nTriple	
revolvedSurface1		crater1.out0	Color	
revolvedSurface2		bulge1.outColor		
revolvedSurface3		leather2.outColor		
revolvedSurface4		cloth2.outCo	blor	
Default			5	

Shading 338

Reference > Nodes

Adjust the textures for each item if necessary. The following gives you a better idea of how the textures are mapped to the bowls and how the connections display in the Hypershade.



Reference Nodes

General utilities

Array Mapper

Maps array attributes to the color attributes of texture nodes. Used by particle objects to invoke color values from the texture node for each particle.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

See "*Particles*" on page 15 in the Dynamics guide for more information about particle mapping.

Reference > Bump 2d

Min Value, Max Value

The minimum and maximum limit on the output attribute outValuePP.

Compute Node

Allows the propagation of any changes to the computeNode's outColor through the arrayMapper and onto the attribute the arrayMapper is driving.

Bump 2d

Converts a 2D texture to bump maps. Middle-drag the 2D texture swatch over the material swatch and select bump map from the pop-up menu. Maya creates the bump2d utility.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

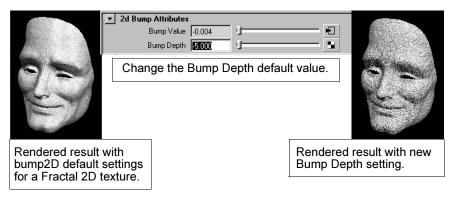
To use the Bump 2D utility, see "Use the Bump 2d utility" on page 315.

Bump Value

The source 2D texture used for the bump map. You can connect the output of any shading network to Bump Value to use as the source of the bumps.

Bump Depth

Controls how high the bumps display on the surface. Increase Bump Depth to make the surface bumpier. Decrease Bump Depth to make the surface smoother.



You can achieve almost identical effects by adjusting the Bump Depth or the Alpha Gain and Alpha Offset of the texture. The Bump Depth is determined by reading the alpha gain value of the texture. Both

Reference > Bump 3d

controls can be useful in complex shading networks where there may be multiple bumps. The alpha gain attribute lets you individually adjust the bump for each texture.

Bump Filter

Affects the filtering level performed on a texture used as a bump map. Maya calculates the amount of filtering based on how much screen space the texture occupies in the final image. The Bump Filter attribute is a multiplier of that value.

Values greater than 1.0 produce more filtering, making the bumps smoother. Increase the value if aliasing occurs (jagged staircase effects) in final renderings, or if the bump map appears to pop or "sizzle" over the course of several frames.

Values less than 1.0 produce less filtering, making the bumps appear sharper. Decrease the value if bumps are too smooth in the final rendered images.

Bump Filter Offset

Affects the amount of filtering performed on a texture.

Unlike the Bump Filter attribute (which is a multiplier), Maya adds Bump Filter Offset to calculated filtering values. This increases the amount of filtering uniformly.

This attribute can be used to lock Maya's filtering values. If you want the Bump Filter Offset value to completely determine the amount of filtering, set the Bump Filter attribute to 0.

Adjust Edges

Artifacts may display on texture boundaries when you map textures with the place2dtexture's Wrap U and Wrap V attributes turned off. Using Adjust Edges removes these artifacts when this happens, but has no effect when you turn the Wrap U and Wrap V attributes on.

Bump 3d

Converts a 3D texture to bump maps. You can also cascade bump maps on top of one another.

To use the Bump 3D utility, see "Use the Bump 3d utility" on page 317.

Bump Value

The source 3D texture used for the bump map. You can connect the output of any shading network to Bump Value to use as the source of the bumps.

Reference > Clear Coat

Bump Depth

Controls how high the bumps appear on the surface. Increase Bump Depth to make the surface bumpier. Decrease Bump Depth to make the surface smoother.

Bump Filter

See "Bump Filter" on page 341.

Bump Filter Offset

See "Bump Filter Offset" on page 341.

Clear Coat

This utility is a plug-in (clearcoat.mll). You can use this node in situations where certain materials, such as car paint, reflect light differently depending on the relationship between the viewing direction and surface orientation.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Clear Coat utility, see "Use the Clear Coat utility" on page 317.

Clearcoat is a separate node. In Maya, complex shading networks can be built with many smaller nodes, but because Clearcoat is its own node, it can be applied to any material (even plug-in materials). You plug the output of the Clearcoat node into the Reflectivity of the material.

