Maxwell for SketchUp

version 2.6.0

Contents

1 Plugin Versions

The Maxwell for SketchUp plugin exists as two separate products: the *Standalone* plugin, and the *Render Suite* plugin.

1.1 Maxwell for SketchUp (*Standalone*)

The *Standalone* plugin has no dependencies on Maxwell Render; all rendering is done directly inside of SketchUp, using the *Maxwell Fire* window. Throughout this manual, topics and features which only apply to the *Standalone* plugin are marked using **[SA]**.

This plugin is distributed using a single .zip file which supports both SketchUp and SketchUp Pro, versions 6 and up, on Windows and OSX. Installation is accomplished by simple copy & paste. In order to support the free version of SketchUp, data-transfer from the SketchUp model into the Maxwell scene description (a.k.a *export*) is accomplished using a Ruby-based exporter.

By default, the *Standalone* plugin is provided freely, with a *Free* license (see section 4.4, *Maxwell Render EULA.pdf*, included in the plugin .zip file) which allows you to render images without making any purchase from Next Limit. Under this license:

- The rendered output resolution is limited to 800 pixels.
- The render engine is restricted to rendering in its *Draft* (7.2) mode.

Optionally, a *Commercial* license (see section 4.1, *Maxwell Render EULA.pdf*) may be purchased. This license may be activated (a license key will be sent by email upon purchase) from within the plugin, providing for an 'in-place' upgrade. Under an activated (5.6) *Commercial* license:

- The rendered output resolution limit is increased to 1920 pixels.
- The render engine is allowed to render in its *Production* (7.2) mode.

The *Standalone* plugin, being written in Ruby, supports neither SketchUp's 2-D Perspective mode, nor by-layer materials.

1.2 Maxwell for SketchUp (*Render Suite*)

The *Render Suite* plugin expects to find a full Maxwell Render Suite installation on the machine. Throughout this manual, topics and features which only apply to the *Render Suite* plugin are marked using **[RS]**.

Although it is possible, as with the *Standalone* plugin, to render images from within the plugin, this is not the primary intended workflow for the *Render Suite* plugin; rather, it is primarily designed to accommodate rendering in Maxwell Render, outside of the SketchUp process.

As such, the *Render Suite* plugin provides much broader functionality than the *Standalone* plugin. For the most part, this functionality concerns features which are provided by Maxwell Render itself, for example, the output of Maxwell MXS files, editing of Maxwell MXM files in Maxwell's MXED material editor, network rendering via Maxwell Render's Network Rendering system, etc.

Additionally, this plugin requires SketchUp Pro, since it uses a very high performance C++ -based MXS Exporter to transfer data from SketchUp into Maxwell's format.

When the *Render Suite* plugin is run in the absence of a valid Maxwell Render Suite license, it will operate in its *Demo* mode. When running in *Demo* mode, the plugin's Maxwell Fire implementation will provide the same functionality as that of a *Standalone* plugin running on the *Free* license.

2 Technical

2.1 Supported Platforms

[SA] The *Standalone* plugin is designed for use with:

- SketchUp and SketchUp Pro, version 6 or greater
- 32- and 64-bit Windows XP or greater
- Mac OSX 10.5 or greater, on Intel processors

[RS] The *Render Suite* plugin is designed for use with:

- Maxwell Render Suite 2.6
- SketchUp Pro only, version 6 or greater
- 32- and 64-bit Windows XP or greater
- Mac OSX 10.5 or greater, on Intel processors

2.2 [SA] Installation

The *Standalone* plugin is delivered using a single download, in .zip format. Installation is performed by simply copying one file and one folder using Windows Explorer or OSX Finder.

Installation may be performed as many times as desired, as may be the case when there are multiple versions of SketchUp installed on the machine. This method of deployment may be described as *low-impact*, in that it does not alter the state of the machine (i.e. registry, etc.). Uninstallation is accomplished by simply reversing the installation; in other words, by deleting the plugin's files using Windows Explorer or OSX Finder.

2.2.1 Windows

1. Unzip the downloaded .zip file to your Desktop.

2. Locate the Google SketchUp **Plugins** folder. You will find this inside the folder where you installed SketchUp, typically: **C:\Program Files (x86)\Google\Google SketchUp 8\Plugins**.

3. Copy **maxwell.rb** and the **maxwell** folder from the unzipped **plugin** folder into the SketchUp **Plugins** folder.
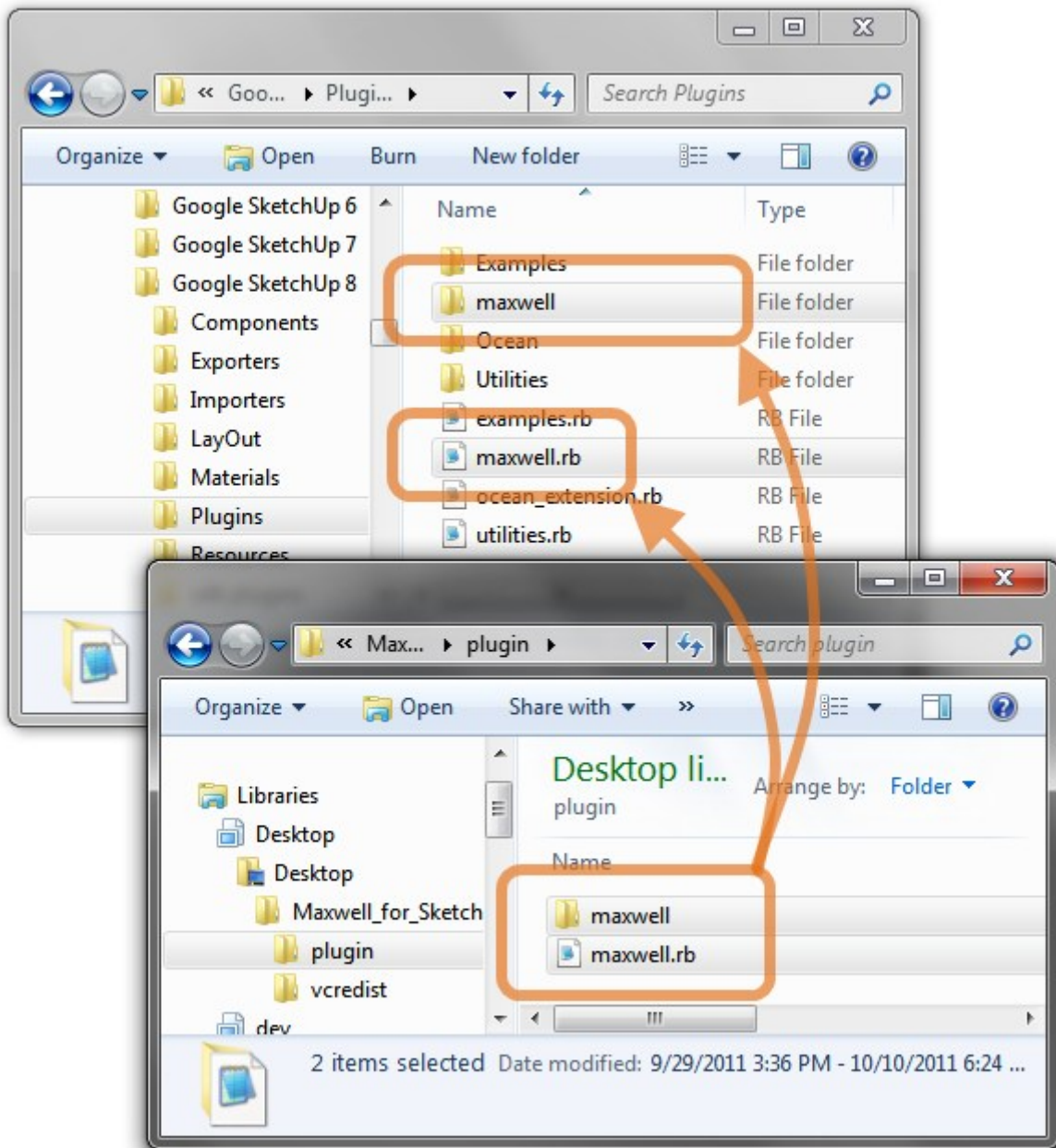
Figure 2.2.1: Copy **maxwell.rb** and the **maxwell** folder.

4. Install *Microsoft Visual C++ 2008 SP1 Runtime*: navigate to the **vcredist** folder, right-click on **vcredist_x86.exe**, and choose *Run as administrator*.

5. Start SketchUp; you should find that you have a new toolbar, and a new **Maxwell** item in your SketchUp **Plugins** menu.

2.2.2 Mac OSX

1. Unzip the downloaded .zip file to your Desktop.

2. Locate the Google SketchUp *plugins* folder. You will find this inside your **/Library/Appli-cation Support** folder, typically: **/Library/Application Support/Google SketchUp 8/S-ketchUp/plugins**.

3. Copy *maxwell.rb* and the *maxwell* folder from the *plugin* folder in the unzipped download into the SketchUp *Plugins* folder.
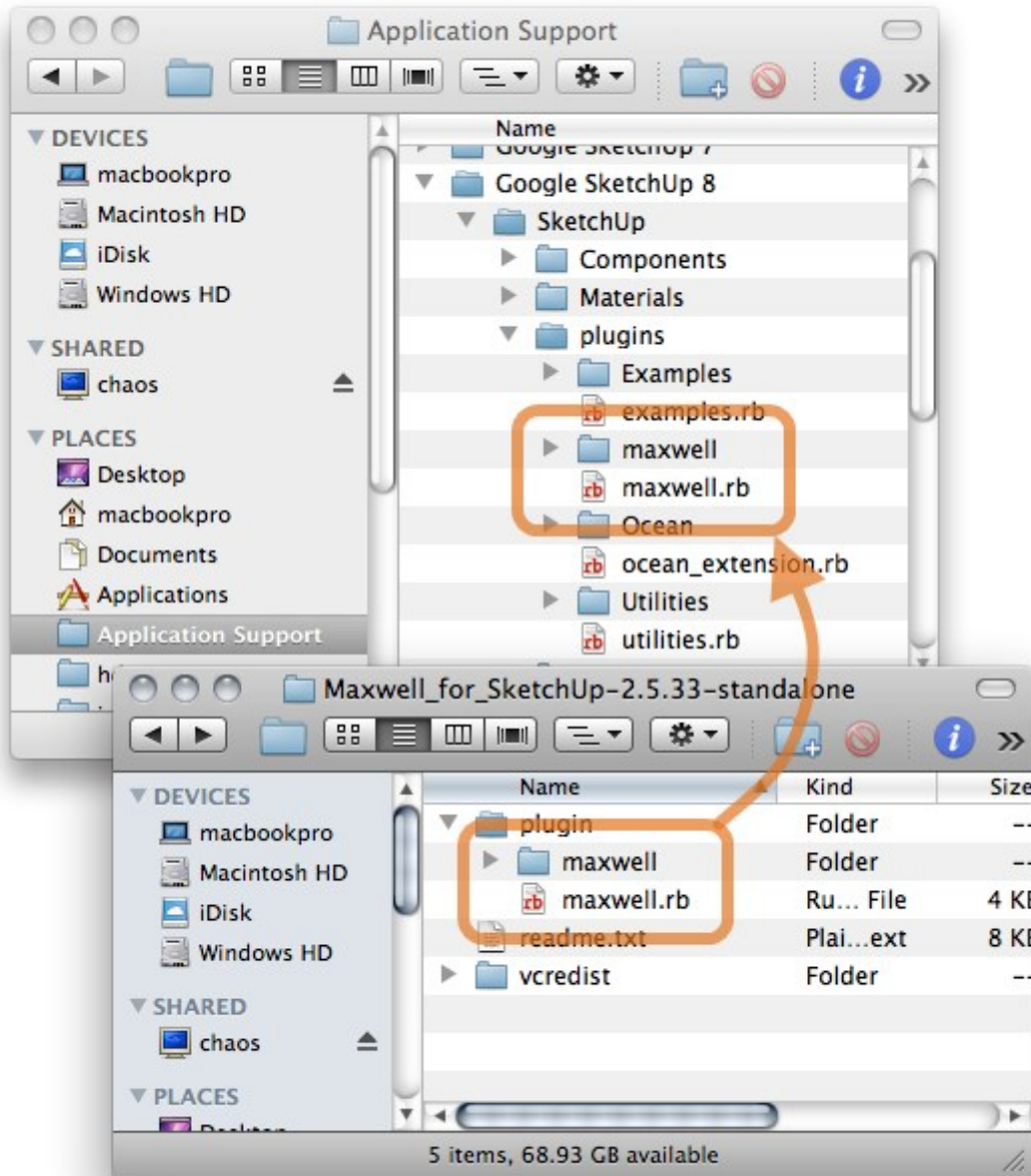
Figure 2.2.2: Copy **maxwell.rb** and the **maxwell** folder.

4. Start SketchUp; you should find that you have a new toolbar, and a new *Maxwell* item in your SketchUp *Plugins* menu.

2.3 [RS] Installation

The *Render Suite* plugin uses OS-specific installer technology. Separate installers are provided (on the plugin download page) for the various combinations of SketchUp version (6/7/8) and operating system (Windows/OSX).

2.3.1 Windows

As downloaded, the plugin consists of a .zip file. Installation is accomplished using the following steps:

1. Unzip the downloaded .zip in a location where you possess rights to install software.

2. Navigate to the **setup** subfolder, right-click on **setup.exe**, and choose *Run as administrator*.

3. The installer allows you to specify the directory into which files will be written. The directory path specified here should be your SketchUp directory, typically **C:\Program Files (x86)\Google\Google SketchUp 8**.

4. Once installed, the plugin should automatically appear in SketchUp; if you do not see a new plugin toolbar, go to SketchUp's *Preferences > Extensions* window and make sure the *Maxwell for SketchUp* extension is enabled.

Note that the plugin's installer is not capable of uninstalling some very old versions of Maxwell's SketchUp plugin. If you have any doubt about whether one of these might be installed, use Windows *Programs and Features* (*Add or Remove Programs* in XP) to verify that you do not find any entries named similar to *MaxwellExport (Version 2.x)*.

If such a plugin is indeed currently installed, you should also find a *MaxwellExport.dll* (actual name may vary slightly) in your SketchUp *Extensions* directory. If not removed, this will cause the new plugin to malfunction; for example, it may start two instances of Maxwell Render when rendering, or one, when attempting to write an MXS file or render in Maxwell Fire. If you find that any of the above things are true, it will be necessary to remove the old plugin components:

1. Use Windows *Programs and Features* to uninstall the old plugin.

2. Delete any Maxwell-related .dll files from **[SketchUp 8]\Extensions**.

3. Delete any Maxwell-related files and folders from **[SketchUp 8]\Plugins**.

4. Use Windows *Programs and Features* to *Repair* the new plugin.

2.3.2 Mac OSX

As downloaded, the plugin consists of a .zip file. Installation is accomplished by the following steps:

1. Unzip the downloaded .zip in a location where you possess rights to install software

2. Double-click the package it contains, and follow the instructions to install the plugin.

3. Once installed, the plugin should automatically appear in SketchUp; if you do not see a new plugin toolbar, go to SketchUp's *Preferences > Extensions* window and enable the *Maxwell for SketchUp* extension.

