



Twilight Render V2.0

Deep Material Editor Guide

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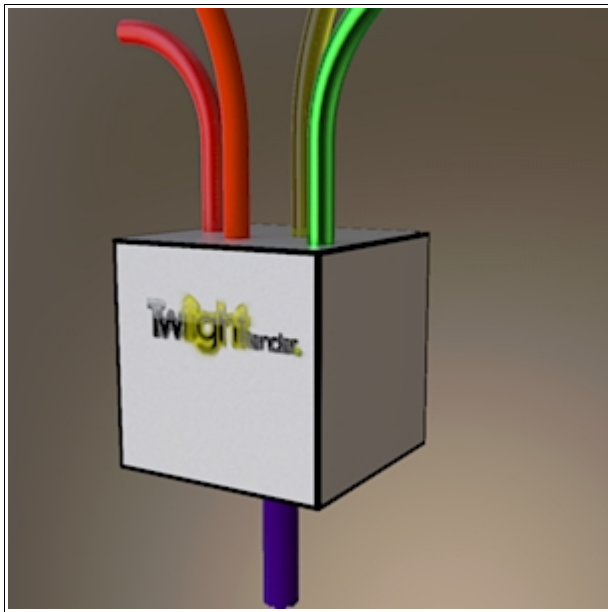


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An Overview of the Deep Material Editor

Twilight Render provides a lot of tools to add realism to your SketchUp renders. Maybe the biggest, most valuable tool is the Material Editor. Twilight Render has been built on the idea of templates, predefined materials that take your colors and textures from SketchUp and add realism in an easy to select, easy to configure way. With Twilight Render, Version 2, we have added the Deep Material Editor, exponentially increasing your ability to create and customize materials.

The core of Twilight Render's materials is the Kerkythea material object. Think of it as a box.



Characteristics feed into the box; we call these 'channels'. The channels are mixed, and the result is the final material that appears in the render.

The key to a good material, then, is to combine just the right channels to achieve the effect you want. The Deep Material Editor gives you access to all the channels. How you mix them is up to you.

Of course, there are limitations, and some right ways and some wrong ways to do it. This guide will show what each channel is capable of and the best ways to combine them.

To get started with the Deep Material Editor, click the Plugins menu in SketchUp, choose Twilight V2, the Deep Material Editor. This will

open the editor and launch the 'selection' tool. Click the tool on a material to begin editing it in the Deep Material Editor.



Note: If the material you click on is already a Template Material (previously edited in the standard Twilight Render Material Editor), you will be warned that continuing will erase your template data. You will be given an option to convert the template to a matching 'Deep' material. This is a great way to 'jump ahead' when creating a material. More on that later.



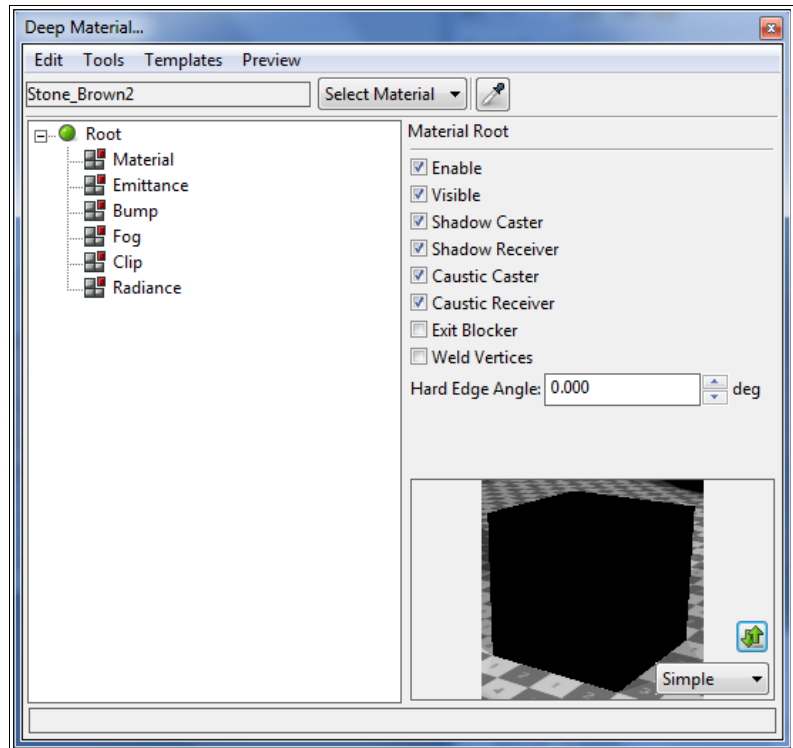
When you see this icon in the Guide, that means there are warnings, suggestions, or tips that you should pay careful attention to.

Understanding Channels

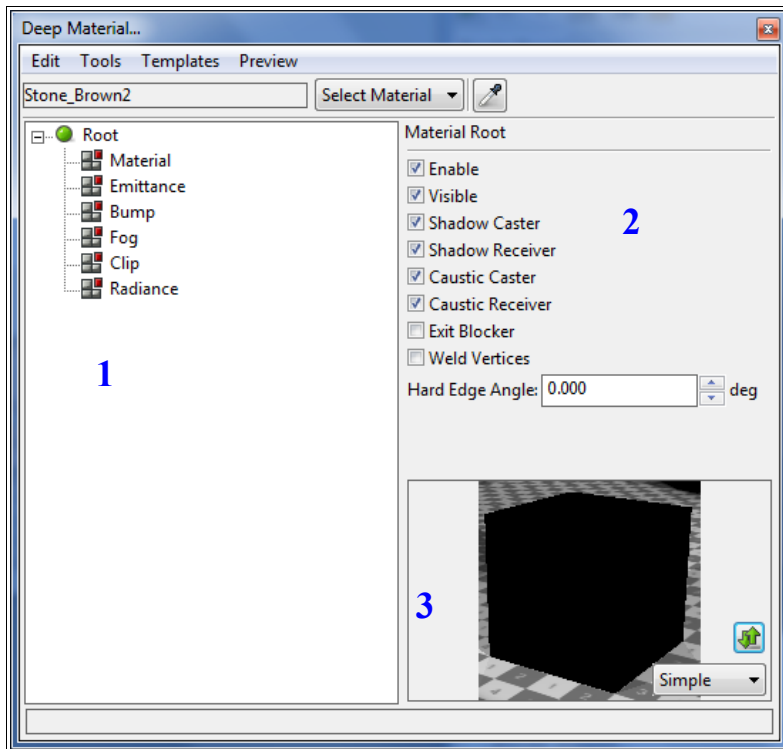
A Deep material has 6 primary channels. Each channel has a specific purpose.

- **Material** – this channel determines the color and reflection of the material. It is the most important channel and the one you will deal with the most
- **Emittance** – this channel specifies the light that the material emits, as if it were glowing. This channel will only be used for light-emitting materials, like tv screens.
- **Bump** – this channel sets the bump mapping to give your material a sense of roughness
- **Fog** – this channel determines how light will scatter as it passes through the material. This channel is used in volumetric and sub-surface scattering materials; typically for advanced users.
- **Clip** – this channel controls how the geometry is clipped, as if it were cut with scissors. Note that 'clipping' produces a hard edge. This is different than the 'blended clip' or partial transparency (which is controlled by Material).
- **Radiance** – this channel is mostly unused. It provides control of some advanced, special purpose features.

We will be showing you how to configure simple and complex combinations for each of these channels. We will show you how the standard templates correspond to the various channels to produce the most common material effects.



Using the Editor



The Deep Material is composed of 3 areas.