You can use IPR to tune Clearcoat attributes. This is especially powerful when you apply the output of the Clearcoat node into the color of a Surface Shader node.

In the following, white shows maximum reflectivity and black shows minimum reflectivity.



When satisfied with the Clearcoat settings, you can plug the output back into the material's Reflectivity attribute and be confident of the result.

The next image was produced using the Clearcoat plugin. Notice how the hood and top of the car are more reflective than the front and sides of the car.

Reference > Condition



lmage by Dua Xiong

As well as the generic Caching and Node State operations, Clearcoat contains the following attributes:

Index

Describes the refraction properties of the material.

Scale

A simple multiplier on the final result.

Bias

Controls the middle point of the contrast adjustment and is added to the final result. Increase Bias to move the middle point upwards (more of the texture becomes dark as contrast increases). Decrease Bias to move the middle point down (more of the texture becomes light as contrast increases).

The computation is:

final result= f(index of refraction) * scale + bias

Where f(index of refraction) is the clearcoat computation with the index of refraction as input.

Condition

Incorporate the Condition utility in shader networks capable of acting one way in one set of circumstances and another way in a different set of circumstances. For example, you can create a double-sided shaded surface (see "Double-sided shaded surfaces" on page 25).

For an example of how to use this utility, see "Use the Condition utility" on page 318.

Condition produces a color value depending on the conditions you set. It requires one logical operator and two choice values, as shown in the following example:

```
If (A operation B)
Outcolor = Color1
else
Outcolor = Color2
```

Reference > Condition

Condition compares the value in A with the value in B to find out whether the value in A is greater, smaller, equal to, less than, less than or equal to, greater than or equal to, or not equal to the value in B.

Since it is a branching function, it does one thing if a logical expression is true and something else if it is false. For example, if the value in A is not equal to the value in B, Color If True is chosen in OutColor. If the value in A is equal to the value in B, and Color If False is chosen in OutColor.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

First Term

Represents the first term of the condition.

Second Term

Represents the second term of the condition.

Operation

Displays a drop-down menu from which you can select an operator. The operators include: Equal, Not Equal, Greater Than, Greater or Equal, Less Than, Less or Equal.

Color If True

The color or texture that is output when the condition is true.

Color If False

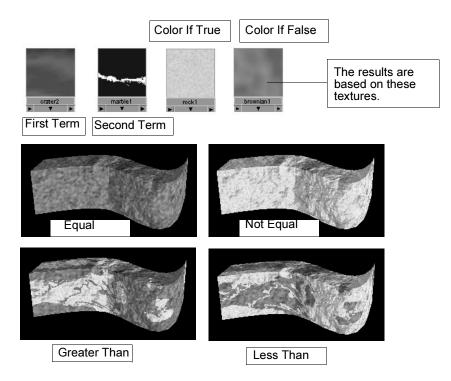
The color or texture that is output when the condition is false.

Out Color

The output attribute with the result obtained. *Available in the Connection Editor only.*

The following shows a few examples.

Reference > Height Field



The Condition utility can be something as simple as comparing the values in the First Term and the Second Term. The result of this comparison makes it possible to change the color or texture of an object.

For example, if the First Term is less than the Second Term, the resulting color of the object (OutColor) is Color If True, and Color If False appears when the First Term is not less than the Second Term.

Tip Because you can also map all the input attributes, you can switch between two textures, for example, connecting them to Color If True and Color If False.

Height Field

This draws a plane that interactively shows the displacement of a Surface texture or an Ocean Shader. It is currently for preview or interactive display purposes only, and does not appear in a render. Use it to preview the displacement effects and then recreate them by mapping the same texture displacement to your target shader.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

Reference > Light Info

To use the Height Field utility, see "Use the Height Field utility" on page 318.

Resolution

The number of samples relative to the largest side of the plane. Higher values result in a more detailed surface, but slower draw time.

Color

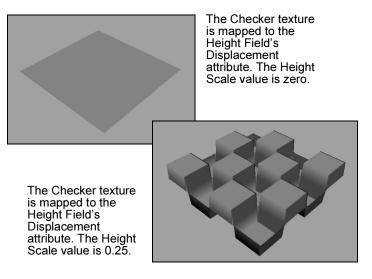
The basic color of the preview surface. This can be mapped with a Surface texture or an Ocean Shader; however, only the outColor value can be used.