Note: the installer expects to find SketchUp in its standard location. When this is the case, the installation will be accomplished automatically, as described above. If, however, you have installed SketchUp in a non-standard location, it will be necessary to extract the contents of this package (right-click, *Show Package Contents*) and install the plugin's components manually.

If this is necessary, extract and place the **Skp2Mxs.plugin** file into the folder on your machine which corresponds with:

/Applications/Google SketchUp [6,7,8]/SketchUp.app/Contents/PlugIns

Then, extract and place the file **maxwell.rb** and the **maxwell** folder into the folder on your machine which corresponds with:

/Library/Application Support/Google SketchUp [6,7,8]/SketchUp/plugins

If previous versions of the Maxwell plugin are present (i.e. **SkpToMxs.plugin**, **MaxwellExport.rb**, and the **Maxwell** folder), it will be necessary to delete them manually before installing new plugin files.

2.4 Notes on First Use

After installation, the plugin should automatically appear in SketchUp the next time it is started. If it does not, check SketchUp's *Preferences > Extensions* window to make sure the plugin extension is enabled.

The plugin's user interface is built using Microsoft Silverlight and requires a minimum of Silverlight 3.0. If you do not have Silverlight 3.0 or greater installed, you will be asked to download and install it the first time you open either the Scene Manager (6) or Maxwell Fire(7) window:
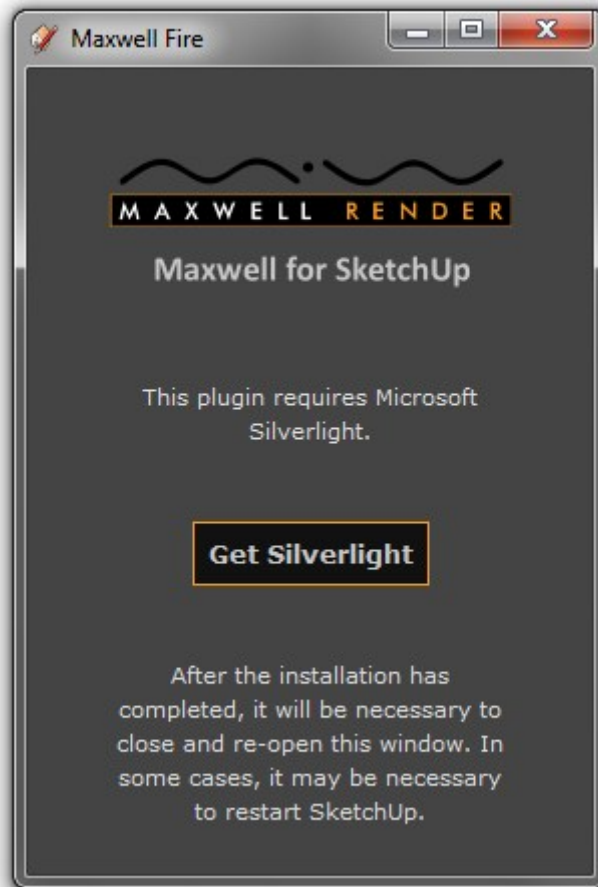
Figure 2.4.1: Install Silverlight.

To download and install Microsoft Silverlight, simply click the *Get Silverlight* button. Once Silverlight has been installed, it will be necessary, on Windows, to close and re-open the Scene Manager window, and on OSX, to close and re-open SketchUp. This is the case because Silverlight is a web browser plugin, and the web browser being provided by SketchUp must be re-started after the installation.

2.5 Notes on Plugin Files

The plugin consists of two main parts:

- A Ruby-based SketchUp Extension plugin, which consists of the file **maxwell.rb** and a folder named **maxwell**. These items are the same on Windows and OSX.

- **[RS]** A SketchUp 3D Exporter plugin, named **Skp2Mxs.dll** on Windows, and **Skp2Mxs.plugin** on OSX.

2.5.1 Windows

On Windows, **maxwell.rb** and the **maxwell** folder are located in SketchUp's **Plugins** directory. With the *Render Suite* plugin, the SketchUp MXS Exporter, **Skp2Mxs.dll,** is located in SketchUp's **Exporters** directory.

2.5.2 Mac OSX

On Mac OSX, **maxwell.rb** and the **maxwell** folder are located by default in **/Library/Application Support/Google SketchUp [6/7/8]/SketchUp/plugins**. With the *Render Suite* plugin, the SketchUp Exporter, **Skp2Mxs.plugin**, is located directly in SketchUp's app bundle, at **/Applications/Google SketchUp [6/7/8]/SketchUp.App/Contents/PlugIns**.

Note that these are the typical default locations,and the actual paths may differ slightly on your installation; if this is the case, refer to the Installation instructions above.

2.5.3 Relocation

Optionally, you may elect to move **maxwell.rb** and the **maxwell** folder to any location you wish. If these are moved out of SketchUp's standard plugins directory, SketchUp will no longer find, and will therefore no longer load, the plugin. To get things working again, all that is required is to make a new Ruby file (that is just a regular text file with the extension **.rb**) which will be responsible for loading **maxwell.rb** from its new location. One might name that file something like **maxwell_loader.rb**, and it would need to contain just a single line:

```
require 'C:/the/directory/where/maxwell/rb/is/now/located/maxwell.rb'
```

Figure 2.5.1: Example of *maxwell_loader.rb* code.

You would then need to place this **maxwell_loader.rb** file in the standard SketchUp **plugins** directory; at startup, SketchUp will find it and execute the **require** statement, loading the maxwell plugin from its new custom location. This strategy is used extensively during development: code is written and compiled for the most part on one machine, while being run and tested on multiple machines (and OSes). Using this strategy ensures that exactly the same code runs, regardless if it is being loaded from the local machine, or over the network.

2.6 [RS] Why is the plugin complaining that it cannot find Maxwell Render?

The plugin requires some way of finding the location of Maxwell Render on your machine, since it needs to be able to start various Maxwell Render executables when you render, edit MXM files, and so on. The methods used for locating Maxwell Render on your machine depend on which OS is in use.

On Windows

When Maxwell Render Suite is installed on your machine, it sets up an environment variable named **MAXWELL2_ROOT**, which points to the directory in which it was installed. Therefore, if the plugin ever indicates that it cannot find Maxwell Render, or any other Maxwell component, it means that you should open the Windows *Environment Variables* dialog (*Start > Computer > Properties > Advanced system settings > Environment Variables*) and check the existence, and value, of your **MAXWELL2_ROOT** variable:
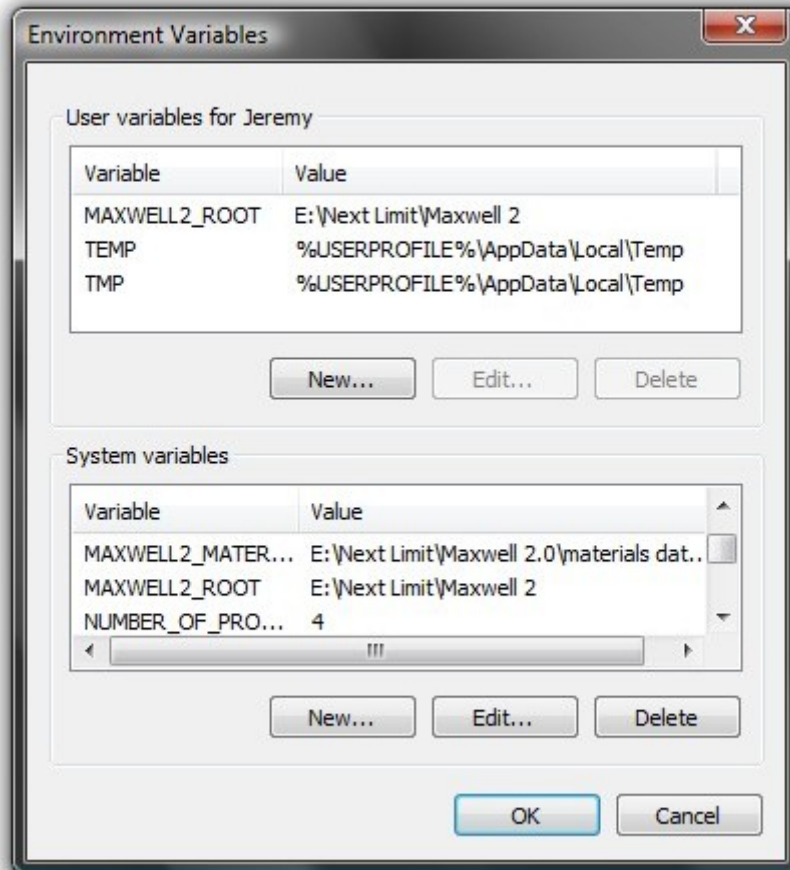
Figure 2.6.1: The Windows Environment Variables dialog.

As shown above, **MAXWELL2_ROOT** has been set in both the *User* and *System* variables sections. Note that the path to the Maxwell folder may be different on your machine.

On Mac OSX

If, when you attempt to render, the plugin indicates that it is unable to find Maxwell Render, this either means that you have not installed Maxwell Render Suite, or that the *.mxs* extension is not registered (in OSX Finder) to open with Maxwell on your system. If Maxwell Render Suite is indeed installed, it will be necessary to set *Maxwell.app* or *Studio.app* as the default application for .mxs files. To register the default application for .mxs files, follow these steps:

1. Right-click on an .mxs file in OSX Finder and choose *Open With > Other*.

2. Check the *Always Open With* box.

3. Locate and choose *Maxwell.app* or *Studio.app*.

4. Confirm that .mxs files are now opened in the correct application when double-clicked.

Note that when switching from one version of Maxwell Render to another, OSX Finder may still try to open .mxs files with the older version, even if it is in the Trash (or has been renamed or moved to another directory). If there is any question about which version is being opened, try using the following steps:

1. Empty the Trash.

2. Reboot the machine.

3. Perform the above-described registration process.

4. Reboot the machine.

5. Confirm that .mxs files are now opened in the correct application when double-clicked.

3 Overview

3.1 What is covered by this manual?

This manual includes all the information you need to know to use the Maxwell for SketchUp plugin. It goes into the details of some general Maxwell concepts, but it is not intended to replace the standard Maxwell Render manual, which may be opened using the Maxwell Manual menu item or toolbar button (5.4.2) . If any non-plugin-related parameters are not explained sufficiently here, please consult the standard Maxwell Render manual for further direction.

3.2 What do I need to know to use the plugin?

The Maxwell for SketchUp plugin has been designed to work in as simple a manner as possible. Wherever appropriate, unnecessary items have been optimized away, leaving what is intended to be a very simple and straightforward, yet complete, interface to Maxwell Render from within SketchUp. The list of items used to build Maxwell scenes and render them is very short; in fact, there are only four:

3.2.1 The Menu & Toolbar

The plugin adds a new Maxwell menu to SketchUp's Plugins menu. Note that the actual items may vary, depending on the actual installed plugin build.
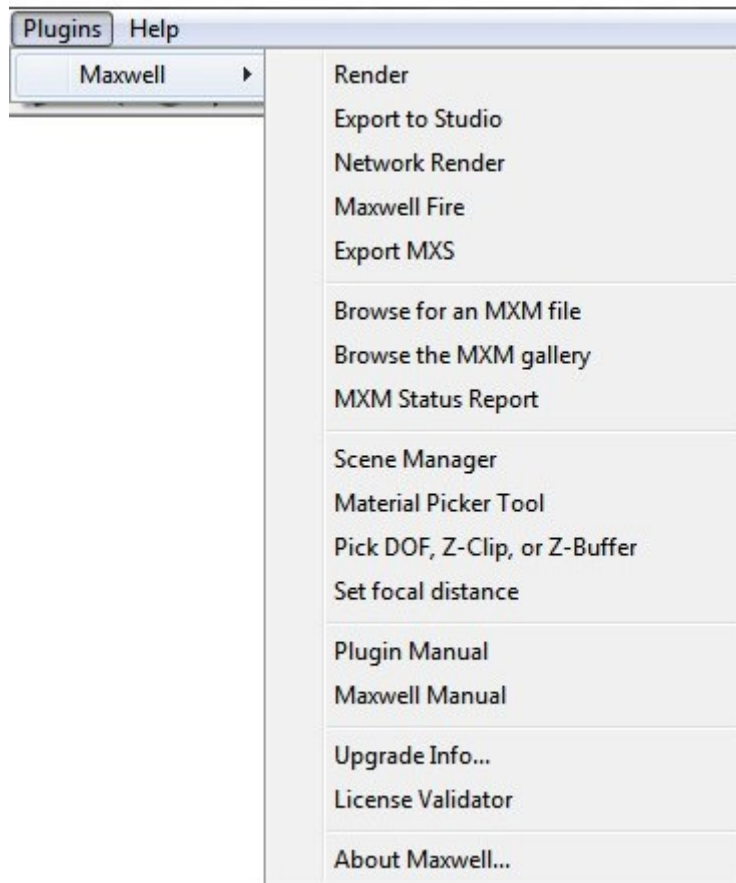
Figure 3.2.1: The Maxwell menu.

The plugin also adds a new toolbar, with commands which duplicate most of the commands found in the menu:

Figure 3.2.2: The plugin toolbar.

These commands fall into four main groups. Those related to writing, opening, and rendering MXS files do not appear in the *Standalone* plugin.

Rendering & Export (5.1)

Figure 3.2.3: The rendering & export command group.

Five commands are provided here:

- **[RS] Render**: Export the scene to an MXS file and render it using Maxwell Render. (**5.1.1**)

- **[RS] Export to Studio**: Export the scene to an MXS file and open it for editing in Maxwell Studio. (**5.1.2**)

- **[RS] Network Render**: Export the scene to an MXS file and render it using the Maxwell Network Rendering system. (**5.1.3**)

- **Maxwell Fire**: Opens or closes the Maxwell Fire window. (**7**)

- **[RS] Export MXS**: Simply exports the scene to an MXS file. (**5.1.5**)

MXM Browsing (5.2)

Figure 3.2.4: The MXM browsing command group.

Three commands are provided in this group:

- **Browse for an MXM file**: Opens Maxwell MXED in local-disk browsing mode. (**5.2.1**)

- **Browse the MXM Gallery**: Opens Maxwell MXED in MXM Gallery-browsing mode. (**5.2.2**)

- **MXM Status Report**: Shows a list of all materials and the status of their MXM paths. (**5.2.3**)

When an MXM file is selected by either *Browse* method (by double-clicking an MXM thumbnail in the MXED Browser for local browsing, or by downloading for MXM Gallery browsing), a new SketchUp material will be added to SketchUp's material list; this material will be linked to the selected MXM file.

If Maxwell MXED is not found (typically due to running the *Standalone* plugin), browsing the local disk will use a standard file browser, and browsing the MXM Gallery will open the Maxwell MXM Gallery web page in the default browser.

Scene & Camera (5.3)

Figure 3.2.5: The scene & camera command group.