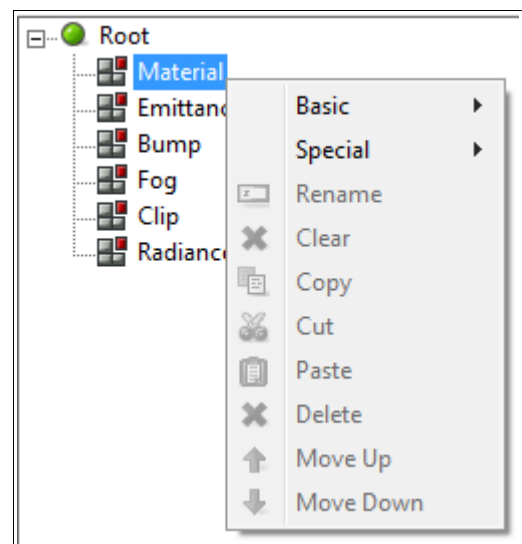
1. The channel list, or *tree*
2. The property editor
3. The preview

The tree is where you will be creating your material properties such as choosing color or texture, composing layers, and more. Editing the tree is done entirely by **right-clicking**. Each element in the tree has its own menu, specific to what kind of element it is. Right-clicking on the node will bring up the menu from which you can choose to add, delete, or replace.


Lets start with the Material channel. Most material characteristics will be set here, and you will probably spend most of your time working on it. Right-click on the Material channel. You will see a fairly simple menu. Most of the element menus will look about the same. At the top are elements that you can add to that channel, grouped into **Basic**, **Special**, and (later) **Layers**. Below that are a variety of editing options. Because the channel is *empty*, those options are available. We'll see how to use those next.

Highlight the **Basic** entry, and choose **Standard**. Standard is the most common Material element. Each Material element has its own characteristics, and Standard is the most versatile.

Before moving on, go back one and re-select the Material channel. Right-click on it and you will see that, in addition to the Basic and Special menus, you can now **Clear** the channel. Clicking on this option



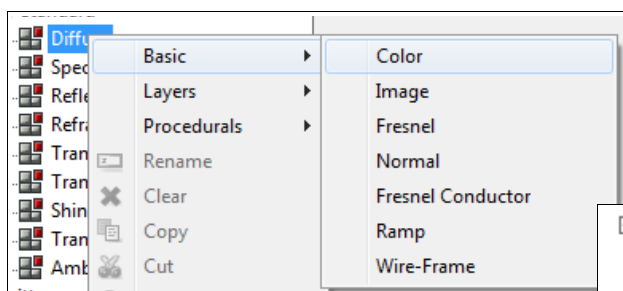
will erase everything below that point. This will be true for all elements.

 Channels are fairly specific and there is a limit to what you can do with them. As you saw, the only editing option was to Clear the channel. You will soon encounter Secondary Channels. The operation of these is still the same. You can set an element to them, or you can erase it, and not much else.

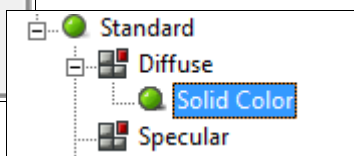
Moving on, select the Standard element you added before. Observe that the property editor, the area on the right side above the preview, now has options. Almost every element has options. We will go into each element in detail later; for now just note that they are there.

Below the Standard element, you will now see addition channels. These are the Secondary Channels. Some elements have them, some don't. The 'box' idea is the same, though, for primary and secondary channels: The channels feed in to the element (or box) and are mixed before being passed out to the box higher up in the tree until it reaches the final result. Additionally, just as the primary channels do, each secondary channel has its own unique characteristics.

Right-click now on the **Diffuse** channel. You will see a choice of Basic, Layers, and Procedurals (we'll get to that later). Choose Basic, **Color**.





You will see an element added, called Solid Color. This element doesn't have any additional channels. It is the end-point of this particular pipe. In this case, it is the source of a single color.



Notice, quickly, that the property editor for the Solid Color element shows a color selector (among other options). Without going in to detail, the use should be obvious: the chosen color feeds the channel (in this case, the 'Diffuse' channel).









Moving back to the material tree, right-click on the Solid Color element. Now you will see a few more options (though not all yet). For now, choose Delete. After confirming the delete, right-click on Diffuse again, and this time, choose Layers, Addition.

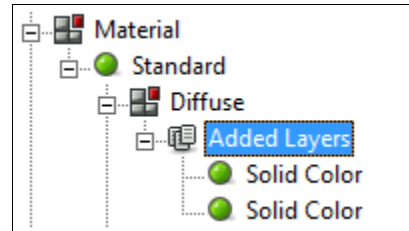
 Layers act to combine the elements beneath them in a very simple way. There are typically three choices: **Addition**, **Multiplication**, and **Piped**. To add an element as a layer, right click on the Added Layers element and choose **Add Basic**, Color.


 You might have noticed the option to Add Layers underneath a layer. Using this technique you can create multiple levels of layers, essentially as many as you can conceive!

Right-click again on the Added Layers element, and again choose Add Basic, Color. You

should now see two color elements beneath the layer. If you right-click on one of the Solid Color elements, you should now see quite a few editing options available. Let's look at all those editing options now.

-  • **Rename** – As the name suggests, you can choose to rename the node. You can organize your material by giving it sensible names. However, changing names is by no means necessary!
-  • **Clear** – As discussed above, clear deletes all the elements below the one selected. It is available for layers and channels (but not end-points, like Solid Color).
-  • **Copy** – Elements can be copied and pasted, just like text, into other channels or layers. Take note, however, that just any element can be pasted into a channel. If you try to paste into an invalid channel, the paste will not work.
-  • **Cut** – Place the element in the clipboard for pasting, and delete it from its current location.
-  • **Paste** – Paste the copied element under the currently selected channel or layer. See the note on Copy above.
-  • **Delete** – Deletes the element from it's current location (and all the elements within it if it's a layer).
-  • **Move Up** – For elements under a layer, allows you to move the element up in the layer order.
-  • **Move Down** – Just like Move Up, allows you to move the element down in the layer order.



 There are some great shortcuts when editing elements. Just like when editing text, you can click Ctrl+C to copy, Ctrl+V to paste, and Ctrl+X to cut. You can also click Delete to delete the highlighted element. What's more, you can click and drag an element from one location to another (assuming, of course, that where you are dropping the element is valid)! Give it a try!

Converting from Templates

The easiest way to get a head start on creating a material is to convert a Template material into a Deep Material. There are several ways to do this.

- Open the standard Material Editor and select a material. Apply a template to it, then choose Tools, Convert to Deep. The Deep Material Editor will open with the material converted over.
- Open the Deep Material Editor and select a material. Click on the Templates menu and choose the template you want from the list.
- Open the Deep Material Editor and select a material that you know has a Template assigned to it. You will be asked if you want to convert that template to a Deep Material. Click Yes and the material will be converted over.



Template settings and Deep Material settings are mutually exclusive. A material can not have both. If you choose to edit a material in one editor or the other, any previous settings (of the opposite type) will be erased.

Loading and Saving Libraries

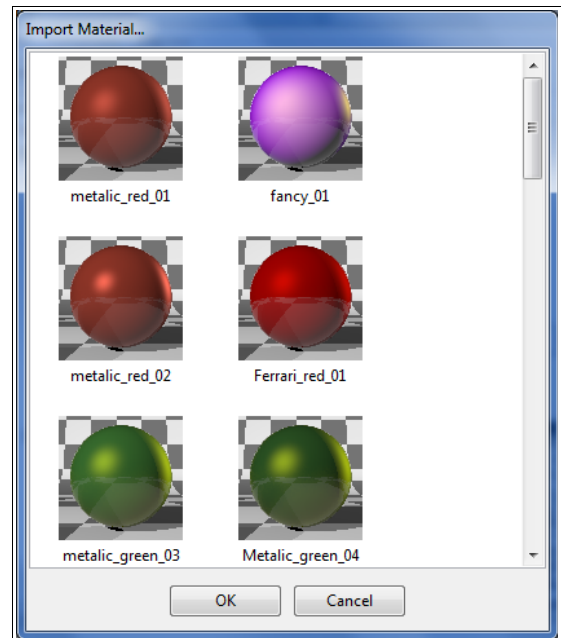
The Deep Material Editor allows you to load and save materials in Material Libraries. These are the exact same material libraries used by Kerkythea. In addition to the standard Twilight Render libraries, there are many user-created libraries available on the internet and at TwilightRender.com. All of these libraries can be loaded directly for use in your render.