Displacement

The displacement of the plane. This may be mapped with a Surface texture or an Ocean Shader; however the outAlpha value is always used. This does an optimized evaluation of the texture that ignores added shading engine inputs.

Height Scale

Scale factor for input displacement. As the value increases, the displacement is more pronounced.



Light Info

Similar to the Sampler Info node, Light info provides light information instead of surface property information. You use the Light Info utility node to obtain information about the position of a light relative to a

Reference > Light Info

texture. As each point on the texture is shaded, the attributes of Light Info can determine the precise distance from the light to the point being shaded.

The Light Info node provides:

- The position of the light in world space
- The direction the light is shining (if it is not a point light)
- The distance from the light to the point being shaded.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58). To use the Light Info utility, see "Use the Light Info utility" on page 319.

Light Position

The position of the connected light in world space. The connected light is the light (or other object) whose World Matrix attribute is connected to the World Matrix attribute of this node.

Light Direction

The direction in which the connected light is shining. Point lights shine in all directions.

Sample Distance

The world-space distance between the connected light and the point on the surface being shaded. This can be calculated in different ways. See Light Direction Only for details.

World Matrix

Connect the output World Matrix attribute of a light or other object to this attribute. This must be done before the output of this node is usable.

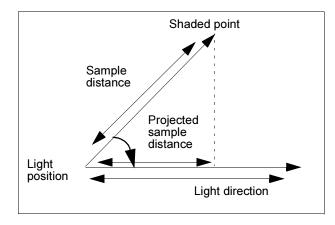
Light Direction Only

Controls how the Sample Distance attribute is calculated. If off, the Sample Distance is the world-space distance from the light to the point being sampled.

If on, the Sample Distance is the distance along the light direction vector to the closest point on that vector to the point being sampled.

In mathematical terms, it returns the length of the projection of the light-to-object vector onto the light-direction vector.

Reference > Multiply Divide



Note The Light Data attributes work with light information in camera space, whereas the Light Direction attribute of the Light Info utility works with light information in world space.

Multiply Divide

Multiplies or divides input attributes. This utility is divided into three parts—two input attributes, an operator you apply to the two input attributes, and an output attribute to hold the result of the operation. The input and output attributes represent X, Y and Z. Use this node to multiply colors or triple-value attributes.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Multiply Divide utility, see "Use the Multiply Divide utility" on page 319.

Operation

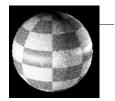
Displays a pop-up menu from which you can select an operator:

No operation

Copies the value of the Input1 attribute to the output attribute without making any changes.

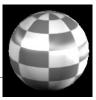
For example, if Input 1 is a Checker texture and Input 2 is a Crater texture, when you select No Operation, only the Checker texture's attributes are rendered.

Reference > Multiply Divide



Inputs 1 and 2 (Checker and Crater)

No Operation means only Input 1's attributes are rendered.



Multiply

Multiplies the Input1 attribute and the Input2 attribute, as in the following formula:

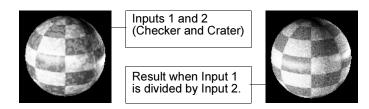
 $Output = Input1 \times Input2$

Divide

Divides the Input1 attribute by the Input2 attribute, as in the following formula:

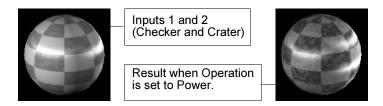
$$Output = \frac{Input1}{Input2}$$

In the following example, the Input 1 texture is divided by the changes made to the Input 2 texture.



Power

Sets the output to equal Input 1 raised to the power of Input 2. See the following example:



It evaluates an expression by raising the value to the power of a number you choose or by calculating the square root. Raising a value to the power means multiplying a number by itself a given number of times as in:

> Shading 349

Reference > Plus Minus Average

$$2^3 = 2 \times 2 \times 2$$

The command for calculating the square of a number is:

power (value, 2.0)

The mathematical formula is:

 $Power = value^2$

The formula for computing the square root is:

$$Power = \sqrt{value}$$

If you want to multiply the value of a component twice, you would set Input1 to represent the color (possibly mapping it with a texture), and then set all the three components of Input2 to 2.0. Because the inputs are both colors, you can work on the color of a singlecomponent value or on all three-component values.

You can also get the square root of a number by setting Input2 to 0.5 as shown in the following:

Output = power (input1, input2)

which, in math terms, would be written like input1^input2.

See also the "Power" operator example.

Input1

The first of two arguments presented to Multiply Divide.