Four commands are provided here:

- **Scene Manager***:* Shows the plugin's Scene Manager window. (5.3.1)

- **Select Tool**: Provides an eye-dropper for selecting the materials of entities in the model. (5.3.2)

- **Set DOF, Z-Clip, or Z-Buffer***:* Prompts for two points in the scene and once chosen, adjusts either the camera's DOF (Depth of Field), Z-Clip Planes, or Z-Buffer distances. (5.3.3)

- **Set Focal Distance***:* Prompts for a single point which, once chosen, is used to set the focal distance of the camera. (5.3.4)

Manuals (5.4)

Commands are provided for opening the this manual, or the Maxwell Render manual. If the Maxwell Render manual is not present on your machine, the plugin will attempt to navigate to an online version using your default web browser.

Upgrade Info (5.5)

This item only appears on the menu. If it is possible to upgrade the currently-installed plugin, clicking the *Upgrade Info* menu item will show the appropriate web page in your default browser.

[SA] License Validator (5.6)

This item only appears on the menu, and is only shown in the *Standalone* plugin, when it is running without a *Commercial* license. Clicking this item brings up the *Maxwell Render License Validator* window.

About Maxwell (5.4)

Shows the plugin's About box, which contains build and licensing information for the currently-installed plugin.

3.2.2 The Scene Manager Window

The *Maxwell Scene Manager* window is the single central point of access to all Maxwell-related scene parameters.
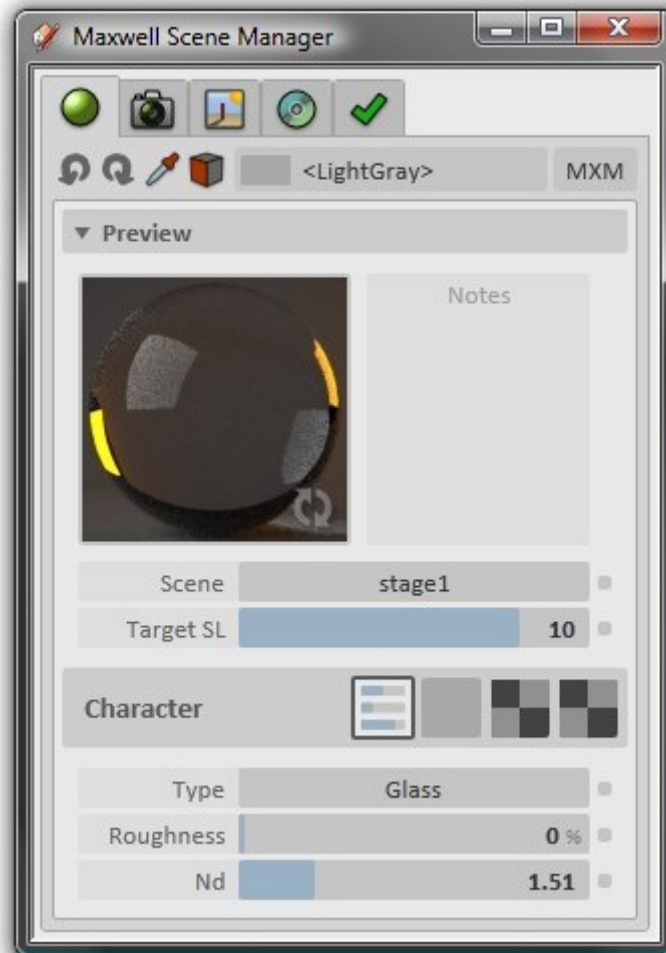
Figure 3.2.6: The *Scene Manager* window.

These parameters are divided into four main categories, *Materials*, *Camera*, *Environment*, and *Output*, each of which is represented in a tab in the Scene Manager.

3.2.3 The Maxwell Fire Window

In the *Standalone* plugin, all rendering is done using the Maxwell Fire window:
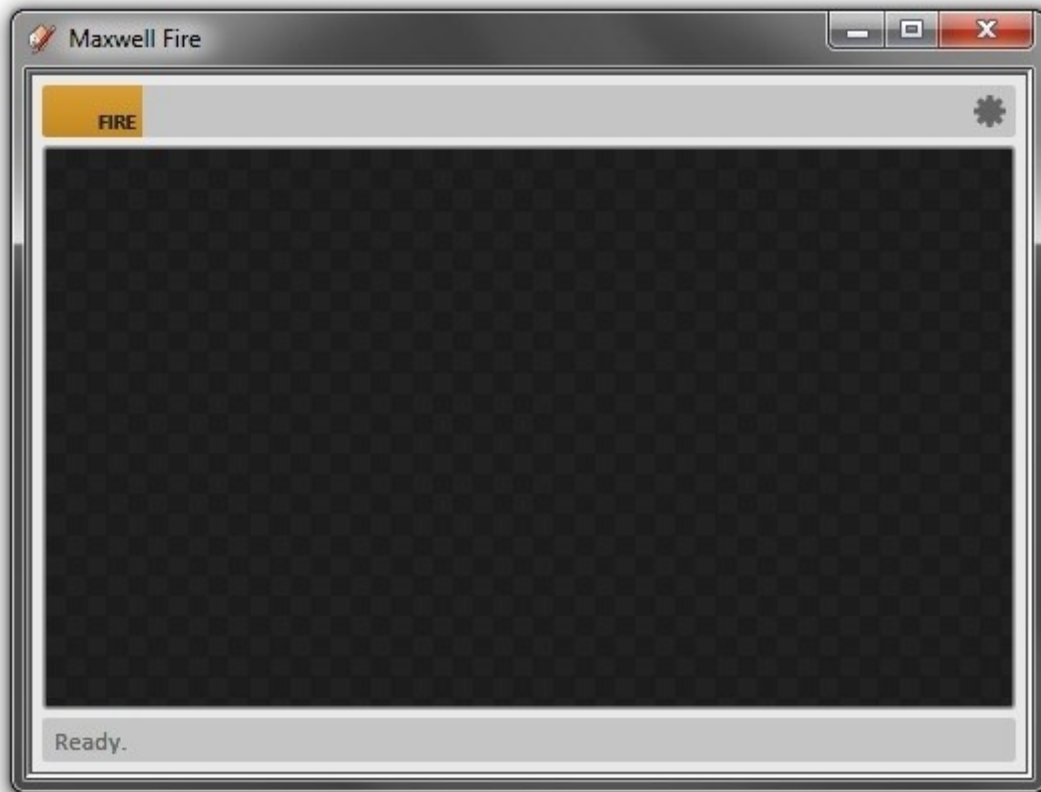
Figure 3.2.7: The Maxwell Fire window.

To render the scene, simply open the Maxwell Fire window and click the orange *Fire* button (7.1) near the top left corner of the window. The plugin will transfer (a.k.a *export*) data from the SketchUp model into the Maxwell format and begin rendering:

Figure 3.2.8: Maxwell Fire in the process of rendering.

When the rendering is finished, the image may be saved by clicking the *Save Image* button (7.1) in the Maxwell Fire toolbar. Though this is also the case in the *Render Suite* plugin, it is usually the case that Maxwell Fire serves as more of a scene-setup tool, with final rendering being done using Maxwell Render itself.

3.2.4 The Entity Context Menu

In the context (i.e. right-click) menu for SketchUp entities, you will find a *Maxwell* item:

Figure 3.2.9: The Maxwell entry in SketchUp's context menu.

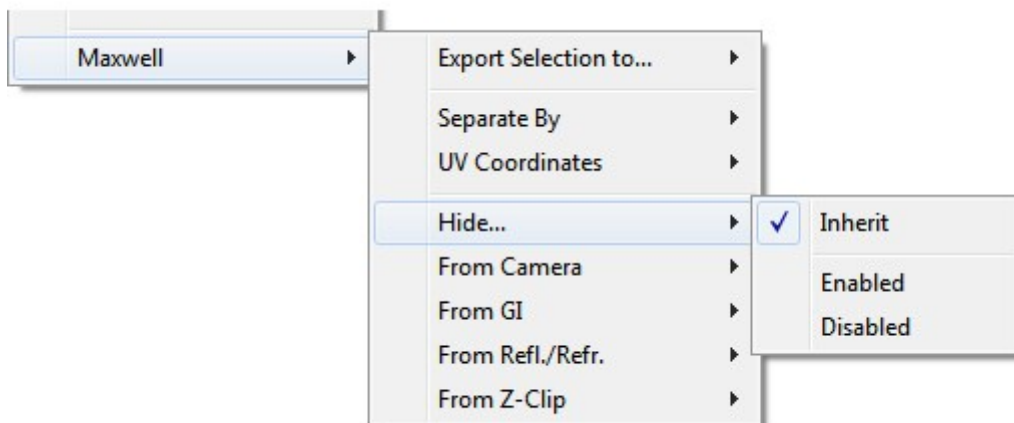The commands here allow you to enable the various Maxwell *Hide-to* flags (8.1) on a SketchUp entity, to decide how the faces it contains will be separated (8.2), and to decide whether or not to you would like to override SketchUp's UVs (8.3) for the entity. Additionally, there are commands for exporting or rendering just the selected entity (8.4).

3.3 Included Assets

All versions of the plugin are provided with a set of assets, which may be found in the plugin's *res* directory, which is located inside of the plugin's main *maxwell* folder. These assets are organized into several sub-directories:

mxm: This folder contains a rudimentary collection of pre-made Maxwell MXM files, along with associated texture files, located in a *textures* subdirectory. Maxwell MXM files may be used in plugin materials by using the material's *MXM Mode* (6.2.7).

ior: This folder contains the same collection of .ior files that ship with Maxwell Render Suite. IOR files may be used in the creation of Maxwell materials, by choosing the *Complex IOR* material *Character* (6.2.3).

preview: This folder contains Maxwell MXS files which are used by the plugin material editor to provide its list of material *Preview Scenes* (6.2.2). This folder is only used if no Maxwell Render Suite installation is detected on the machine, otherwise the *preview* folder found in your Maxwell folder will be used.

simulens: This folder contains various maps which are designed for use with Maxwell's *Simu-lens* (6.5.7) feature.

sky: This folder contains various Maxwell .sky files, which may be imported in the Scene Manager's *Environment* (6.4.1) page.

4 Plugin Quick Start

Following is a tutorial that will help you get started using the plugin.

4.1 Notes

Firstly, it is worth mentioning that it is entirely possible to render a scene simply by clicking the *Render* button (or opening the Maxwell Fire window and clicking the **Fire** button). The plugin will automatically convert SketchUp's materials into Maxwell materials, using various heuristics to decide how each material ought to be converted. This process, however, is somewhat limited by a lack of information in the source SketchUp material; for example, all non-transparent materials will be exported as simple diffuse Maxwell materials, simply because there is no parameter in the SketchUp material by which the plugin could infer whether or not it should be exported differently.

The determination of whether to export as transparent is made based both on the SketchUp material's *Opacity* value and on its color; in cases where it seems appropriate, the plugin will generate what is known in Maxwell as an *AGS* material – this is a glass-like material which works with non-volumetric meshes and also renders faster than a real dielectric glass material, due to its lack of refraction.

That aside, it is quite simple to customize how SketchUp materials are translated by the plugin. By default, the plugin's representation of the material (as seen in its material editor) will infer color and texture from the SketchUp material it is associated with. Additionally, a *Roughness* parameter is given; as this is reduced, the material will become more shiny and plasticine.

4.2 Scene & Material Setup

Let's try this out to see how it works. First, create a simple 1-meter rounded cube, make it into a Component, and create a copy.
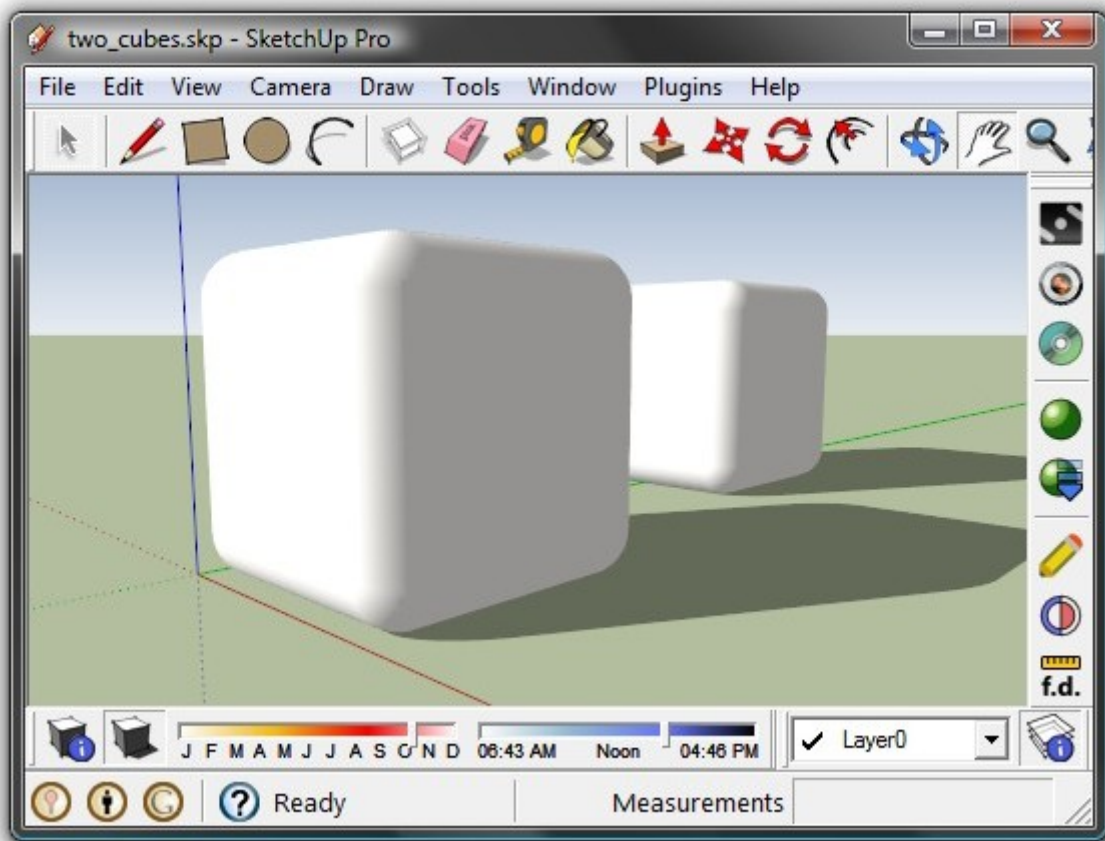
Figure 4.2.1: The example scene, shown in SketchUp.

Next, let's edit and assign a material to our first cube. In the plugin's toolbar, click the *Scene Manager* button.

Figure 4.2.2: The *Scene Manager* button.