To load, or 'import' a library material, first open the Deep Material Editor and select a material. Then choose Tools, **Import**. Browse to the location of your library and select it.



Material libraries are either .xml files or .zip files. The Deep Material Editor supports both.

After selecting the material library, the Import window will open with a list of materials available to choose from. Select one and click Open. The library material will be loaded directly into your material editor and applied to the chosen SketchUp material.



To save a material to a library, just repeat the process in reverse. After editing your Deep material, choose Tools, **Add Export** or Tools, **New Export**. Add Export will add a material to an existing library. New Export will create a new library (or overwrite an existing one) and add your material to it.

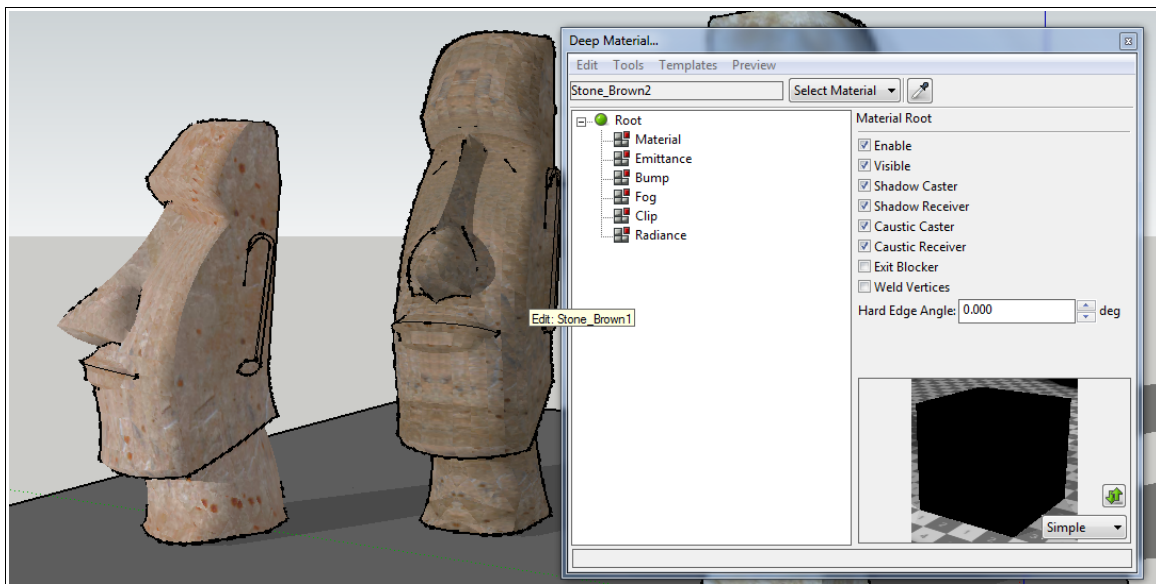


The name of the SketchUp material will be the name used to identify the material in the library. Additionally, adding a material to a library that already contains a material with the same name will not overwrite the existing material. A second material of the same name will simply be added.

Creating Materials

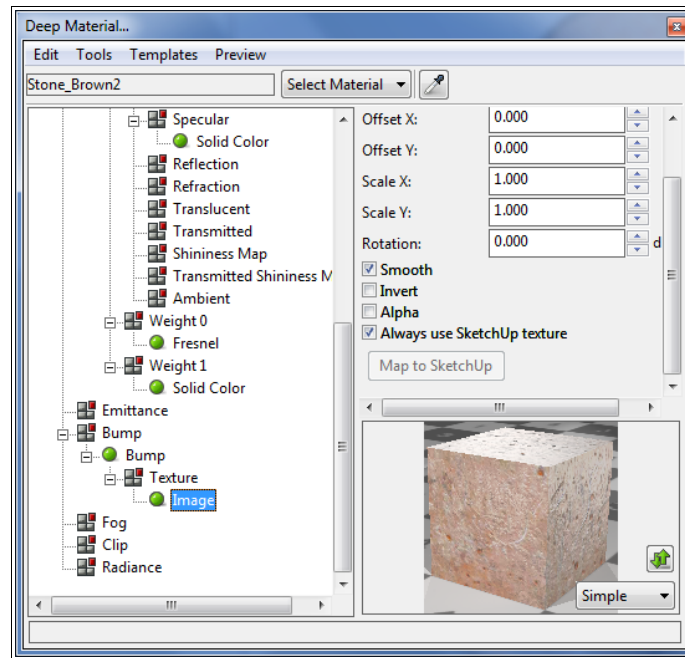
Let's get started creating materials. First, we'll convert from a Template. After that, we'll try creating one from scratch.

1. Launch SketchUp and open your demo scene. For this Guide, we are using a model of Easter Island Moai Statues created by Rebel available from the 3D Warehouse here: <https://3dwarehouse.sketchup.com/model.html?id=9c78d10e8b0a918be3c2af5d2605b63f>
2. Open the Deep Material Editor (Plugins → Twilight V2 → Deep Material Editor).
3. Using the eyedropper selector or by choosing from the Select Material list, choose your material. We are selecting the Stone_Brown_2 material.



4. Let's make our first material a realistic stone. Under Templates, choose Stone, Rough. *If you have the Exploration Renderer open, you should see the view update to reflect the new material.*
5. Now that our material is started, let's modify it. Find the Bump channel, right-click, and choose **Bump Map**. This will create a standard bump map to add roughness to the model.
6. Right-click on the Bump Map element and choose Basic, Image. This will add a texture for use as our bump map.
7. From here, we could choose a texture image as the source of the bump map. However, for now, we will choose to use the same SketchUp texture that's already applied to the

model by selecting the Image element, then in the property editor check the box next to **Always use SketchUp Texture** (you may need to scroll down a little).

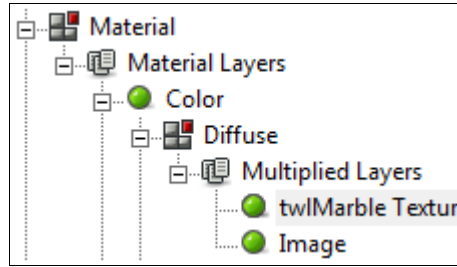


- Depending on the contrast of your image, you might need to select the Bump element and adjust the Strength value up or down.