Input2

The second of two arguments presented to Multiply Divide.

Plus Minus Average

Add, subtract, or average values in a list of input attributes. The Plus Minus Average utility has three parts—two or more input attributes, an operator that you apply to these input attributes, and an output attribute that holds the result of the operation.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Plus Minus Average utility, see "Use the Plus Minus Average utility" on page 320.

Reference > Plus Minus Average

Operation

Displays a pop-up menu from which you can select an operator

No operation

Copies the value of the Input1 attribute to the output attribute without making any changes.

Sum

Adds the values in the Input list, as in the following formula:

$$Output = Input1 + Input2 + ... + InputN$$

Subtract

Calculates the difference between one element in the list and another element in the list, as in the following formula:

Output = Input3D[1] - Input3D[2]

For example, if you want to subtract Input3D[1] from Input3D[2] of multi-attribute nodes, make the necessary connections using the right mouse button in the Connection Editor and then select Subtract.

Average

Adds the values in each Input attribute and divides the result by the number of input attributes, as in the following formula:

$$Output = \frac{Input1 + Input2 + \dots + InputN}{N}$$

where N is the number of input attributes.

For example, if there are seven input values in the list, the values for each input in the list ranging from one to seven are added and the result is divided by seven.

Input1D

A list of elements composed of single-value connections. The values in the list can be added, subtracted, or averaged depending on the Operation you select.

Input2D

A list of elements composed of two-value connections. The values in the list can be added, subtracted, or averaged depending on the Operation you select.

Reference > Projection

Input3D

A list of elements composed of three-value connections, such as color. The values in the list can be added, subtracted, or averaged depending on the Operation you select.

Tip Give nodes meaningful names to help you remember their functions. For example, rename the first Multiply Divide node to PowerSquare, the Plus Minus Average node to SumComponents, and the second Multiply Divide node to PowerSquareRoot.

Projection

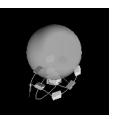
Turns any 2d texture into a 3d texture you can place on the surface using one of the available projection types. Use to adjust the texture placement on the surface.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Projection utility, see "Use the Projection utility" on page 320.

Interactive Placement

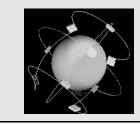
Displays the Projection manipulators in the modeling view.



Spherical "Proj Type"



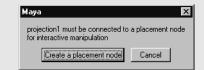
Use "Fit To BBox" to center the manipulator around the object.



Reference > Projection

Using these manipulators in combination with Maya's transform tools, you can orient and position the texture map in three dimensions. The manipulators for texture mapping are exactly the same as those used for texturing polygons. See the "*Polygons*" on *page 13* in the Polygonal Modeling guide for details.

Note If no place3dtexture node exists, Maya displays the following alert box:



Click the Create a placement node button to create the place3dtexture node.

Fit To BBox

The texture map coincides with the bounding box of the mapped object or set. See also "Interactive Placement" on page 352.

Proj Type

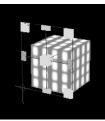
Off

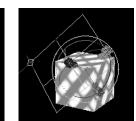
Select a projection type from the drop-down menu to display seven projection manipulators.

Uses no projection type.

Planar

Default Proj Type. Places the texture on a planar surface and projects it onto the object.





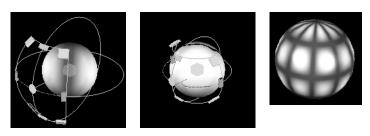


Spherical

Places the texture inside a sphere and projects it onto the object.

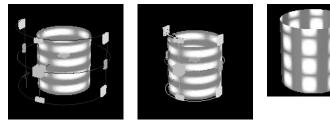
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Reference > Projection



Cylindrical

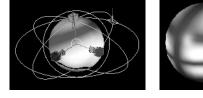
Places the texture inside a cylinder and projects it onto the object.



Ball

Places the texture inside a ball and projects it onto the object. For example, Maya projects the texture as if a candy wrapper is pulled around a lollipop. There is one pinch point to the mapping at the -zpole, as opposed to the two pinch points at the +y and -y poles in spherical and cylindrical mapping.

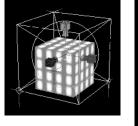


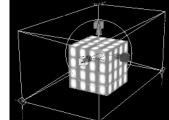


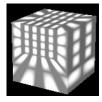


Cubic

Defines the projection surface as a box. Maya places images on each plane and projects them onto the object.