The plugin's Scene Manager window will be shown. As you will see, there are five tabs at the top of the window; select the left-most tab to show the material editor. Next, from the drop-down list at the top of the page, select the *<Beige>2* material (or another if that one is not in your scene) and click the *Refresh Preview* button (at the bottom-right of the preview image) to generate a material preview for this material.
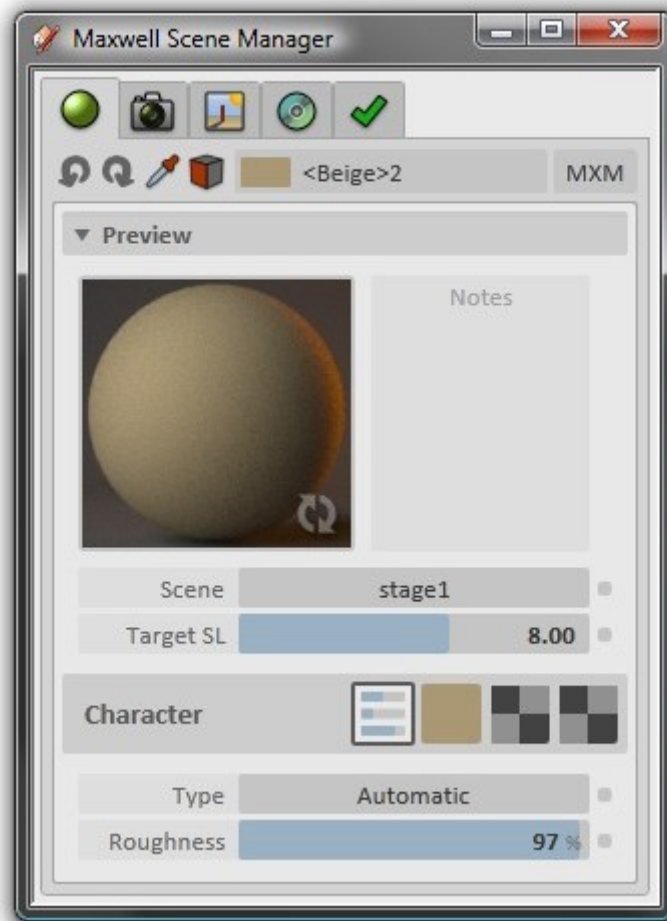
Figure 4.2.3: *<Beige>2* rendered using its default settings.

As you can see, by default, materials use a *Character* type of *Automatic* and a *Roughness* value of 97.0; this produces a diffuse material. If you inspect the *Type* drop-down, you will see that there are several types of materials available; for now, though, we will continue to use the *Automatic* type. Let's adjust the *Roughness* value down to 10% to see what that looks like (refresh the preview again after adjusting the Roughness).
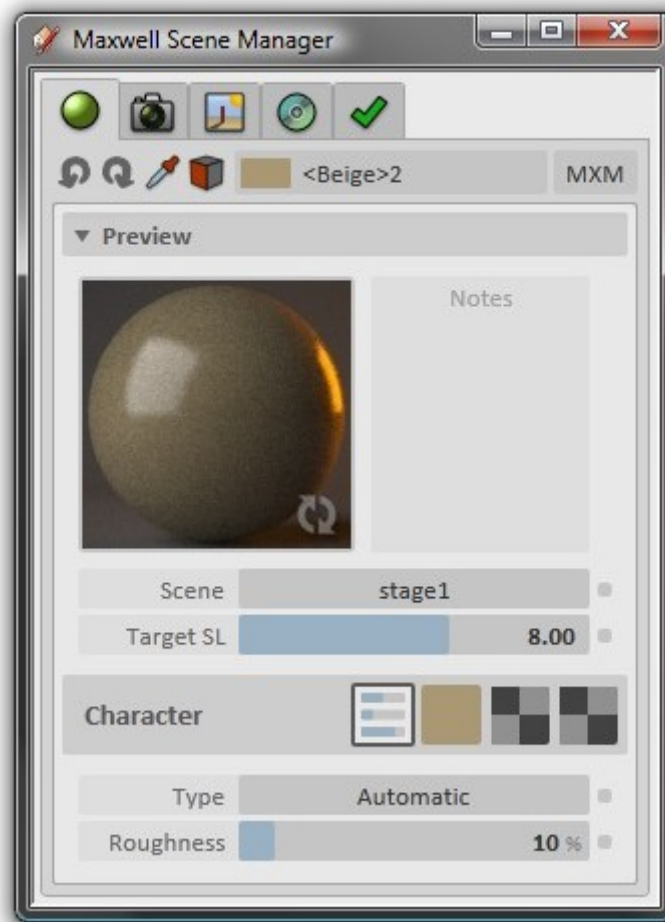
Figure 4.2.4: *<Beige>2* rendered with Roughness set to 10%.

Next, select the cube nearest the camera and click the *Assign to Selected Entities* button.
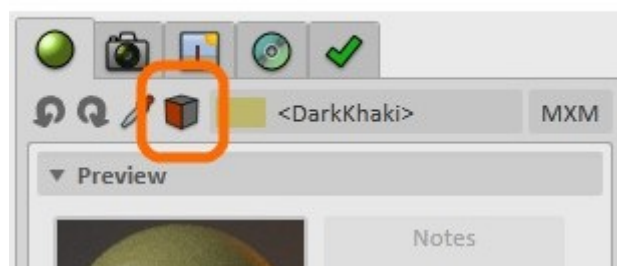
Figure 4.2.5: The *Assign to Selected Entities* button.

The material will be assigned to the cube.
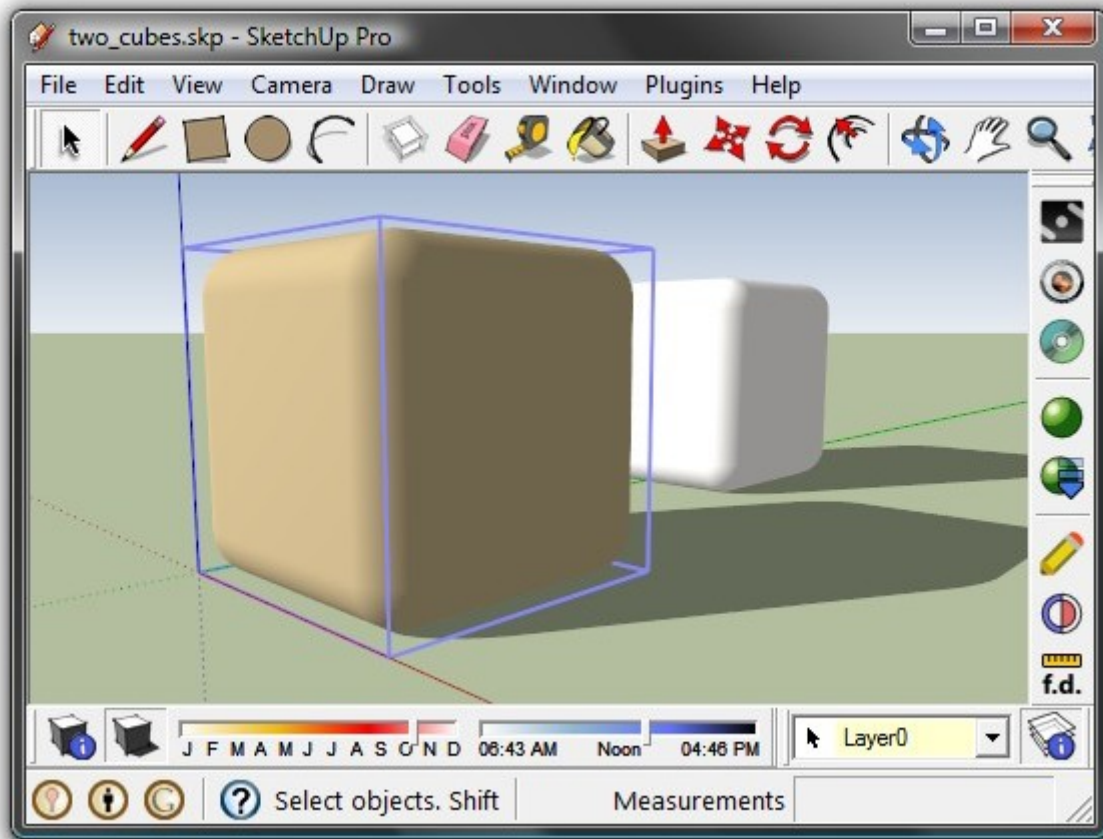
Figure 4.2.6: *<Beige>2* assigned to the near cube.

Now repeat these steps using the *jean blue* material, but assign it to the far cube.

4.3 Camera Setup

Before we render the scene, let's set up the camera; select the second tab in the Scene Manager to show the Maxwell camera parameters for the current SketchUp scene (in this case, there is no scene, so the camera will simply be named *Current*).

Figure 4.3.1: The *Camera* panel.

By default, cameras use what is referred to in the plugin as *Viewport* mode; when this is the case, the plugin will always infer the camera's resolution settings from the SketchUp viewport. We will continue to use this mode, but before we render, let's set the camera's focal distance; click the *Set Focal Distance* button in the plugin toolbar.

Figure 4.3.2: The *Set Focal Distance* button.

The plugin will prompt you to select a point in the scene; select the nearest face of the near cube.

4.4 Ground Plane

We could render now, but first, let's also enable the plugin's *Ground Plane* feature. Select the *Environment* tab in the Scene Manager and switch the Ground Plane mode from *Disabled* to

Application.
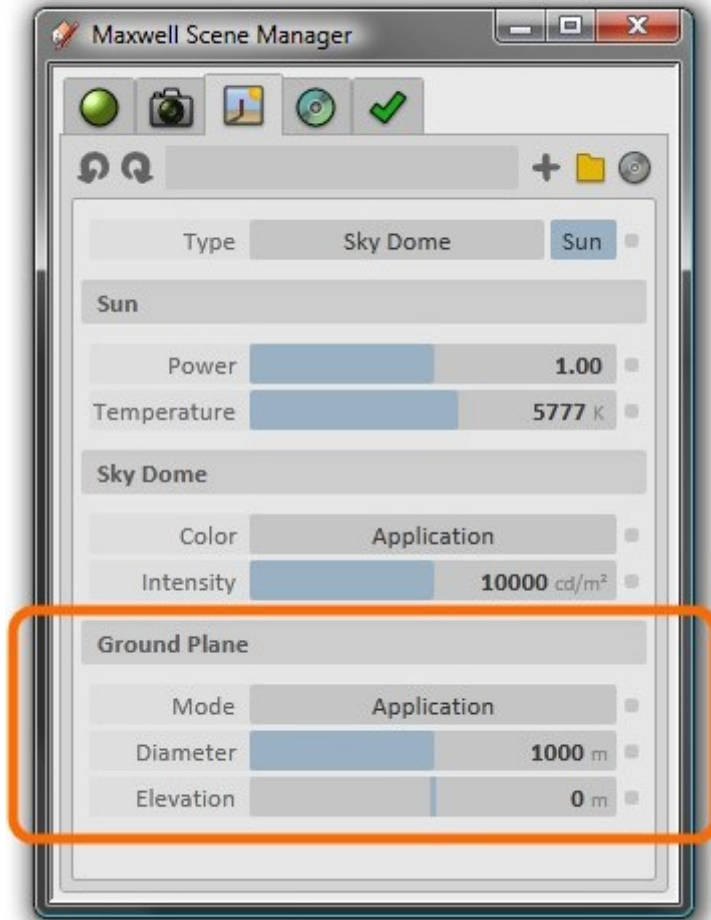
Figure 4.4.1: The *Ground Plane* panel.

Using this mode, the plugin will read the ground plane options from SketchUp and generate a suitable approximation in the exported Maxwell scene.

4.5 Rendering the Scene

Let's render the scene now and see how it looks. The method of rendering depends on the plugin version.

[SA] In the *Standalone* Plugin

Click the Maxwell Fire toolbar button to show the Maxwell Fire window:

Figure 4.5.1: The *Maxwell Fire* button.
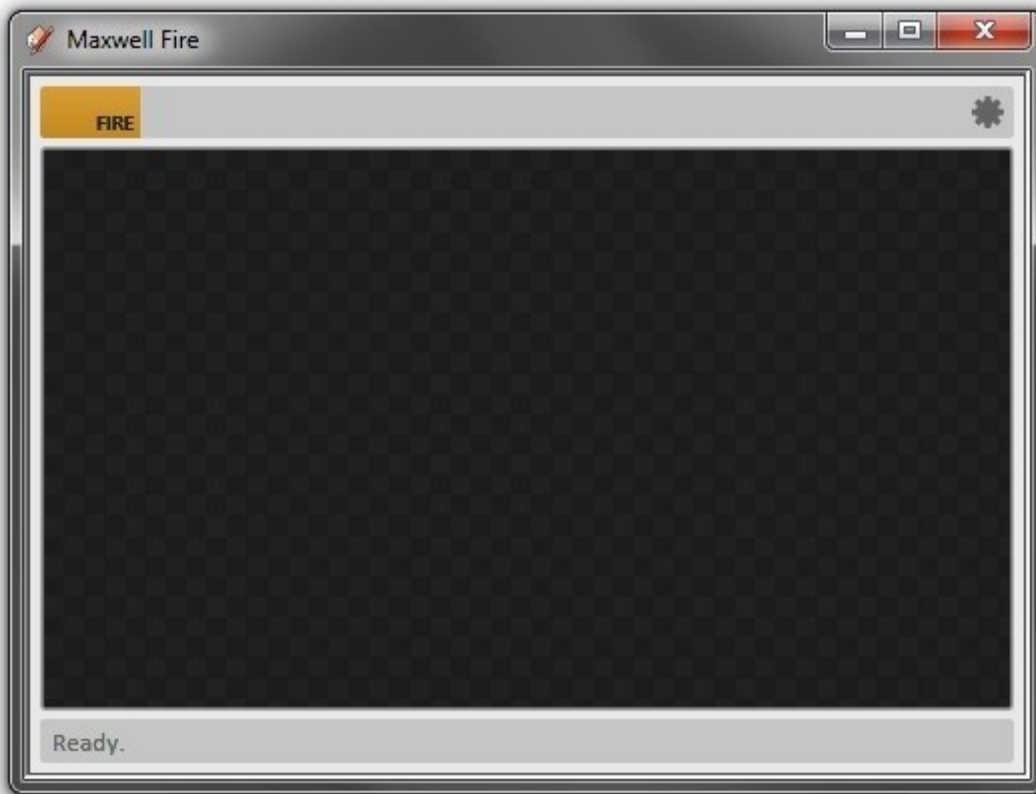
Figure 4.5.2: The *Maxwell Fire* window.