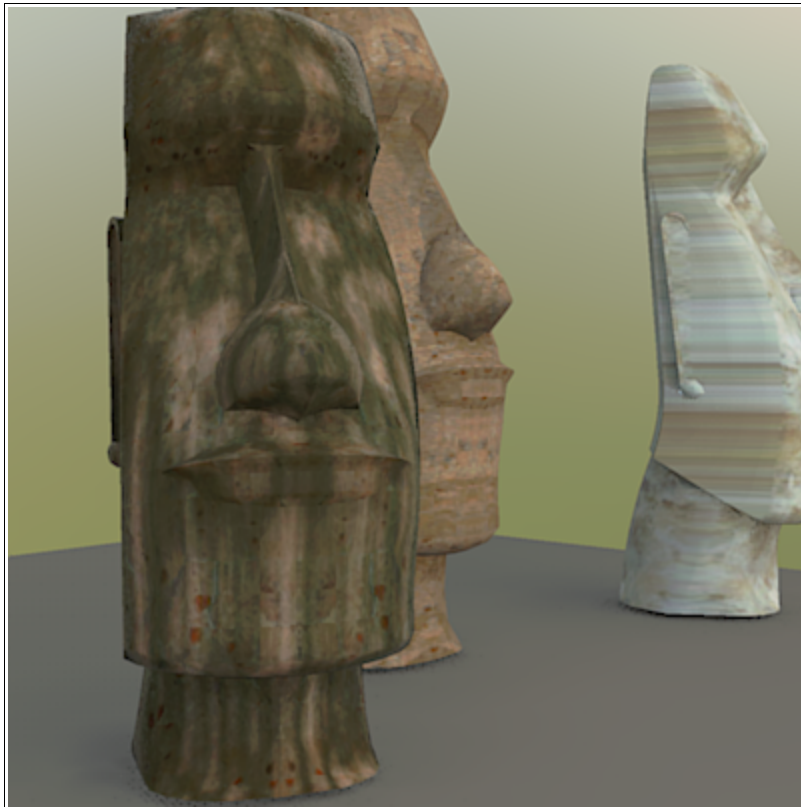
We are making fair progress, but it needs some interesting detail.

- Navigate to Material → Material Layers → Color → Diffuse. Right-click on the Diffuse element and choose **Layers, Multiplication**. This will replace the existing Color element with a layer element.
- Right-click on the Layer element and choose Add Procedural, twIMarble.
- Before moving on, change the colors of the Marble element to a dark gray and a light gray. Then make sure to un-check "Use Group Coordinates". This will be useful later on.
- Go back to the Layer node, right-click and choose Add Basic, Image. Just like with our Bump element, check "Always use SketchUp Texture".





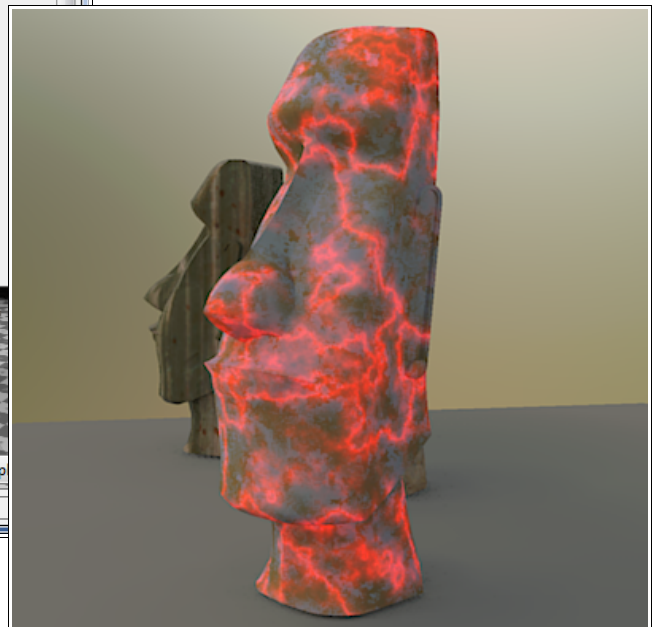
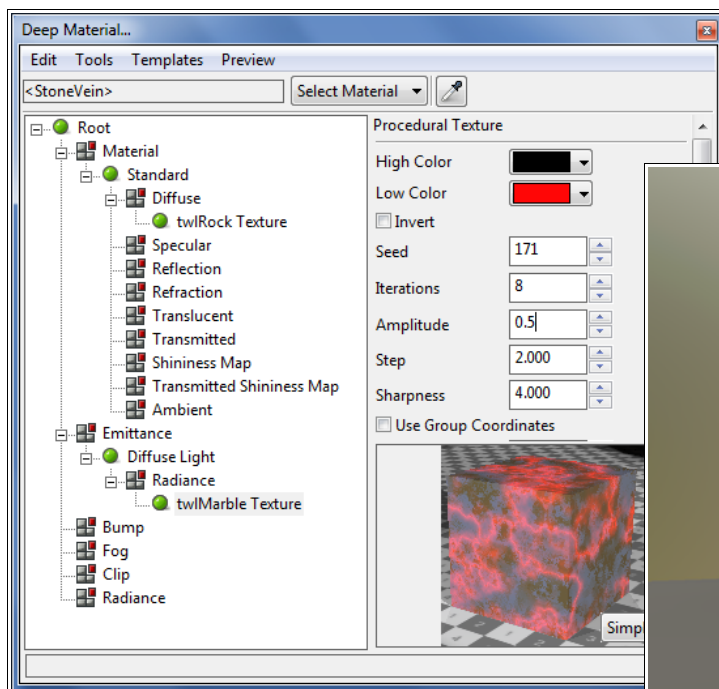
13. Depending on what colors you used, you should have something like a cracked clay pot.
14. Select the twlMarble Texture, and try playing with the settings. Change the Scale Z to 50 to give it a streaky weathered look. Change the Low Color to a gray-green to make it look mossy. Play around to find just the right look!



Now let's look at building a material from scratch.

1. Choose a new material to edit. We are using <StoneVein> from the third statue. If necessary, you can clear any existing material by right-clicking on the Root element of the Deep Material Editor and choosing Clear.

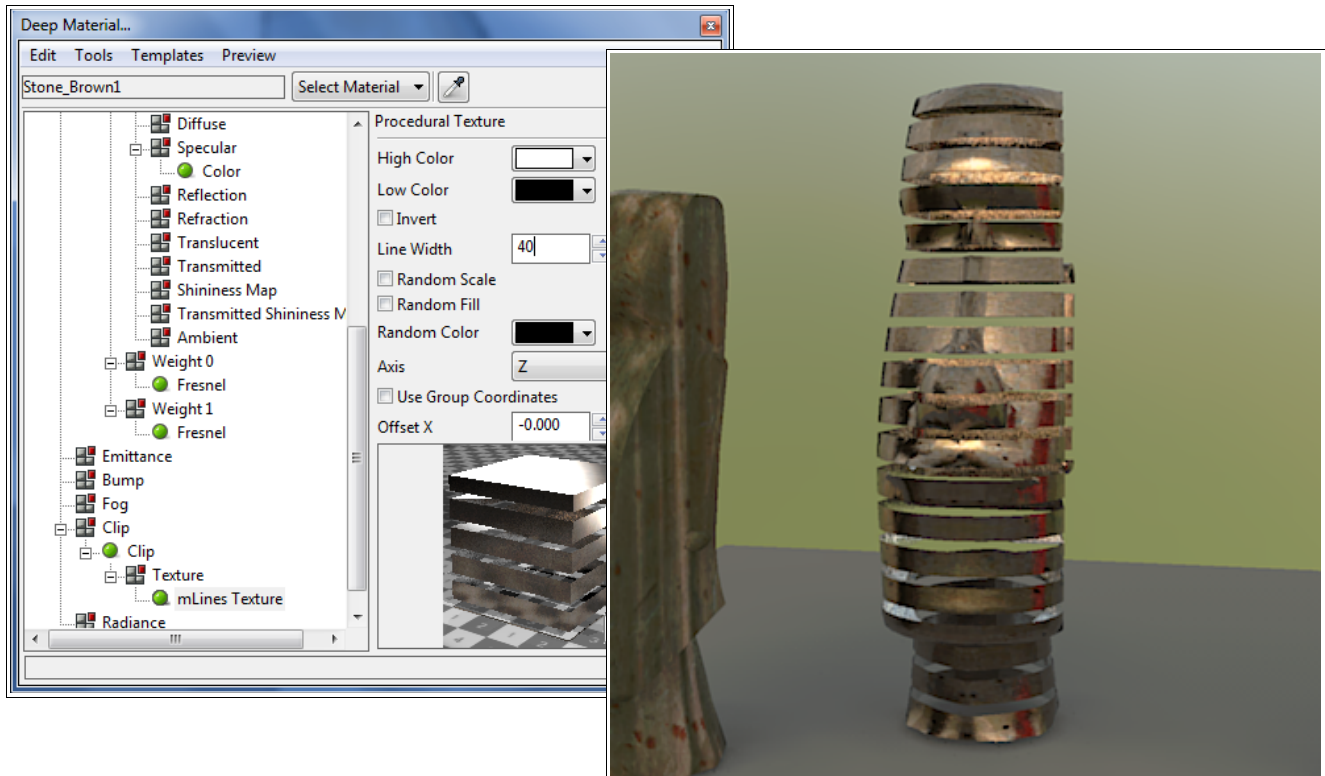
2. First up is the color and texture in the Material Channel. This model has some stretched textures and I want to replace that with something else. Right-click on Material and choose Basic, **Standard**.
3. Right-click on Diffuse and choose Procedurals, **twlRock**.
4. Change the High and Low Colors to match the original texture, and uncheck 'Use Group Coordinates'.
5. Once you are satisfied with the color and appearance of the rock, right-click on Emittance and choose Diffuse. Remember, Emittance controls how light is emitted from an object, it's 'glow'.
6. With Diffuse Light selected, uncheck the Emitter checkbox. For our purposes, we don't need the material to emit light at it's surroundings. We just want the glow.
7. Right-click on Radiance and choose Procedural, twlMarble.
8. Change the marble High Color to black, and the Low Color to red.
9. For the appearance of larger, finer cracks, increase all the Scale values to 2 and change Sharpness to 4.