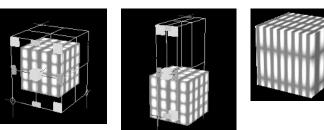




Reference > Examples

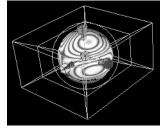
Triplanar

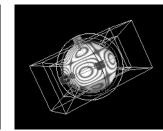
Extrudes the texture along the axis defined by the maximum direction of the surface normal. The texture is projected much like fabric pulled around an arc.

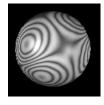


Concentric

Projects a vertical slice of the texture from the inside to the outside edge of the voxel. The vertical slice used is randomly chosen for each voxel. A *voxel* is a 3D version of a rectangle—a voxel grid is a series of 3D cubes that line up to form a bigger cube.







Perspective

Integrates 3D elements with a background image or a live action sequence.

Examples

You have a background sequence with a vase on a table you want to blow up. It can be difficult to produce a parametric or solid texture map that exactly matches the vase, but if you use the Perspective Proj Type, you can project the real image of the vase from the background sequence onto a 3D vase placed in a matching position. This allows a perfect match of textures from the camera's point of view.

You want to place a 3D flying saucer within an image of a street scene. The image of the street scene should accurately reflect onto the flying saucer. You could do this with an environment texture, but that would require that you have other images available—if you use the Perspective Proj Type, you can project the image of the street scene onto stand-in geometry. The image projected onto the stand-in geometry accurately reflects onto the flying saucer.

> Shading 355

Reference > Camera Projection Attributes

Image

The 2D texture to be used as a map.

Tip To undo a mapping, in the Attribute Editor, right-click while the cursor is over the attribute's name and select Break Connection from the pop-up menu.

U angle

For spherical and cylindrical mapping only. Changes the U angle.

V angle

For spherical mapping only. Changes the V angle.

Camera Projection Attributes

Control a Projection node when the Proj Type is Perspective.

Link To Camera

The drop-down menu contains a list of the perspective cameras in the scene. Choose the camera from which you want to project the image.

Fit Type

Controls how the texture fits to the camera when Proj Type is Perspective.

None	The image is not squeezed or stretched to fit. One of its axes (determined by the Fit Fill setting) fits to the film gate, and the other resizes appropriately.
Match Camera Film Gate	Squeezes the image to fit the film gate.
Match Camera Resolution	If you use this to match a backdrop, match these settings to the settings in the Image Plane. Usually, the image plane is the same size as the rendered image. If so, use the Match Camera Resolution setting.

Fit Fill

Only available if Proj Type is Perspective and Fit Type is None. If the image plane aspect ratio is not the same as the film gate aspect ratio, this attribute decides which axis of the image is fit to the film gate.

Reference > Noise Attributes

Noise Attributes

Controls the amount of fractal noise added to a Projection node. (Adding fractal noise randomizes or blurs the texture).

Amplitude X/Amplitude Y

Scales the amount of fractal noise added to the projection in the X or Y direction. When Amplitude X and Amplitude Y are 0, no fractal noise is added.

Ratio

Controls the frequency of fractal noise. Increase this value to increase the fineness of detail.

Ripples

Determines how wavy the projected image is when projected, but controls the scale of the frequency of any fractal noise added to the texture. If increased in any direction, the fractal detail seems to smear out in that direction.

Recursion Depth

Depth

Controls the amount of calculation done by the texture when Ripples are added. Fractal noise such as ripples are created by a mathematical process; as the process goes over more levels, it produces a more detailed fractal, but takes longer. Normally, the texture chooses a level appropriate for the volume rendered. You can use Depth Min and Depth Max to control the minimum and maximum amount of calculation.

Stencil

Maps any image input onto an object (such as a shading network, or a file texture). You can mask the input image to control how it covers a surface, to overlay different textures and control what parts of the texture are visible, or to label map a surface.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Stencil utility, see "Use the Stencil utility" on page 321.

Image

The texture used as a stencil.

Reference > HSV Color Key

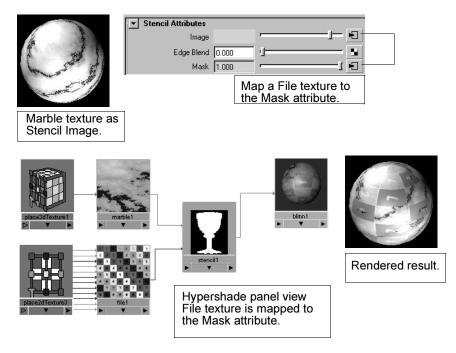
Edge Blend

Controls the sharpness of the texture edges. The default Stencil's color is the color of the edge blend. Increase this value to blend edges softly.