Next, click the window's *Fire* button to export the SketchUp model to Maxwell Fire and start rendering it:
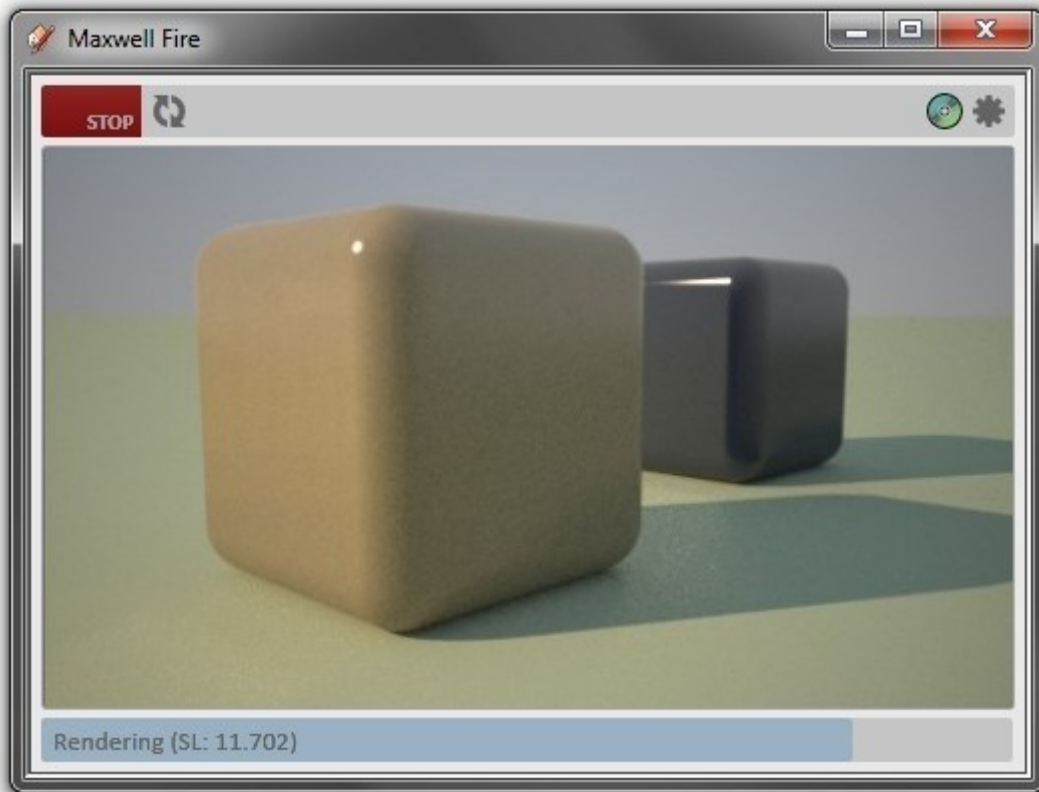
Figure 4.5.3: The scene, in the process of rendering.

[RS] In the *Render Suite* Plugin

First, click Render in the plugin's toolbar:

Figure 4.5.4: The *Render* button.

After doing so, scene will be exported to an MXS file, and Maxwell Render will be started, rendering the exported file.
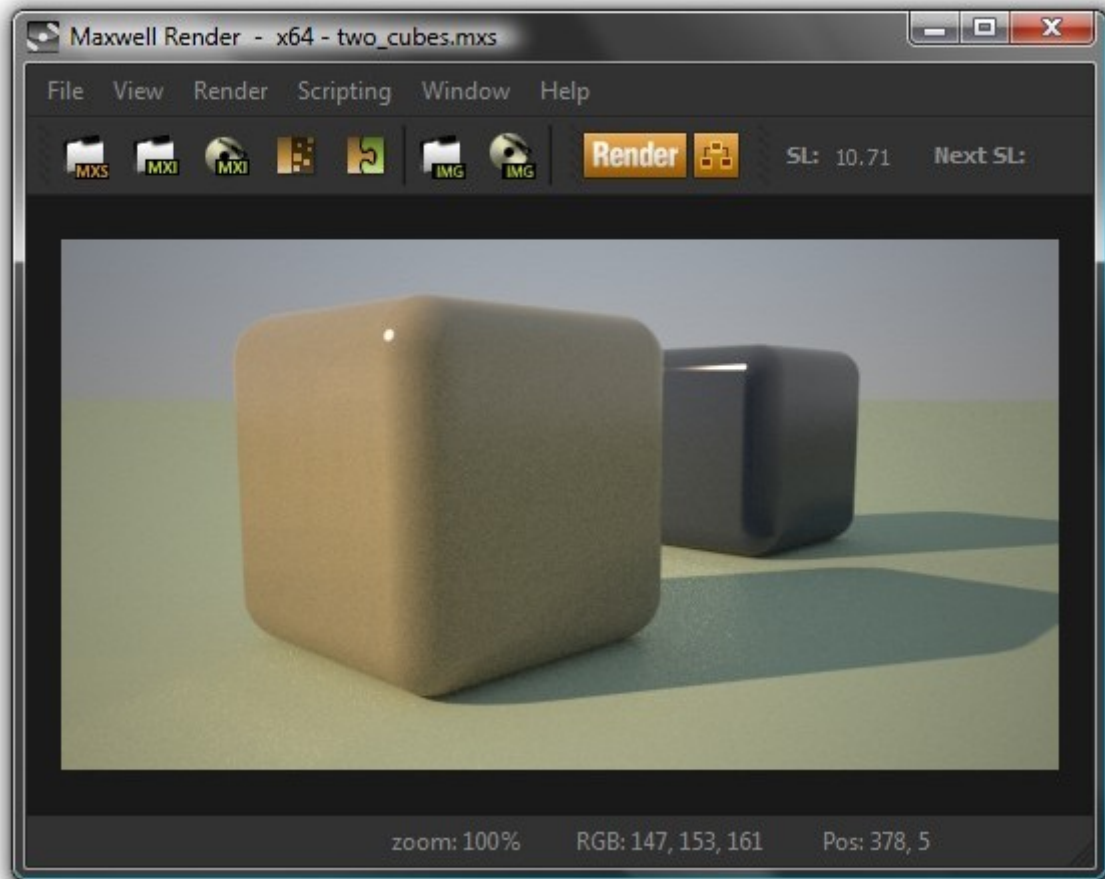
Figure 4.5.5: The scene, rendered.

Altering the scene

Next let's alter the scene a bit, before rendering again. Return to the Environment tab and switch the Environment *Type* from *Sky Dome* to *Physical Sky*. Then, since the size of the scene does not produce any noticeable DOF (depth of field) in the camera, move the camera closer to the near cube, open up the *fStop* to 1.2, and set the focal distance again, using a point similar to the one which was chosen previously. This produces a more dramatic composition:
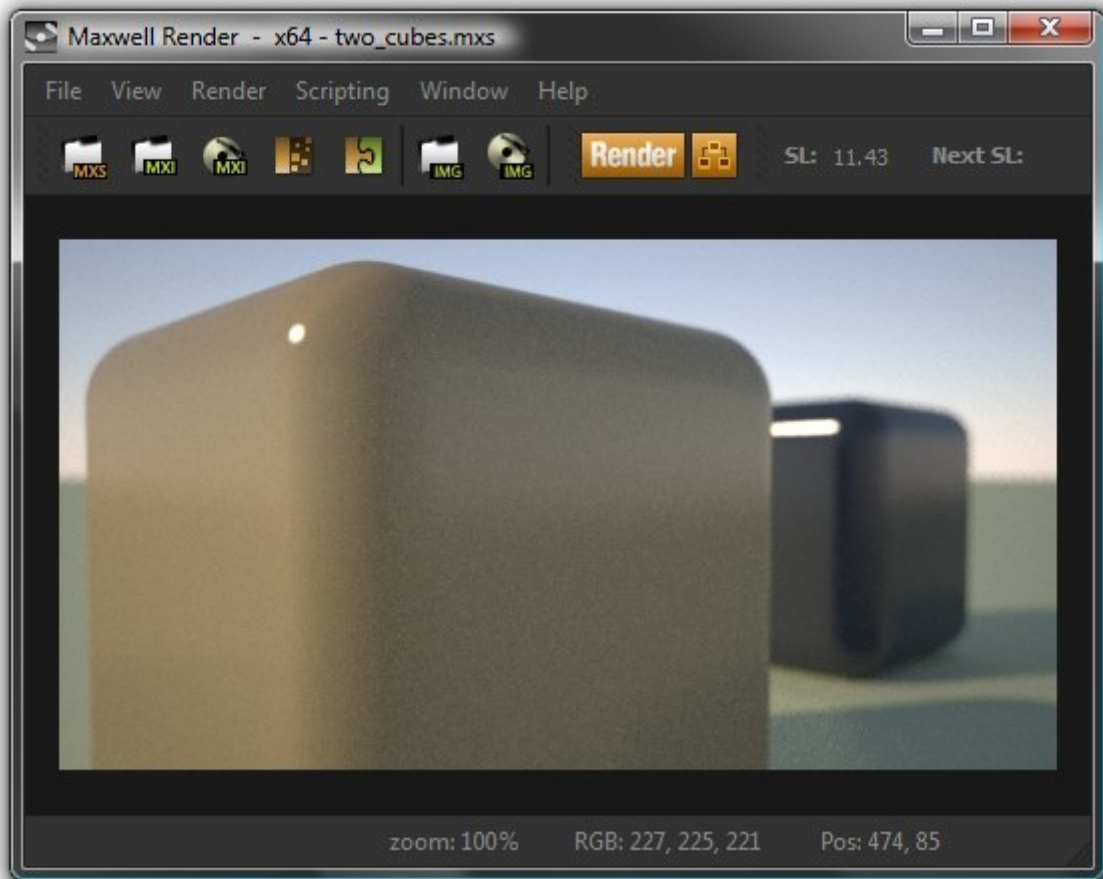
Figure 4.5.6: The scene, rendered with focus set to the near cube.

Naturally, setting the focal distance to a point on the far cube would result in an image like this:
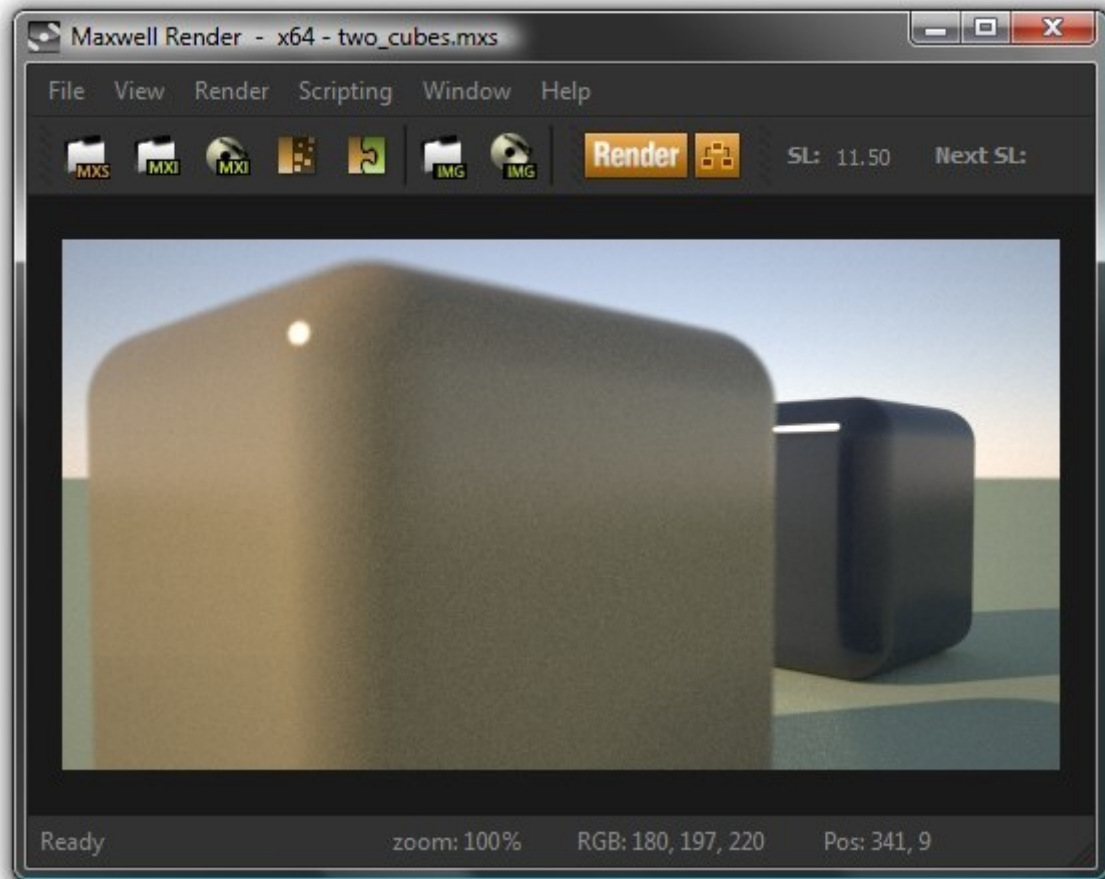
Figure 4.5.7: The scene, rendered with focus set to the far cube.

Note that even though we have altered the camera's fStop, the overall exposure of the image has not changed appreciably; this is due to the Maxwell camera's *Lock Exposure to EV* (**E**xposure **V**alue) feature 6.3.3 .

4.6 Materials: MXM Mode

Let's try editing our *<Beige>2* material so that it uses a custom MXM file, rather than a dynamically-generated material. Select the Materials tab in the Scene Manager and then select *<Beige>2* again from the material list (note, this is the same as selecting this material in SketchUp's material list).

Next, click the *MXM* toggle-button, which is located right next to the drop-down; when you do, the material page will spin around, revealing the material's *MXM Mode* interface. Next, click the *Browse* button to locate an MXM file; I will use *tiles-29.mxm* from the Arroway collection, which is included with Maxwell Render Suite.

Figure 4.6.1: *<Beige>2* using *MXM Mode* and a custom MXM.

Clicking the buttons at the upper right will copy either the MXM's basic color, or its active texture (assuming it has one; this is set in Maxwell MXED) into the SketchUp material, so that we can see a representation of this MXM in the SketchUp viewport. As such, clicking the *Copy Texture to SketchUp Material* button, adjusting the texture size (in SketchUp) to 3 x 3 meters, setting focal distance to the near cube once more, and then clicking Render (in Maxwell Fire, the *Re-export Scene* (7.1) button) will result in the following image:
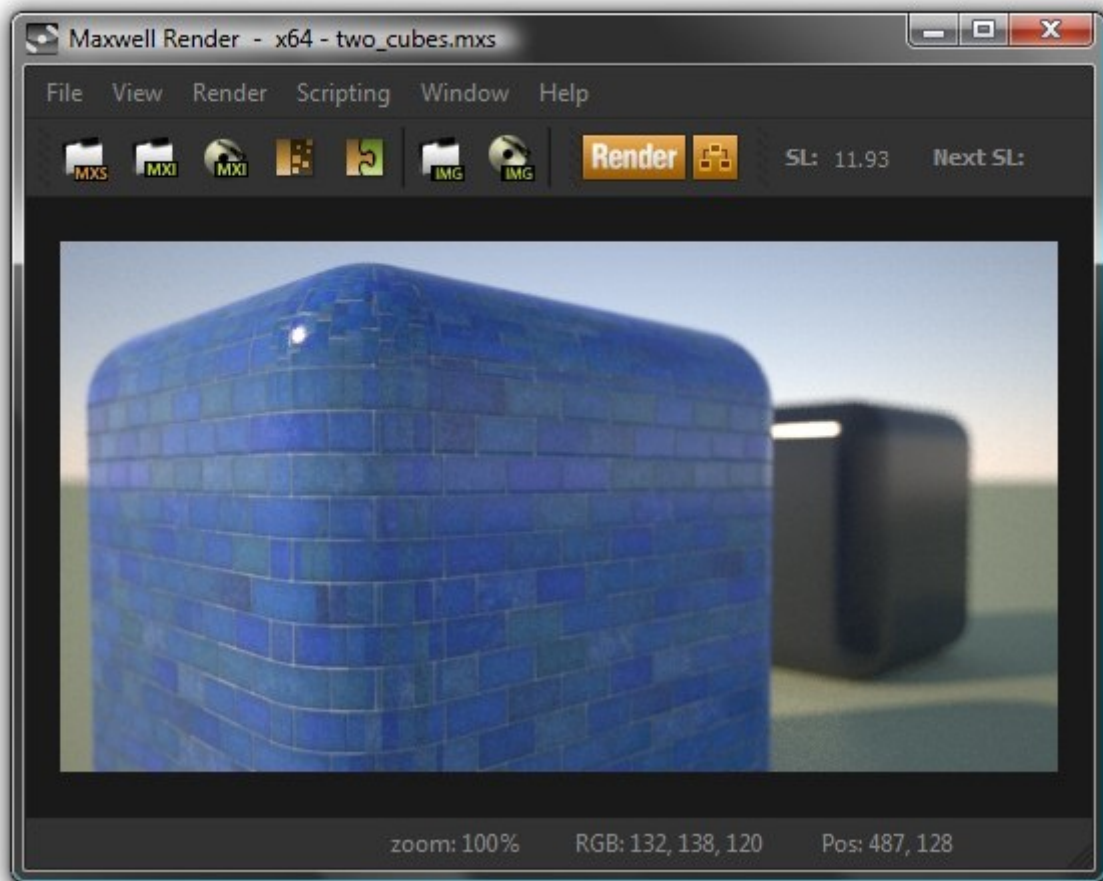
Figure 4.6.2: The near cube, using a custom MXM.