Finally, lets take a look at Clip.

1. Select a new material. We are choosing Stone_Brown1. Reset it if necessary.
2. Choose Template → Metal, Silver.

3. Right-click on the Clip channel, and choose Clip.
4. Right-click on Texture and choose Procedural, Lines.
5. With mLines selected, change the Axis to Z, and uncheck "Use Group Coordinates".
6. You can play with the Scale Z and the Line Width to change the strips.



As you can see, there is enormous potential for creating both realistic and whimsical materials to fit every need.



Elements

Material Elements

Standard

This is the basic, all purpose color and texture node.

Channels

- Diffuse – The color or texture seen from any angle, basically the “base” color.
- Specular – The color of light reflected off the surface.
- Reflection – The color of light *perfectly* reflected off the surface.
- Refraction – The color of light as it passes *perfectly* through the surface.
- Translucent – The color of scattered light as it passes through the surface.
- Transmission – The color of direct light as it passes through the surface.
- Ambient – The color of the surface without any light on it.*
- Shininess Map – Controls the level of specular shininess at any and every point on the surface
- Transmitted Shininess Map – Controls the level of transmitted shininess (clarity) at any and every point on the surface.

At first glance, there appear to be several duplicate, redundant channels. However, each channel, despite it's description, is different. Let's take a look at Specular vs Reflection.

Reflection is considered '*perfect*' reflection. It does not create scattered or blurry reflections but perfectly reflects the scene. It is not affected by the material's index of refraction (IOR). You can modify the color of the reflected light, but little else.

Specular, however, is much more complicated. By default, it only reflects direct light. The sharpness and blurriness of the reflected light is controlled by the Shininess property. The higher the Shininess, the sharper the reflection. In order to reflect indirect light (the scene, basically), you must enable the Specular Sampling property. Once enabled, how the light is reflected is controlled by the IOR as well as the Specular Attenuation.

In like manner, Refraction, Translucent, and Transmission all have various properties.

Refraction is '*perfect*' refraction. How much light is bent passing through the material is controlled by the IOR. However, the light is never scattered or blurry. You can modify the color, but nothing else.

Translucent produces a generic scattered light as it passes through the material but the

clarity of the material can not be set, only the color.

Transmission controls how the light passes through the material with a great deal of control. The clarity of the material is controlled by the Transmit Clarity property. The IOR controls how much light is bent as it passes through. The Transmit Attenuation controls how transmitted light passes through the material based on the viewing angle.

Properties

- Index of Refraction – Also called IOR, controls how much light is bent as it passes through a material, as well as how light reflects off a surface.
- Specular Sampling – Enables reflection of indirect light (the scene) as controlled by the Specular channel.
- Shininess – Controls how sharp reflected light is as controlled by the Specular channel.
- Specular Attenuation – Determines how the strength of the reflected light changes as the viewing angle changes.
- Transmit Sampling – Enables refraction of light as controlled by the Transmission channel.
- Transmit Clarity – Controls how clearly light refracts through the material.
- Transmit Attenuation – Determines how the strength of the refracted light changes as the viewing angle changes.

Realistic Glass

This sets up a glass material with perfect reflection and perfect refraction.

Channels

- Reflection – The color of light *perfectly* reflected off the surface.
- Refraction – The color of light as it passes *perfectly* through the surface.

Properties

- Index of Refraction – Also called IOR, controls how much light is bent as it passes through a material, as well as how light reflects off a surface.
- Dispersion – How much the light separates into constituent colors as it refracts through the material.
- Fresnel – Enables or disables Fresnel attenuation, how reflected and refracted light changes as the viewing angle changes.
- NK File – A file containing complex reflection and refraction data to simulate real-world materials. Twilight Render provides a set of NK data files in its standard installation.

Thin Glass

Glass with reflection only, no refraction.

Channels

- Reflectance – The color of light reflected off the surface.

Properties

- Index of Refraction – Also called IOR, controls how light reflects off a surface.

Anisotropic (Ward)

A simple Diffuse material with non-uniform Specular reflection.

Channels

- Diffuse – The color or texture seen from any angle, basically the “base” color.
- Specular – The color of light reflected off the surface.

Properties

- X Roughness – How much specular reflection is stretched in the 'X' direction
- Y Roughness – How much specular reflection is stretched in the 'Y' direction
- Rotation – Degrees to rotate the X and Y roughness.
- Specular Sampling – Enables reflection of indirect light (the scene) as controlled by the Specular channel.

Note: the 'X' and 'Y' directions are based on the texture mapping of the model.

Anisotropic (Ashikhmin)

A more complicated Diffuse material with non-uniform Specular reflection.

Channels

- Diffuse – The color or texture seen from any angle, basically the “base” color.
- Specular – The color of light reflected off the surface.
- Shininess X – How much specular reflection is stretched in the 'X' direction
- Shininess Y – How much specular reflection is stretched in the 'Y' direction
- Rotation – Degrees to rotate the X and Y roughness.

Properties

- Index of Refraction – Controls how light reflects off a surface.
- X Shininess – A base offset to how much specular reflection is stretched in the 'X' direction. Added to the Shininess X channel.
- Y Shininess – A base offset to how much specular reflection is stretched in the 'Y' direction. Added to the Shininess Y channel.
- Rotation – A base offset of degrees to rotate the X and Y roughness. Added to the

Rotation channel.

- Specular Sampling – Enables reflection of indirect light (the scene) as controlled by the Specular channel.
- Attenuation - Determines how the strength of the reflected light changes as the viewing angle changes.
- NK File – A file containing complex reflection and refraction data to simulate real-world materials. Twilight Render provides a set of NK data files in its standard installation.

Lafortune

A Diffuse material that supports multiple anisotropic Specular reflections.

Channels

- Diffuse – The color or texture seen from any angle, basically the “base” color.

The Lafortune material is unique. Similar to a Layer, Specular reflection elements are added by right-clicking on the Lafortune element and choosing to Add elements.

Properties

- Index of Refraction – Controls how light reflects off a surface.
- Attenuation – Determines how the strength of the reflected light changes as the viewing angle changes.
- Specular Sampling – Enables reflection of indirect light (the scene) as controlled by the Specular channel.