Mask

Represents the Stencil's transparency. Use to control the overall transparency of the entire texture. To control the transparency of selected regions of the texture, map another texture to Mask.

For example, this is what happens when you map a File texture to the Mask attribute.



HSV Color Key

Key Masking

Enables or disables Chroma Key masking. When on, Maya selects the areas in the texture similar to or equal to the Color Key color and masks them out. When off, all other key attributes have no effect.

Positive Key

Inverts the chroma key mask (only the colors specified in the Color Key and HSV Range are displayed). The default setting is off (the colors specified in the Color Key and HSV Range are masked).

Reference > Reverse

Color Key

The color to be masked in the texture. The default setting is black. To mask a range of colors, you must also set the Hue/Sat/Val Range parameters.

Hue Range

The range of hues (H) centered on the Color Key color which are also masked. The valid range is 0 to 1. The default value is 0.5.

Saturation Range

The range of saturations (S) centered on the Color Key color which are also masked. The valid range is 0 to 1. The default value is 0.5.

Value Range

The range of values (V) centered on the Color Key color which are also masked. The valid range is 0 to 1. The default value is 0.5. If you want to mask out the exact key color, set V to 0.

Threshold

Controls the point at which the color state changes.

Reverse

Reverses node effects. For instance, you can reverse a transparency map if the white and black areas are the inverse of what they should be.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Reverse utility, see "Use the Reverse utility" on page 322.

Reverse Attribute

Input

Represents the reversed values.

Sampler Info

Provides you with information about each point on a surface as it is being sampled, or calculated, for rendering purposes. Sampler Info can give you information about a point's position in space, its orientation and tangency, and its location relative to the camera.

Many of the attributes for this node provide values in *camera coordinate space*, the local object space of the camera. Each camera (in its own space) is located at the point 0, 0, 0. It looks straight along the negative Z axis, and the positive Y axis points up.

Reference > Sampler Info

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Sampler Info utility, see "Use the Sampler Info utility" on page 323.

Point World

Provides the position currently being sampled relative to the X-,Y-, and Z-axis of the world.

Point Obj

Provides the position currently being sampled relative to the X-,Y-, and Z-axis of the object.

Point Camera

Provides the point of the object being shaded. This point is located in XYZ camera space. You can connect this surface point in materials for the object being shaded to show some interesting effects based on the camera view.

Normal Camera

Provides the orientation of a face relative to the camera.

Uv Coord

Provides the UV coordinates of a point to be shaded. The convention is that UV coordinates are measured from 0 0 to 1 1.

Ray Direction

Indicates the direction in which the current point is seen from the camera. Use this attribute in materials for objects to provide the direction towards the camera for every pixel in the object.

Tangent UCamera, Tangent VCamera

Sets the surface tangents in camera space (as opposed to world space or object space). For polygons, the tangents are generally not defined. NURBS have a well-defined tangent space (as visible in Maya; create a NURBS object, display its CVs and notice the NURBS object has a U direction and a V direction).

Mathematically, tangents provide an instantaneous direction perpendicular to their point of origin on a surface. Their magnitude is affected by the rate of change (curvature) of the surface. A good math book should have a diagram showing the tangent to a curve, which can then be extrapolated to give you an idea of what tangents on a surface look like. *Tangent U and Tangent V Camera attributes are for advanced users only*.

Reference > Set Range

Pixel Center

Provides Pixel Center X and Pixel Center Y. The result depends on the image, not on the geometry.

Facing Ratio

Produces a value that varies between 0 and 1 depending on the angle between the surface normal and view direction.

Flipped Normal

Turn on or off depending on whether the object is textured differently on either side. The flipped normal attribute indicates if the surface normal is flipped which also tells you which side of the surface Maya is shading.

Set Range

Sets the range within which you want an effect to take place when you don't want to operate on an entire scene. The Set Range utility is used in combination with other nodes.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Set Range utility, see "Use the Set Range utility" on page 325.

Value

Maya maps this value from the old range (Old Min to Old Max) into the new range (Min to Max).

Min/Max

The minimum and maximum value in the new range.