4.7 Image Based Environment

To wrap up, let's render using an Image-based environment.

Go to the Environment tab and select *Image Based* from the *Type* drop-down. Now, browse to an HDR image in the *Background* channel; I will use the Dosch *dh207.hdr* file that comes with Maxwell Render Suite (note: the *Standalone* plugin is not supplied with any HDR files). Let's also disable the sun, so either turn off Shadows in SketchUp, or click the *Sun* toggle-button at the top right corner of the Scene Manager's Environment page. While we're here, let's set up a custom color for our ground plane; set *Ground Plane > Mode* to *Custom Color* and set the color to RGB [50, 50, 50].

Since there will now be less light in the scene, we will also need to adjust the camera's exposure, so switch to the Scene Manager's Camera tab and adjust *EV* down to 8.0. Rendering now produces an image similar to this:
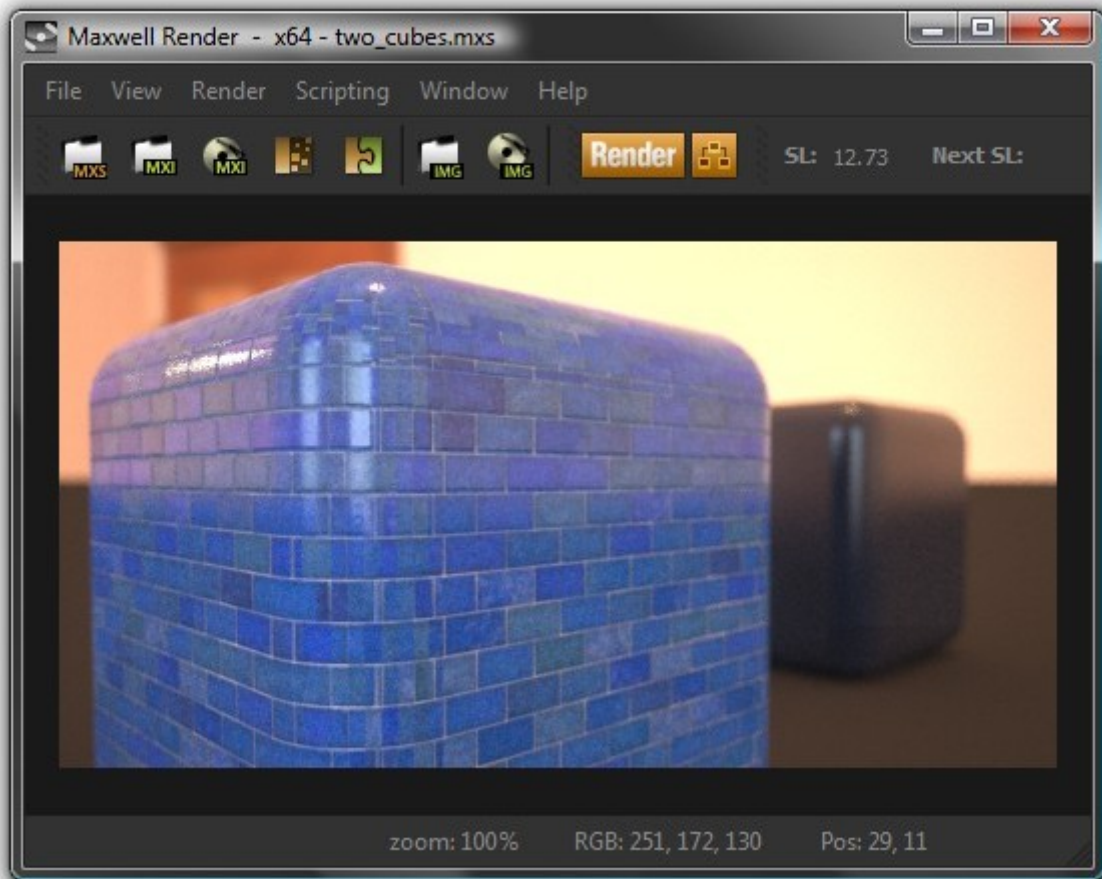
Figure 4.7.1: The scene, rendered using an Image Based Environment.

5 Menu & Toolbar

The commands in the plugin's menu and toolbar fall into four basic groups:

5.1 Rendering & Export

Figure 5.1.1: The rendering & export command group.

5.1.1 [RS] Render

This command exports the scene to MXS and then starts Maxwell Render rendering the exported MXS. As the MXS file is written, the SketchUp progress bar will be shown, indicating the various stages of export.

5.1.2 [RS] Export to Studio

Similar to the Render command, but opens the MXS in Maxwell Studio instead of rendering it in Maxwell Render.

5.1.3 [RS] Network Render

Similar to the Render command, but opens the MXS in the Maxwell Network Render Manager instead of rendering it directly in Maxwell Render. For more information on the operation of the Maxwell Network Rendering system, please refer to the regular Maxwell Render manual.

5.1.4 Maxwell Fire

This command opens or closes the *Maxwell Fire* window (7).

5.1.5 [RS] Export to MXS

This command simply exports the scene to MXS.

5.2 MXM Browsing

Figure 5.2.1: The MXM browsing command group.

5.2.1 Browse for an MXM file

This command starts Maxwell MXED in MXM-browsing mode. To choose an MXM file, double-click its thumbnail in the MXED view panel. When this is done, MXED will close, and the plugin will import the selected MXM file into the scene; a new SketchUp material will be created, and its Maxwell attributes will be set up to reference the chosen MXM file.

If Maxwell MXED is not installed, a standard file browser will be used instead.

5.2.2 Browse the MXM Gallery

Similar to the Browse for and MXM file command, but uses MXED in its MXM Gallery Browser mode, allowing you to search for and download an MXM file from Maxwell's online MXM repository, the MXM Gallery. When you have located the MXM you would like to download, simply click the 'Import' button in the search window to import the selected MXM file into the Scene. The file will be downloaded and unzipped to one of three places:
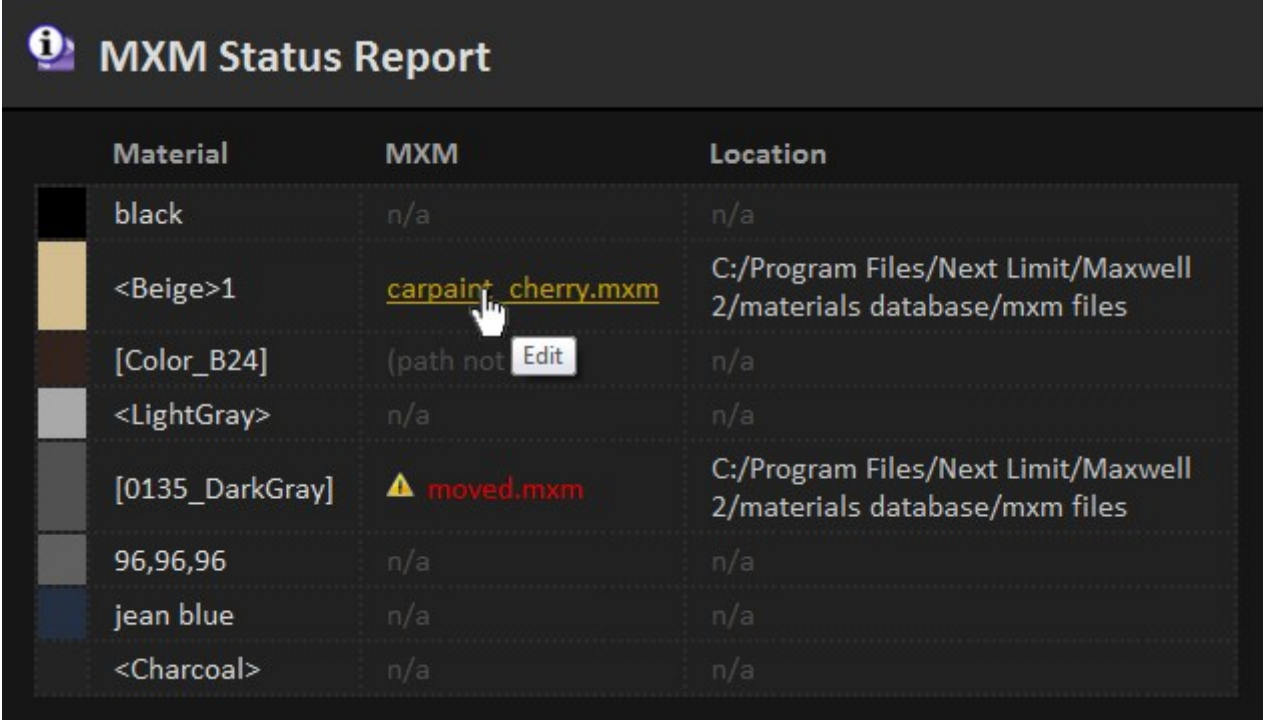
- if the current document has not been saved, the MXM and related files will be saved to the path specified in *Maxwell MXED Preferences > Materials > MXM Gallery > Alternative Folder*.

- if no alternative folder has been specified in Maxwell MXED, they will be saved to *[Documents]/Maxwell/mxmgallery*.

- if the current document has been saved, the MXM and related files will be saved to the standard *textures* folder, which will be created according to the same rules specified in the Pack & Go topic (6.5.5).

During this process, all files referenced by the newly-downloaded MXM will be copied to the destination directory, with the paths inside of the MXM file being altered to point to the new file locations, since many MXMs from the MXM Gallery contain paths which will not exist on your machine.

If Maxwell MXED is not found, the plugin will attempt to navigate to the Maxwell MXM Gallery website in your default browser.

5.2.3 MXM Status Report

Shows a listing of all materials in the scene, along with the status of their MXM links:

Figure 5.2.2: The MXM Status Report.

MXM files and their directories are shown as hyperlinks; clicking them will open MXM files for editing in Maxwell MXED (provided that it is installed), or open their location in Windows Explorer or OSX Finder. MXM files which cannot be found are indicated as such.

5.3 Scene & Camera Tools

Figure 5.3.1: The scene & camera command group.

5.3.1 Scene Manager

This command simply opens or closes the plugin's Scene Manager window.

5.3.2 Select Tool

This command toggles on/off the plugin's *Select Tool*, which is used to sample materials from entities, and to add or remove them from the current selection set. When the tool is active, it uses the following modifier keys:

- **SHIFT:** add or remove the picked Group or Component from the selection.

- **CTRL /Option (Win/OSX)**: add or remove the picked Face from the selection.

- **ALT /Command (Win/OSX)**: set the material of the picked Group or Component as current.

- **no modifier:** set the material of the picked face as current.

Normally, it is necessary to use SketchUp's Paint Bucket tool to accomplish these things; however, it is not possible to use the Paint Bucket without also opening the SketchUp materials window, so you may oftentimes find this plugin tool to be preferable.

5.3.3 Set DOF, Z-Clip, or Z-Buffer

This command prompts for two input points. Depending on keyboard modifiers, these points will be used to set one of the following:

- **SHIFT:** set the current camera's Z-Clip planes (6.3.4).

- **CTRL /Option(Win/OSX)**: set the Z-Buffer min/max distances (6.5.7).

- **no modifier:** set the DOF (*Depth Of Field*) of the current camera, while maintaining its current exposure.

5.3.4 Set Focal Distance

The focal distance of the SketchUp camera moves along with the camera as it is zoomed in and out; this causes objects which are in focus with the camera at one position to come out of focus as the camera is moved to a different position. It is often necessary, therefore, to re-adjust the camera's focal distance, and this is quickly done using the Set Focal Distance tool: just click this button and choose some point in the model.

Note that this Focal Distance is only used when the camera is using *Manual* (6.3.3) focus mode.

5.4 Help & Info

Figure 5.4.1: The help & info command group.

5.4.1 Show Plugin Help

Opens this manual.

5.4.2 Show Maxwell Help

Opens the standard Maxwell Render PDF manual.

5.4.3 About Box

Shows the plugin's About box, which contains information about the currently-installed plugin.

5.5 Upgrade Info...

Clicking this menu item will open your default web browser and navigate to a page containing information on available upgrades to the currently-installed plugin.

5.6 [SA] License Validator

This menu item, which is only shown when the plugin is running using a *Free* license, is used to access the *Maxwell Render License Validator*. The purpose of the *Maxwell Render License Validator* is to allow you to upgrade from the *Free* license to the *Commercial* license (see *Maxwell Render EULA.pdf* for licensing information). The serial number required for doing so will be emailed after purchase of the *Commercial* license.