Each Specular channel added to the Lafortune element will add a set of Cx, Cy, Cz, and Shininess parameters. These parameters set the direction along which that respective Specular channel reflects.

Layers

Allows multiple Material Elements to be layered. Each layer adds a 'Weight' texture. The 'Weight' controls when the associated layer is added into the final result.

Emittance Elements

Omni Light

Emits light in all directions.

Channels

- Radiance – The color or texture of the emitted light.

Properties

- Light Attenuation – Controls how light decreases with distance from the light source

Spot Light

Emits light in a cone

Channels

- Radiance – The color or texture of the emitted light.

Properties

- Light Attenuation – Controls how light decreases with distance from the light source
- Fall Off – The angle at which the light terminates
- Hot Spot – The angle within which light is at maximum; outside of which light falls off to termination at the Fall Off angle

Projector Light

Emits light in a rectangle

Channels

- Radiance – The color or texture of the emitted light.

Properties

- Light Attenuation – Controls how light decreases with distance from the light source
- Width – The width of the rectangle of light at the Focal Distance from the light emitter (in meters)
- Height – The height of the rectangle of light at the Focal Distance from the light emitter (in meters)
- Focal Distance – The distance from the emitter at which the Width and Height specify the shape of the light rectangle

IES Light

Emits light according to an IES light definition file

Channels

- Radiance – The color or texture of the emitted light.

Properties

- Light Attenuation – Controls how light decreases with distance from the light source
- IES – The file that specifies the complex emitter geometry

Diffuse

Emits light in all directions with advanced properties

Channels

- Radiance – The color or texture of the emitted light.

Properties

- Light Attenuation – Controls how light decreases with distance from the light source
- Emitter – Sets whether light is emitted from the surface or if the surface is only self-lit
- Front Facing – Indicates that light is emitted from the 'Front' facing direction
- Back Facing – Indicates that light is emitted from the 'Back' facing direction
- Power – The power of the emitter, in Units
- Units – The units that determine the power of the emitted light (ie. Watts, Lumens)
- Efficiency – A percentage multiplier on the emitted Power

Sky Portal

A special purpose material that causes all the photons emitted by the Sky (Color, HDRI, Physical, etc) to be channeled through the surface. This material is often used outside windows to increase the light into an enclosed space.

Bump Elements

Bump Map

The standard bump map in which neighboring pixels are evaluated to determine the amount of bump effect at each point.

Channels

- Texture – The texture used to determine the bump effect

Properties

- Strength – a multiplier that controls the magnitude of the bump effect

Normal Map

The RGB map in which each pixel's color (red-green-blue) is evaluated to determine the normal of reflected light at that point (x-y-z).

Channels

- Texture – The texture used to determine the bump effect

Bevel

Causes the hard edges of the material to be rounded

Properties

- Thickness – The diameter of the rounding effect, in centimeters
- Hard Angle – The angle between surface normals, above which indicates a hard edge

to be beveled



For Bevel to be rendered correctly, the material Root must have 'Weld Vertices' checked. Note that welding vertices can cause incorrect UV mapping.

Layers

Allows multiple Bump Elements to be layered in an additive effect.

Fog Elements

Fog

Creates a volumetric, scattering effect. This element is used primarily for volumetric and sub-surface scattering.

Properties

- Absorption – The color of light that is absorbed/removed as the light passes through the surface
- FallOff – The color component of the light that decreases as it passes through the surface
- FallOff Intensity – The magnitude of the FallOff effect
- Emittance – The color that the material emits as a glow
- Emit Intensity – The magnitude of the Emittance effect
- Scatter – The color component of the light that is scattered as it passes through the surface
- Scatter Intensity – The magnitude of the Scatter effect
- Absorption Bias – Modifies the color of the absorbed light
- Use SketchUp for FallOff Color – The FallOff color will be set by the color of the corresponding SketchUp material.
- Use SketchUp for Scatter Color – The Scatter color will be set by the color of the corresponding SketchUp material.

Clip Elements

Clip

Cuts the material at a sharp edge based on the gray-value of the material at each point.

Channels

- Texture – The texture used to determine the clip effect

Properties

- Threshold – The gray-scale value below which the material is cut

Layers

- Allows multiple Clip Elements to be layered in an either/or effect.

Radiance Elements

Edge Emphasis

Colors geometry edge-lines to emphasize boundaries.

Properties

- Line Color – The color of the edge-lines
- Line Thickness – The width of the edge-lines, in centimeters
- Line Fade – The distance to fade the edge-lines, in centimeters
- Inner-Edge Ratio – A multiplier on Line Thickness for Inner Edges
- Inner-Edge Angle – The angle between two surfaces above which constitutes a hard edge

The Edge Emphasis element is different from the Wire Frame effect used elsewhere in Twilight Render.

Fluorescence

Create a fluorescent effect in response to light.

Properties

- Red – The fluorescent response to the red component of light.
- Green – The fluorescent response to the green component of light.
- Blue – The fluorescent response to the blue component of light.

Texture Element

Every secondary channel accepts a Texture element. These are (usually) the end-points of each branch of the tree, and include things like color and image. They fall into 3 categories: Basic, Layer, and Procedural.

Basic Textures

Color

Specifies a solid color

Properties

- Color – The selected color
- Always use SketchUp color – Overrides any color choice and uses the color of the SketchUp material. If the SketchUp material specifies an image texture, the 'average color' of the image is used.
- Max. Color Brightness – The selected or SketchUp color is modified to increase its brightness to the maximum value.
- Max. Color Saturation – The selected or SketchUp color is modified to increase its saturation to the maximum value.

Image

Specifies an image texture

Properties

- Image – The selected image texture
- Offset X – Offset to the surface's texture mapping X (or U) component. Pushes the texture mapping in one direction.
- Offset Y – Offset to the surface's texture mapping Y (or V) component. Pushes the texture mapping in one direction.
- Scale X – Scales the surface's texture mapping X (U) component.
- Scale Y – Scales the surface's texture mapping Y (V) component.
- Rotation – Rotates the texture mapping of the surface by the specified angle
- Smooth – Smooths the texture rendering between pixels, when necessary
- Invert – Invert the texture's colors
- Alpha – Use the texture's alpha / transparency component, if one is present. Requires an image that supports alpha such as .png (not .jpg).
- Always use SketchUp texture – Overrides any texture choice and uses the texture of the SketchUp material.
- Map to SketchUp – Replaces the texture in the SketchUp material with the selected texture image.



The Image texture has a very important hidden feature. If 'Always use SketchUp texture' is checked but the SketchUp material does not have a texture (it is a color instead), the texture will automatically render as a Color, instead of an image. This allows you to create generic materials that can be used across multiple SketchUp materials.

Fresnel

Creates a gradient between high and low colors based on the *viewing angle*.

Properties

- High Color – The color to use at a glancing viewing angle. The angle between the surface normal and the direction of the eye is highest, 90 degrees.
- Low Color – The color to use at a direct viewing angle. The angle between the surface normal and the direction of the eye is lowest, 0 degrees.
- Index of Refraction – Controls how quickly the gradient progress from low to high color. A value of 1.0 will produce only the Low color. As IOR increases, the gradient pushes more toward the high color.
- Invert – Reverses the High and Low colors
- Exit Attenuation – Required for transparent materials.

Normal

Creates a gradient between high and low colors based on the angle between the surface normal and the specified vector

Properties

- High Color – The color to use when the normal is the same as the vector. The angle between the surface normal and the vector is 0 degrees.
- Low Color – The color to when the normal is 90 degrees or more from the vector.
- X Axis – The x component of the comparison vector
- Y Axis – The y component of the comparison vector
- Z Axis – The z component of the comparison vector

Fresnel Conductor


Models a material that absorbs light but does not transmit light.