Old Min, Old Max

The minimum and maximum value in old range.

Vector Product

Multiplies a vector by another vector or by a matrix. The Vector Product node has three parts—two input attributes, an operator that you apply to the two input attributes, and an output attribute that holds the result.

- A *vector* is the quantity of an attribute (such as color) which has direction (X, Y, and Z) as well as magnitude.
- A *matrix* is an array of interconnected attributes. These attributes are combined to create one single entity.

7 | Render node utilities

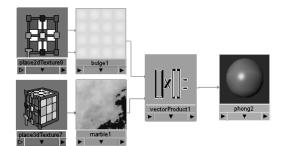
Reference > Vector Product

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Vector Product utility, see "Use the Vector Product utility" on page 326.

Operation

Displays a pop-up menu from which you can select an operator. The following examples are based on Input 1 as a Bulge texture and Input 2 as a Marble texture.



No operation

Copies the value of the Input1 attribute to the output without making any changes.

Dot Product

A single-component value produced by the dot product of the two input vectors. The value of the dot product is copied to the three components of the vector produced.

Cross Product

The result of two input vectors.

Vector Matrix Product

Produces a vector by multiplying the Input1 attribute and the Matrix attribute, as in the following formula:

Outvector = Input X Matrix

Point Matrix Product

Produces a point by multiplying the Input1 attribute and the Matrix attribute as in the following formula:

Output = Input x Matrix

Color utilities

Blend Colors

To use this utility, see "Use the Blend Colors utility" on page 327.

Blends two input values using a mixer. You use a mask to determine where to put two materials placed on an object.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

Blender

Controls how much of each of the input colors mixes into the final Output. As the value increases, you see more of Color 1 and less of Color 2. As it decreases, you see more of Color 2 and less of Color 1.

Color1/Color2

Color1 and Color2 are the first and second input colors (or textures). Click to access the mapped node's attributes.

Clamp

To use this utility, see "Use the Clamp colors utility" on page 329.

Isolates colors within a relatively complex texture. This is helpful when you create complex shader networks.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

Min

The minimum values for the color channels.

Max

The maximum values for the color channels.

Input

The input color or texture that Maya clamps.

Contrast

To use this utility, see "Use the Contrast utility" on page 330.

Use to increase or decrease the contrast in a texture. You can control the contrast of each of the R, G, and B channels individually.

7 | Render node utilities

Reference > Gamma Correct

When you increase Contrast, light colors become lighter and dark colors darker. When you decrease contrast, you bring all the colors closer to the middle range. The Bias attribute controls the center of this range.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

Value

The input color or texture to adjust.

Contrast

Controls the amount of contrast adjustment. You can adjust the contrast of the R, G, and B components individually. Increase Contrast to make light colors lighter, and dark colors darker. Decrease Contrast to make everything gray.

Bias

Controls the middle point of the contrast adjustment. Increase Bias to move the middle point upwards (more of the texture becomes dark as contrast increases). Decrease Bias to move the middle point down (more of the texture becomes light as contrast increases).

Gamma Correct

To use this utility, see "Use the Gamma Correct utility" on page 330.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

Converts an HSV (Hue-Saturation-Value) color into an RGB (Red-Green-Blue) color. This is useful when you want to control a color using HSV values. For example, you can animate a material to run through all the rainbow colors. (This is the same as animating the Hue of an HSV color).

To animate a material, create an HSV to RGB node, connect the Out Rgb attribute to the material's color, then animate the first channel of InHsv.

Use Gamma Correction to smoothly remap the colors in an image. Extreme values (very light or very dark) do not change much, but you can make mid-range tones brighter or darker.

This utility lets you specify different gamma values for the three channels of the input. The typical formula for calculating gamma is:

new == old ** (1.0/Gamma)

Value

The input color or texture to gamma-correct.

Reference > HSV to RGB

Gamma

Controls the amount of gamma correction applied to each channel. A value of 1 means that the color is not adjusted. Increase Gamma to make the mid-range tones brighter. Decrease Gamma to make them darker.

HSV to RGB

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

In Hsv

The input color (represented as Hue, Saturation, and Value) converted to an RGB color.

Out Rgb

The output RGB color calculated.

Luminance

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

Converts color to grayscale. The luminance derives from a color value. Maya uses the following formula to calculate the luminance by adding the following amounts of red, green, and blue.

Luminance = 0.3 red + 0.59 green + 0.11 blue

Value

The input color or texture.