If you have purchased a *Commercial* license and would like to activate it, click the **License Validator** menu item; the *Maxwell Render License Validator* window will be shown:
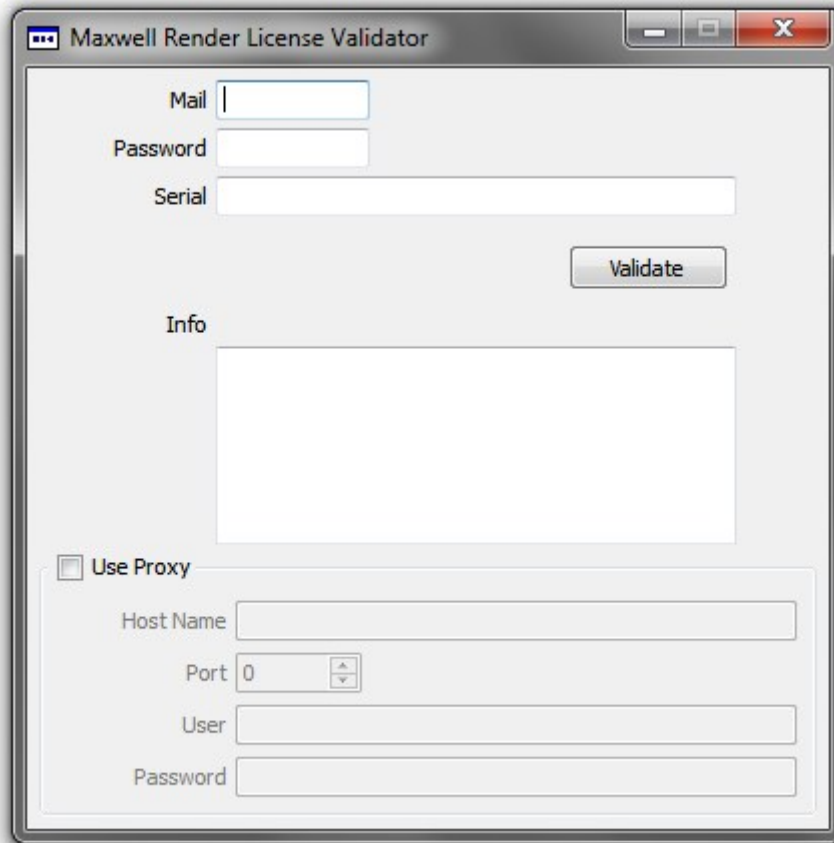
Figure 5.6.1: The Maxwell Render License Validator window.

To activate the license, enter your email address, password, and serial number, then click the *Validate* button. After Next Limit servers have been contacted and authenticity verified, the following confirmation dialog will be shown:
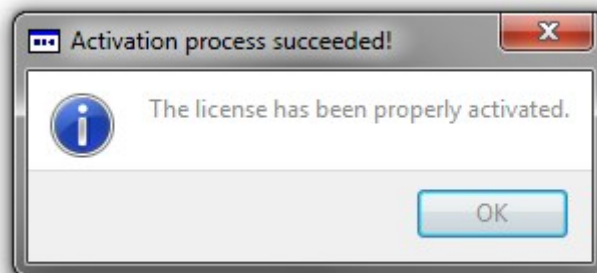
Figure 5.6.2: Successful license validation.

Afterward, it will become possible to render using the *Production* Maxwell engine (see Maxwell Fire *Engine Settings*, 7.2), and maximum output resolution (7.1) will be increased from 800 pixels to 1920 pixels.

Note: if open, it will be necessary to close and re-open the *Maxwell Fire* window after successfully upgrading the license, since parts of its UI will need to be reconstructed.

6 Scene Manager

The plugin's *Scene Manager* window is the single, central place from which you manage all Maxwell-related scene parameters:
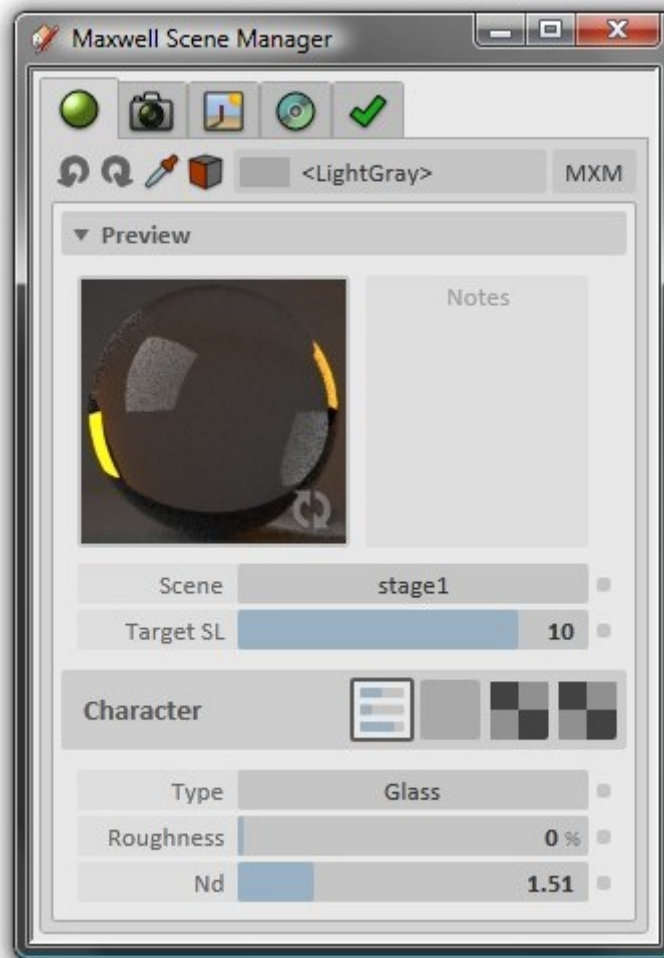
Figure 6.0.1: The *Scene Manager* window.

It may be opened or closed using the *Scene Manager* menu item or toolbar button:

Figure 6.0.2: Open or close the *Scene Manager*.

The *Scene Manager* contains five tab pages, each of which is responsible for dealing with a different aspect of a Maxwell scene.

6.1 Overview

6.1.1 User Interface

The Scene Manager's interface uses a set of controls which have been custom-designed for use in this particular environment. In very few cases is any keyboard input necessary; it is always possible where applicable, but it is not usually required. This has been done primarily to facilitate tablet use.

Context Menus

Most parameters have a small button at their far right side:
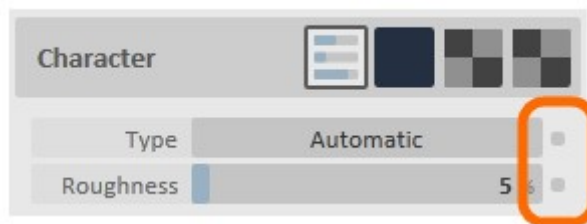
Figure 6.1.1: Context-menu buttons.

Clicking this pops up the control's context menu:
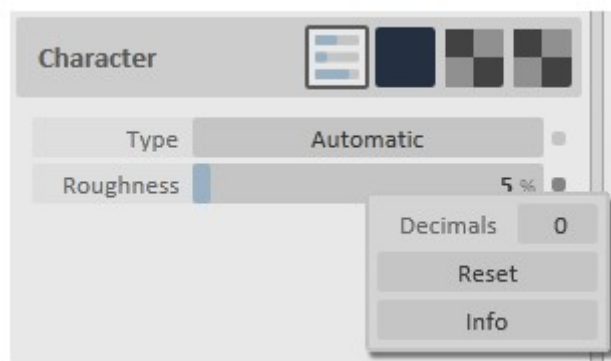
Figure 6.1.2: Context menu for a numeric slider.

In the case of numeric sliders (as shown), you will find a *Decimals* value which is used in the slider's text-entry area. The number of decimals chosen is per-slider and persists between sessions. You will also find a *Reset* button in the context menu for some controls; clicking this simply brings the value back to its default. Lastly, you will find an *Info* button; clicking this causes parameter-specific help to be shown. This feature may or may not yet be implemented at the plugin's release, depending on the time available.

Color Picker

The plugin also implements a custom RGB color-picker:

Figure 6.1.3: The color picker.

Operation is fairly self-explanatory. In addition to manually choosing a color, drop-downs are provided for named and numbered color presets. A third drop-down is provided, which holds a list of user-defined named custom colors. A new custom color may be added at any time; the list persists across SketchUp sessions.

Texture Editor

For working with textures, the plugin provides a custom editor:
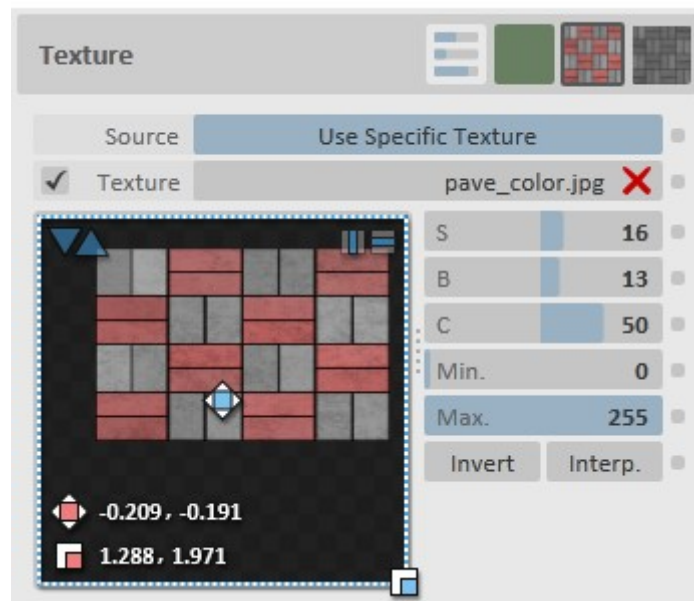
Figure 6.1.4: The texture editor.

The sliders on the right control saturation, brightness, contrast, minimum RGB, and maximum RGB. The Invert button inverts the RGB values of the texture's pixels. These adjustments work in real-time, also affecting the appearance of the texture's thumbnail.

To activate texture tile and offset controls, click on the image with your mouse. To adjust tile size, drag the grip at the lower-right corner; to adjust offset, drag the grip in the center. To quickly

reset tile or offset, use the buttons at the lower left. Exact tile and offset values may be typed in using the numeric inputs at the lower left. At the upper left are toggle buttons which enable and disable repeat in the U and V directions. At the top left are buttons which may be used to copy the associated SketchUp material's texture here, or to copy this texture into the SketchUp material's texture; these are only shown when the texture's *Source* is set to *Use Specific Texture*.

Color Schemes

All of the colors used in the interface are customizable. In the Scene Manager's *Options* tab, in the *User Interface* sub-panel, you will find a button labeled *Color Scheme*; clicking this button will cause the *Color Scheme Editor* to be shown:
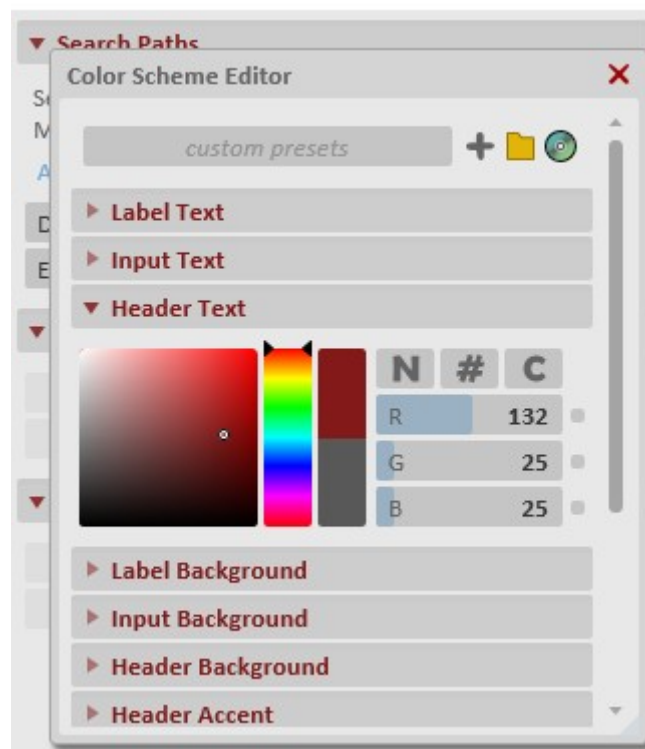
Figure 6.1.5: The Color Scheme Editor.

As you see here, the Header text is being set to [132, 25, 25]. At the top of the editor is a list of custom presets; by default three schemes are already defined:
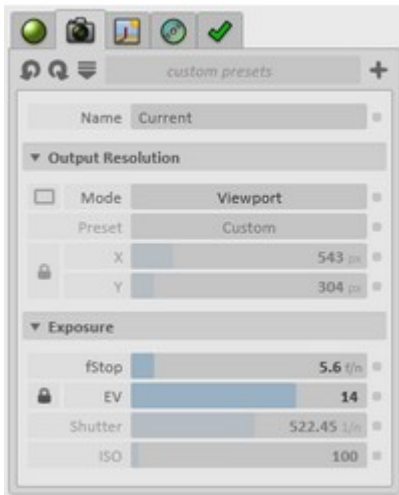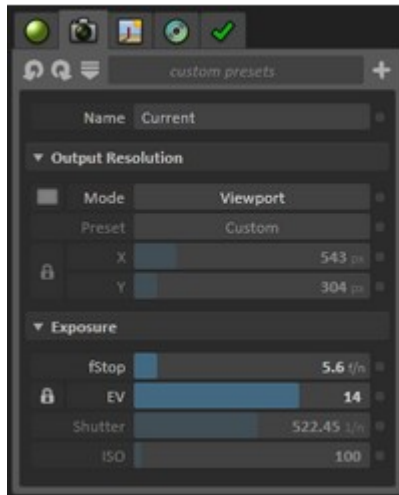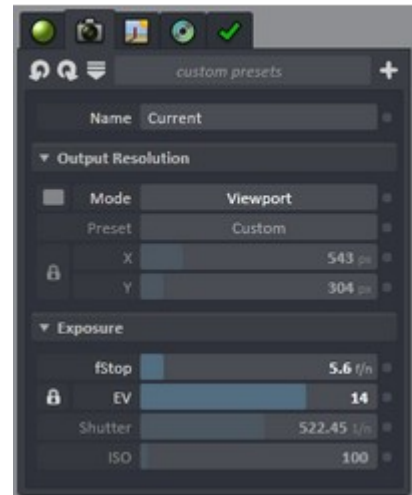
| Light | Dark | Slate |

Additionally, color schemes may be saved to and/or read from disk, allowing them to be shared, if desired.

6.1.2 Materials

This page is used to manage Maxwell material parameters. It contains a list of materials, which is always kept synchronized with SketchUp's material list. The reason for this is that a material in the plugin exists as a set of parameters which are attached to a SketchUp material; selecting the material (or its associated SketchUp material, via SketchUp's material list) causes these parameters to be shown in the plugin's material editor user-interface, enabling you to alter how the material will be written at export time.

6.1.3 Camera

This page is used to manage Maxwell camera parameters. A camera in the plugin exists as a set of parameters attached either to the SketchUp document, or to a SketchUp Scene, depending on whether or not the document contains any Scenes. When a Scene is selected in SketchUp, its associated Maxwell camera will be shown in this page. If there is no Scene, then there will only be one Maxwell camera, and its name will be *Current*.

6.1.4 Environment

This page is used to control whether to render using Maxwell's Sky Dome, Physical Sky, or Image Based environment. It is also in this page that the Sun and Ground Plane may be configured.

6.1.5 Output

This page is used to control output file names and formats, export-time plugin behaviors, and various other engine-related features.

6.1.6 Options

This page contains global parameters which are in effect across SketchUp sessions: user interface behaviors, search paths, and the like.

6.2 Materials

Materials in the plugin exist as a set of parameters which are attached to each individual SketchUp material contained in the document. When a material is selected, either by selecting a SketchUp material in the SketchUp materials browser, or by selecting a material from the drop-down at the top of the Materials page, these parameters are made available for editing in the plugin's material editor user interface. The material editor interface has two main sub-panels, one which holds the material preview and any notes stored with the material, and a second, which is used to set various physical parameters of the material.