Properties

- Index of Refraction – The color of light reflected from the surface
- IOR Intensity – Multiplier on the IOR reflected light
- Absorption – The color of light absorbed by the surface
- Absorption Intensity – Multiplier on the Absorbed light
- NK File – File specifying complex IOR values for the material

Ramp

Specifies a multi-point gradient along a specified vector

Ramp is unique among textures in that you click the  button to add points along the gradient. Each point specifies a color and a fraction along the vector to put that color. The

gradient is interpolated between points

Properties

- Type – Controls how to interpolate between colors
- Axis X, Y, Z – Specify the vector along which colors are evaluated
- Offset X, Y, Z – Offset of color points along the vector
- Use Group Coordinates – Indicates that the group/component origin will be used as the origin for the material, instead of the scene's axis origin.

Wire Frame

Creates lines along the edges of the geometry.

Properties

- Inner Color – The color of the non-line area
- Wire Color – The color of the wireframe lines
- Thickness – The thickness of the lines in millimeters
- Fadeout – The thickness of the fade of the lines
- Hard Edge Angle – The angle between two faces that represents a hard edge
- All Edges – Lines should be drawn along all edges
- Silhouette Edges – Lines should be drawn on edges that border the object silhouette
- Open Edges – Lines should be drawn along edges that do not connect to another face
- Soft Edges – Lines should be drawn along edges whose face normals are separated by less than the Hard Edge Angle (ie. not hard edges).
- Hard Inner Edges – Lines should be drawn along edges whose face normals are separated by more than the Hard Edge Angle
- Hard Outer Edges – Lines should be drawn along edges whose face normals are separated by more than the Hard Edge Angle



In order for Silhouette Edges and Open Edges to be drawn correctly (or at least as expected), the material Root must have 'Weld Vertices' checked. Note that welding vertices can cause incorrect UV mapping.

Layer Textures

Layer Textures work by adding 1 or more textures beneath them. How the included textures are combined is different for each layer type.

Addition

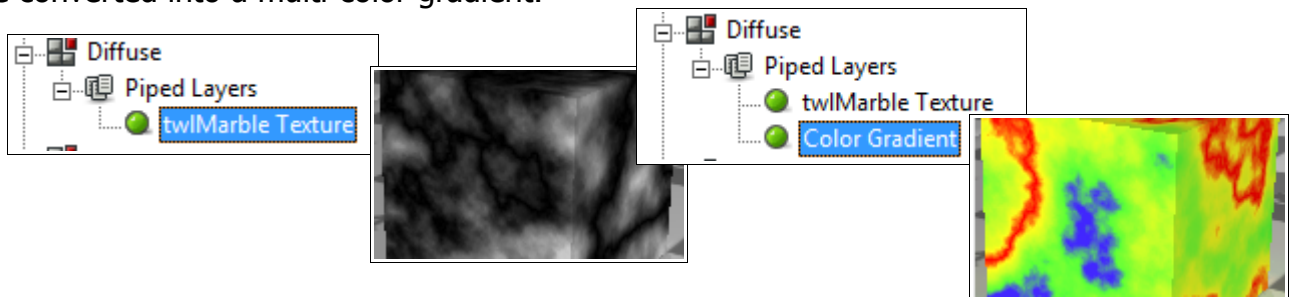
The result of each included texture is added directly to the final result, a 'sum' operation. After adding textures to the layer, selecting the Added Layers element will list a Weight value for each layer, allowing layers to be combined in different proportions.

Multiply

The result of each included texture is multiplied by the accumulated result of all the textures above it, a 'product' operation. Each color channel (RGB) is multiplied separately.

Piped

The Piped Layers element is a bit complicated, at first. Essentially, the result of one texture (a color RGB) is fed as the three-dimensional location to the next texture. For most textures, this does not produce usable results. However, there is one specific arrangement that can be **very** useful. When a texture (often a procedural texture) is fed into a Ramp texture, the 2-color gradient (all procedurals and most other textures only produce a 2-color gradient) can be converted into a multi-color gradient.



There are more uses for the Piped Layer element, but incorporating a multi-color gradient is the most useful. Some more uses will be discussed next in the Procedurals section below.

Procedural Textures

Procedural textures are mathematical algorithms that take a three-dimensional point as input and use it to create a color (RGB) output. The texture may be non-repeating, anti-aliased, and infinitely detailed. The down-side is that, being mathematical, the renderer must run the algorithm for each point rendered which may increase the total render time.

Twilight Render comes installed with a large set of procedural 'plugins'. These are separate code libraries that the rendered loads when necessary to render the procedural. All the Twilight Render V1 procedurals have been completely rebuilt to make them faster and more detailed. In addition, updates of Twilight Render V2 will continue to add new procedurals.



All Twilight Render procedural libraries are the property of Twilight Render LLC and can not be distributed outside of the standard Twilight Render installation.

Common

Most procedurals are built on a common configuration and share some common properties.

Properties

- High Color – The first color in the 2-color gradient
- Low Color – The second color in the 2-color gradient
- Invert – Swap the High and Low Colors
- Seed – The random number seed to create unique patterns
- Use Group Coordinates – If checked, the origin of the group or component using the material is considered the origin of the texture. If unchecked, the origin of the entire scene is considered the origin of the texture.
- Offset X, Y, and Z – Offsets the position of the texture in the x, y, and z direction.
- Scale X, Y, and Z – Scales the features of the texture in the x, y, and z direction.

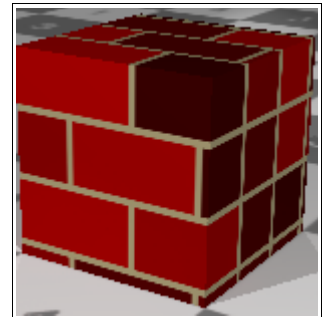
Many procedurals contain more properties that can be used to modify the result of the texture. Below is a list of **some** of the procedurals with brief descriptions of the properties.

mBrick

Creates a stacked brick pattern. High color is the brick, low color is the mortar.

Properties

- Aspect Ratio – The aspect ratio of the bricks
- Brick Offset – Shifts the brick layers as they stack
- Mortar Percent – The thickness of the mortar lines
- Axis – The axis along which the rows of bricks run
- Random Bricks – When checked, the brick color is interpolated randomly between the High Color and the Random Color.



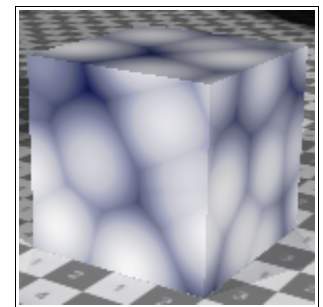
Updated from Twilight Render V1, the brick texture is now fully anti-aliased and does not produce any sharp transitions.

mCells

Creates a cellular or cobblestone patter (depending on settings).

Properties

- Chord – Sets how the pattern is filled
- Metric – Sets how the lines of the pattern are drawn



mCheckers

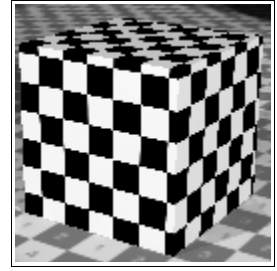
Creates a checker board pattern.

Properties

- Random Squares – Creates random squares of color interpolated between the Random Color and the High or Low Color.



Updated from Twilight Render V1, the checker texture is now fully anti-aliased and does not produce any sharp transitions.



twlCloud

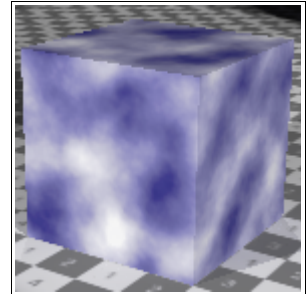
Creates a rough cloud pattern. The cloud texture contains a pair of Perlin noise functions that act together.