RGB to HSV

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

Converts an RGB (Red-Green-Blue) color into an HSV (Hue-Saturation-Value) color.

Some effects are easier to calculate using HSV values than RGB values. You can convert the output of any shading network into HSV values.

In Rgb

The color converted into HSV values.

Out Hsv

The output HSV values.

7 | Render node utilities

Reference > Surf. Luminance

Surf. Luminance

Returns the part of a lit surface and the degree of light it receives from lights in the scene.

- Where the object is lit by light sources, the textures appear.
- Where the object is not lit, such as polygons facing away from the light sources or in the shadow, the textures do not appear.

Switch Utilities

Single Switch

To use the single switch utility, see "Use the Single Switch utility" on page 331.

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

You use the three buttons in the Triple Shading Switch Attribute Editor to add, remove, and map textures to objects.

- The inShape column contains the objects to which you want to map the utility.
- The inSingle column contains the texture, file, or placement node you want to map to the object.

Add Surfaces

Click to determine to which shading groups the Single Shading Switch utility is connected and connect all the surfaces in those shading groups to the Single Shading Switch utility.

inShape

Contains the name of the shape (the object) you want to connect to the Single Shading Switch utility. You can add as many objects as you want to this column.

When one of the objects in this column is rendered, Maya sets Output to its corresponding value. When none of the objects are rendered, Maya sets Output to equal the Default setting.

inSingle

Contains the texture, file, or placement node that you want to map to the object. See also "Map Item".

Remove Item

Removes the currently selected row in the Switch table.

Reference > Double Switch

Map Item

You highlight the InShape column then click the Map Item button to select a texture, file, or placement node to map it to the object.

Tip You can also place the cursor over the column, then right-click Map from the pop-up menu.

Default

For Single switches, the Default attribute represents the value of a single float (such as the Bump Depth for a material's bump mapping attribute). When a surface is shaded, if it is not in the inShape column, this value is used. Shading nodes can also be mapped to the Default.

Double Switch

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Double Switch utility, see "Use the Double Switch utility" on page 334.

You use the three buttons in the Double Shading Switch Attribute Editor to add, remove, and map textures to objects.

- The inShape column contains the objects you want to map the utility to.
- The inDouble column contains the texture, file, or placement node you want to map to the object.

Add Surfaces

Click to determine to which shading groups the Double Shading Switch utility is connected and connect all the surfaces in those shading groups to the Double Shading Switch utility.

inShape

Contains the name of the shape (the object) you want to connect to the Double Shading Switch utility. You can add as many objects as you want to this column.

When one of the objects in this column is rendered, Maya sets Output to its corresponding value. When none of the objects are rendered, Maya sets Output to equal the "Default" setting.

7 | Render node utilities

Reference > Triple Switch

inDouble

Contains the texture, file, or placement node you want to map to the object. See also "Map Item".

Remove Item

Removes the currently selected row in the Switch table.

Map Item

Highlight the InShape column then click the Map Item button to select a texture, file, or placement node to map to the object.

Гір	You can right-click the column, then select Map from the pop-up
	menu.

Default

For Double switches, the Default values represents two float values (such as the Translate Frame or Repeat UV values of a place2dTexture utility).

Triple Switch

Find this utility in the Create Bar (see "Hide, resize or customize the Create bar" on page 58).

To use the Triple Switch utility, see "Triple Switch" on page 368.

You use the three buttons in the Triple Shading Switch Attribute Editor to add, remove, and map textures to objects. The inShape column contains the objects you want to map the utility to. The inTriple column contains the texture, file, or placement node you want to map to the object.

Add Surfaces

Click to determine to which shading groups the Triple Shading Switch utility is connected and connect all the surfaces in those shading groups to the Triple Shading Switch utility.

inShape

Contains name of the shape (the object) you want to connect to the Triple Shading Switch utility. You can add as many objects as you want to this column.

When one of the objects in this column is rendered, Maya sets Output to its corresponding value. When none of the objects are rendered, Maya sets Output to equal the Default setting.

Reference > Triple Switch

inTriple

Contains the texture, file, or placement node that you want to map to the object. See also "Map Item".

Remove Item

Removes the currently selected row in the Switch table.

Map Item

You highlight the InShape column then click the Map Item button to select a texture, file, or placement node to map it to the object.

Default

For Triple switches, the Default attribute represents the RGB channels of a color.

7 | Render node utilities

Reference > Triple Switch

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