Properties

- Amplitude A / B – Determines the amount of detail in the pattern
- Step A / B – Determines the size of the detail in the pattern



The twlCloud pattern is completely rebuilt and is not the same as the previous pattern from V1, mCloud. mCloud is still available under Version 1.0 Procedurals.



twlMarble

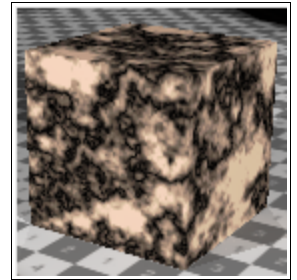
Creates a rough pattern with a marble thread running through it.

Properties

- Amplitude – Determines the amount of detail in the pattern
- Step – Determines the size of the detail in the pattern
- Sharpness – Sets the thickness of the marble thread



The twlMarble pattern is completely rebuilt and is not the same as the previous pattern from V1, mMarble. mMarble is still available under Version 1.0 Procedurals.



twlRock

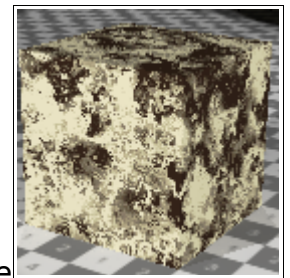
Creates a very rough, rock-like pattern.

Properties

- Amplitude – Determines the amount of detail in the pattern
- Step – Determines the size of the detail in the pattern



The twlRock pattern is completely rebuilt and is not the same as the previous pattern from V1, mRock. mRock is still available under Version 1.0 Procedurals.



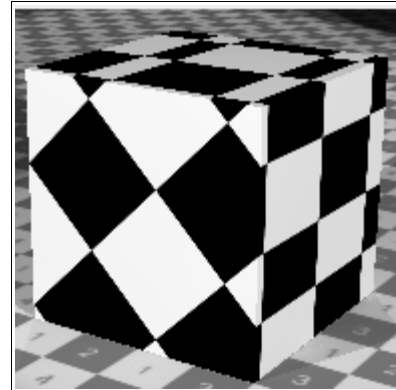
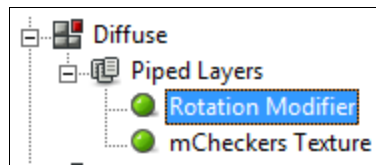
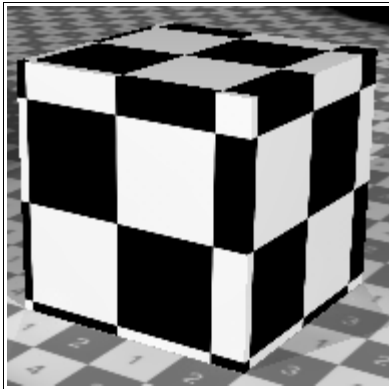
There are many more procedurals available and more are being added all the time. We encourage you to experiment and share your discoveries at www.TwilightRender.com.

Modifiers

Modifiers are special purpose procedurals designed to modify the behavior of other procedurals. This is accomplished using the Pipe Layer element. The modifier is added first. The results of the modifier, depending on what it is, are passed to the second procedural texture to produce a changed result.

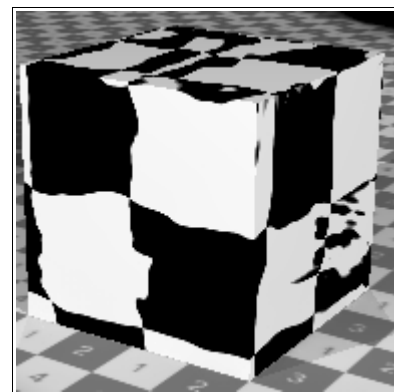
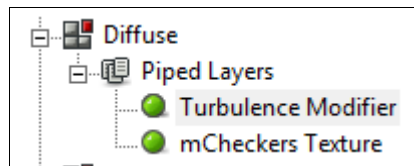
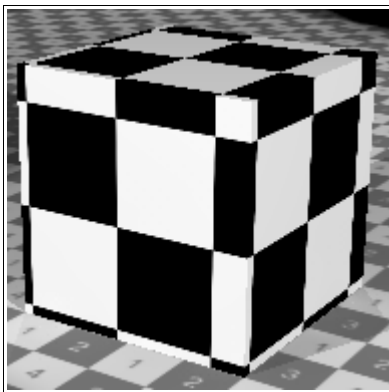
Rotation Modifier

Rotates the following procedurals around one or more axis.



Turbulence Modifier

Introduces turbulent noise into the following procedurals.



Modifiers are a great way to introduce randomness and detail to a scene.



Modifiers usually do not correctly effect Image texture elements. The results are not normally usable.

Tips and Tricks

There are a few useful tips that can make creating realistic materials much easier. Below is a list of important things to know when starting out on a serious material making venture.

Conservation of energy

From physics, we know that the total amount of light that is reflected from and passed through a material can not be more than the light falling on that material (unless it is a light emitting material). If that seems confusing, it just means that when you add up the colors from each channel, the total shouldn't be more than pure white (RGB: 255,255,255).

If you have a material with the Diffuse channel set to White (255,255,255) and the refraction set to White, you now have a material that both transmits 100% of the light falling on it, and reflects 100% of the light falling on it. At 200%, that material will glow like a light bulb!

In the same way, a material with Refraction set to White and Transmitted set to White will allow 200% of the light falling on it to pass through it. Again, it will glow as it will be generating more light than what falls on it.

Sometimes, as materials become more complicated, it becomes difficult to determine if your material is 'balanced'. That's why it's helpful to start out with one of Twilight Render's templates, convert to Deep material, and edit from there. The templates, with few exceptions, are automatically configured to be balanced.

Understand Fresnel

In the real world, materials exhibit Fresnel reflectance. If you are looking at a point on a curved object, like a ball, as your viewpoint gets closer and closer to a 90 degree angle with the surface normal (If you start in the center of the ball and move out closer and closer to the edge), the surface becomes **more** reflective. This isn't always obvious, but a material that simulates this behavior will appear more realistic than one that doesn't.

To that purpose, we recommend the use of the Fresnel texture element. You will notice, with a little exploration, that the Fresnel element is used in **a lot** of Twilight Render templates.

Watch Your Alpha

The alpha, or transparency, of the SketchUp material can have a big effect on your results when you are converting from a Template. The templates all automatically account for transparency (where practical; metal's don't support transparency) and the alpha value is pulled directly from the SketchUp material (unless overridden in the Template editor). Transparent materials generally take a lot longer to render than solid ones, so take care not

to create partially transparent materials when you don't need them.

Don't go too Deep

Layers have a lot of power and are fundamental to creating realistic materials. However, each element added increases the render time. Don't go overboard adding layers. Add just enough to create the effect you want and take the time to consider if there is a different way to achieve what you want without adding more layers.

Use the Specials

The Material channel has several special elements. These are actually composite elements that give you a shortcut when creating some common configurations.

Wireframe Layer

This special element automatically sets up a paired set of materials, one for the wireframe and one for...not. You can easily create some great wireframe effects with very little setup.

Paired Layer

Above we talked about using the Fresnel texture to create realistic, balanced materials. The Paired Layer quickly sets up channels for two materials that can be balanced against each other using Fresnel weights.

Use the Tools

Don't forget to use copy-and-paste. After you've set up a good procedural texture for Diffuse, it's easy to copy and paste it into a Bump Map to create matching bump effect.

Ultimately, the Deep Material Editor is about exploration and discovery, finding a way to create the perfect material for your scene. Don't be afraid to experiment!