Figure 6.2.1: The material panel in *Embedded Mode.*

6.2.1 Toolbar

The Materials panel's toolbar contains the following items:

Undo/Redo

These two drop-down lists hold the history of actions which have been executed in the material panel. They are cleared when a new document is opened, or when a different material is selected.

Entity/Material Selection Tool

This button toggles the activation state of the plugin's Select Tool (5.3.2).
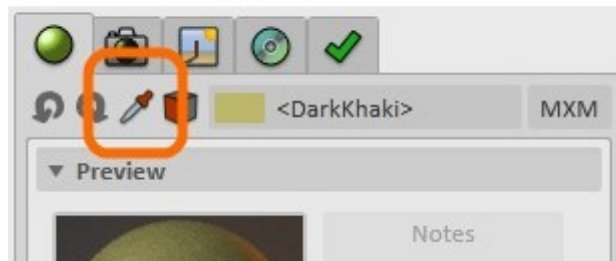
Figure 6.2.2: Activate the *Select Tool*.

Assign to Selected Entities

This button is provided as a convenience; clicking it simply assigns the current material to the current SketchUp selection.
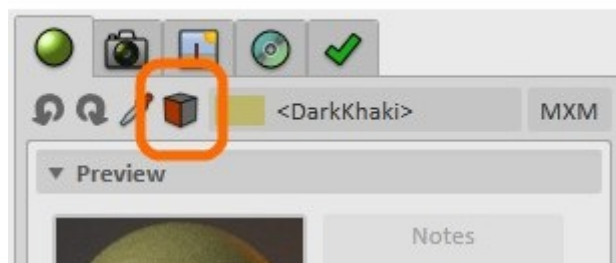
Figure 6.2.3: The *Assign to Selected Entities* button.

If there are no materials in the scene, or if there is no material selected, this button will become disabled.

Material List

This drop-down provides a list of the materials contained in the SketchUp document. Materials may be selected here, or by selecting them in SketchUp.

MXM Mode

This (toggle) button switches the selected material between its *Embedded* and *MXM* modes (6.2.7).

6.2.2 Preview

At the top of the material editor, you will find a material preview image, a place to store notes about the material, a drop-down to select the preview scene used by this material, and a slider used to set the target SL (**S**ampling **L**evel, 6.5.6) used whenever this material's preview is rendered.
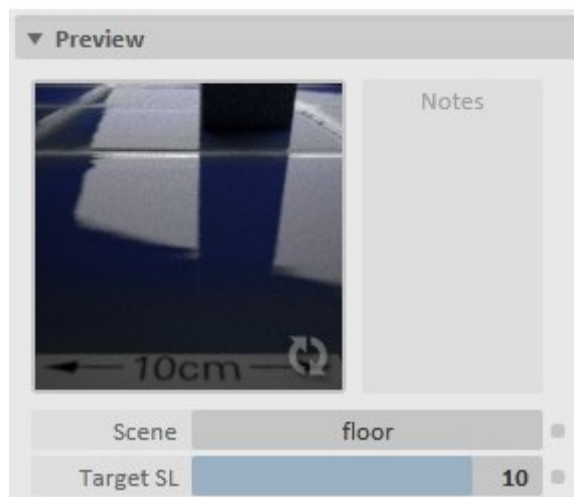
Figure 6.2.4: The *Preview* sub-panel.

Preview Image

The plugin uses Maxwell Fire to provide real-time material editing. To render or re-render the preview for the current material, click the *Render Preview* (small arrows) button, located near the lower right corner of the preview image; if the preview is already rendering, clicking this button will cause it to stop. While a preview is rendering, its current sampling level will be shown in the lower left corner of the image.

Material previews can be rendered manually this way, or they may be generated in real-time via Maxwell Fire, updating automatically whenever a material parameter is changed. This behavior is controlled by the *Refresh Previews* plugin option (6.6.2)*.* In either case, the rendering may be

started or stopped by clicking the *Render Preview* button. Note that the size of the preview image is adjustable; to change it, just pass your mouse over the lower right corner of the image to show the resizing grip. Smaller previews will, of course, take less time to render.

Also note that it is possible to set the number of processing threads which are used for rendering previews using the *Preview Threads* (6.6.2) plugin option.

Scene

In this drop-down, you will find a list of MXS files which have been found in the *preview* sub-directory of your Maxwell installation directory (or in the plugin's *maxwell/res/preview* directory (3.3), if Maxwell Render Suite is not installed). The chosen MXS preview scene will be used to render previews for this material. This setting is stored per-material, enabling each material to use the preview scene most appropriate to its nature.

Target SL

When the material preview is rendered, it will render until the *Target SL* (6.5.6) set here has been reached.

6.2.3 Character

The factor primarily responsible for determining the appearance of a Maxwell material created with the plugin is known as its *Character*.
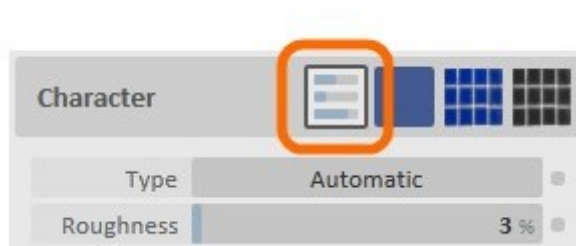
Figure 6.2.5: The *Character* sub-panel.

Character determines whether the material is glass, metal, etc. Character is primarily concerned with the nature of the material on a conceptual level, and not with anything specifically having to do with the material's color or texture; those things are independent from its character.

In total, there are fifteen character types:

Automatic

This is a material's default type. It provides a *Roughness* parameter; as Roughness is decreased, the material will shift from a pure diffuse to a smooth plasticine material.

Plastic

This type describes a hard plastic. It provides Roughness and Nd parameters. As Roughness is decreased, the plastic will become smoother. The Nd value controls the reflective response of the material; lower Nd values result in weaker frontal reflectivity.

Lacquer

This type is designed to create a material which resembles a lacquered surface, and is generally intended to be used in conjunction with a woodgrain texture. It provides a *Finish* type, of which there are five: *Rubbed*, *Satin*, *Semigloss*, *Gloss*, and *Polished*.

Car Paint

This type is designed to produce a metallic car paint material. It provides a *Metallic* parameter; as the value of this parameter is increased, the material will behave as though it has more metallic flake in its composition. Such paints exhibit a rather unnatural reflective response (not at the surface, but within the layer-thickness of the coat), because the flakes suspended in the coat are not oriented in a random fashion.

Metal

This type produces metallic materials, which are defined using *Roughness*, *Nd*, and *K* parameters. Additionally, it provides presets for several pre-defined metal types. Please see the regular Maxwell Render manual for technical information on the Nd and K parameters.

Liquid

This type simply produces a liquid material. It provides an *Nd* parameter, which is set to the refractive index of water (1.33) by default. Being a true dielectric material, this type should only be used on objects which have a closed volume.

Glass

This type is similar to the Liquid character, but it adds a *Roughness* parameter. Its Nd is set to the refractive index of standard glass (1.51) by default. As with Liquid materials, Glass materials should only be used on objects which have a closed volume.

AGS

This type creates what is known in Maxwell terminology as an AGS, or Architectural Glass Solution, material. This is a glass-like material, which possesses no refractive properties; it is especially suitable for use (as opposed to the Glass type) with single-face glass mesh geometry, since real dielectric glass in Maxwell requires an enclosed volume. This character also provides an *Nd* parameter, which allows for adjusting the reflective response of the material; this is set to the refractive index of glass (1.51) by default.

SSS

This (SSS stands for *Sub-Surface Scattering*) type produces a material which possesses complex internal scattering effects (as this is a dielectric material, it should only be used with objects which have a closed volume). This type provides *Roughness*, *Thickness*, *Density*, and *Asymmetry* parameters.

Thickness is used to scale the material based on the basic size of object on which it will be used; lower values will cause light rays to terminate closer to the surface of the object. Density describes how many particles per volume the material contains; this affects how light is scattered inside of the volume. Asymmetry determines the back- or forward-scattering characteristics of the material; positive values cause light to bounce back toward its source, and vice versa for negative values.

See the regular Maxwell Render manual for a more detailed discussion of Sub-Surface Scattering.

SSS (Single Sided)

Single Sided SSS (or *SSSSS*, for purposes of this discussion) is a special Sub-Surface Scattering mode designed for use with single-face meshes; regular SSS is unsuitable for use with such geometry, due to its dielectric nature and the resultant requirement that it be used with an object which describes a closed volume. The SSSSS character provides *Roughness*, *Thickness*, and *Asymmetry* parameters.

Thickness determines the theoretical thickness that Maxwell will give to single-face meshes such materials are applied to. Asymmetry, as with regular SSS materials, determines the back- or forward-scattering characteristics of the material.

Satin

This type has no parameters, and produces a material which behaves like satin cloth.

Velvet

This type has no parameters and produces a material which behaves like velvet cloth.

Complex IOR

This type has no properties other than *Roughness*; rather, its rendering characteristics depend on the selected Complex IOR file. See the regular Maxwell Render manual for information on Complex IOR files.

Emitter

This type produces an emitter material using the supplied *Watts*, *Efficacy*, and *Roughness* parameters. Watts determines the total wattage output of the material, while Efficacy describes the efficiency of the emitter. As Roughness is reduced, a glass-type BSDF is mixed into the material, such that at a Roughness of 0.0, the material will resemble a light bulb.

HDR Image

This type produces an emitter whose light source is an HDR, MXI, or EXR file. *Intensity* and *Roughness* parameters are provided, with Intensity adjusting the power output of the emitter. Similar to the regular Emitter character, as Roughness decreases, a glass-type BSDF is mixed into the material, allowing materials like an LCD screen to be simulated.

6.2.4 Color

Where the *Character* determines the physical properties of the material, its *Color* determines its basic color.
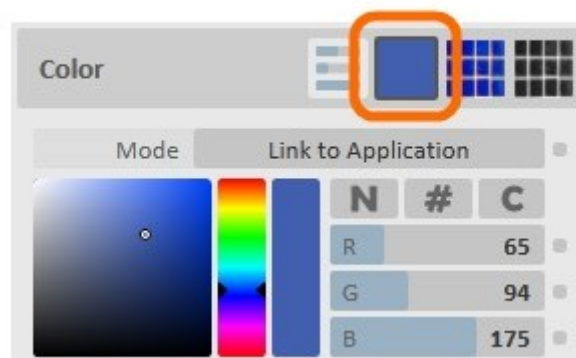
Figure 6.2.6: The *Color* sub-panel.

Mode

The material color can either be linked to the color of its associated SketchUp material, or it can be set independently. If the color mode is set to *Link to Applicatio*n, then any changes made to

the color here will be sent to SketchUp, while any changes made via SketchUp's own material editor will be reflected here. If the color mode is set to *Use Specific Color*, then this link will be broken, and the color of the associated SketchUp material will be disregarded.

Of course, when the color is not linked, what is seen in SketchUp's viewport may not match what is seen in the rendered Maxwell image.

Color Picker

Colors may be entered manually, using either the sliders or numeric inputs, or by click-drag on the color-picking surfaces. There are drop-down lists containing named and numbered preset colors, and there is also a list of custom colors available. At any time, the current color may be added to your list of custom colors; you will be prompted to provide a name for the color.

6.2.5 Texture

Similar to the Color parameter, a material's *Texture* determines its basic color, when a texture is present (if there is no texture, then the material's Color will be used).
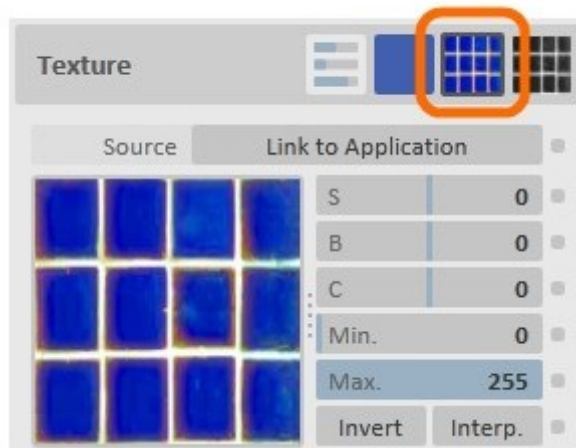

Figure 6.2.7: The *Texture* sub-panel.

Source

Just as a material's *Color* may be linked to its associated SketchUp material's color, its *Texture* may also be linked to the SketchUp material's texture. When *Source* is set to *Use Specific Texture*, this link will be broken, allowing you to choose a different texture map.
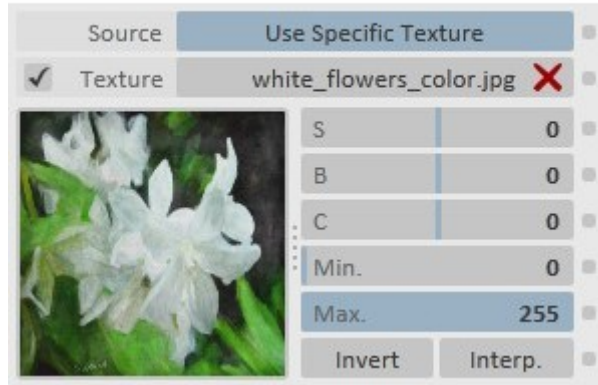
Figure 6.2.8: The *Texture* sub-panel with *Source* set to *Use Specific Texture*.

When *Use Specific Texture* is activated, there is also a checkbox provided, by which the texture may be temporarily disabled.

Texture Editor

The texture editor provides means by which you may adjust the textures *Saturation*, *Brightness*, *Contrast*, and *Minimum* & *Maximum RGB* values. You may also *Invert* the RGB values and instruct Maxwell to apply a cubic interpolation to the texture's pixels at render-time using the *Interp.* (i.e. interpolation) switch. These changes (with the exception of interpolation, which only applies at render time) will be shown in real-time in the texture preview.
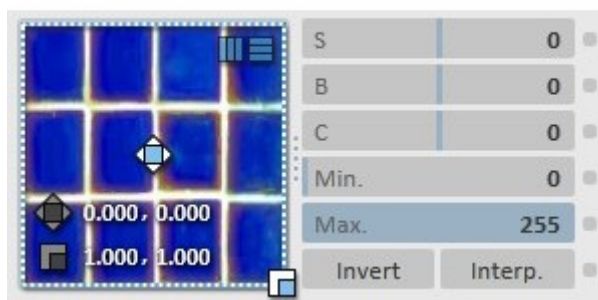
Figure 6.2.9: The texture editor.

Additionally, if you click the texture preview image, you will be presented with controls for setting the texture's *Tile*, *Offset*, and *Repeat U/V* values, as seen above. To adjust texture tiling, drag the grip at the lower-right; to adjust texture offset, drag the grip in the center. To turn on and off repeat, toggle the two buttons at the top right. Specific values may be entered directly by selecting and typing into the numeric inputs.

The size of the texture preview may be adjusted by dragging the grip bar which separates the texture preview on the left from the sliders on the right. Note that some texture formats cannot be shown in the user-interface. For example, TIF files; when such textures are chosen, a placeholder image will be shown instead.

6.2.6 Bump

Where the *Color* and *Texture* parameters control the basic color of the material, the *Bump* parameter controls bump-mapping effects.
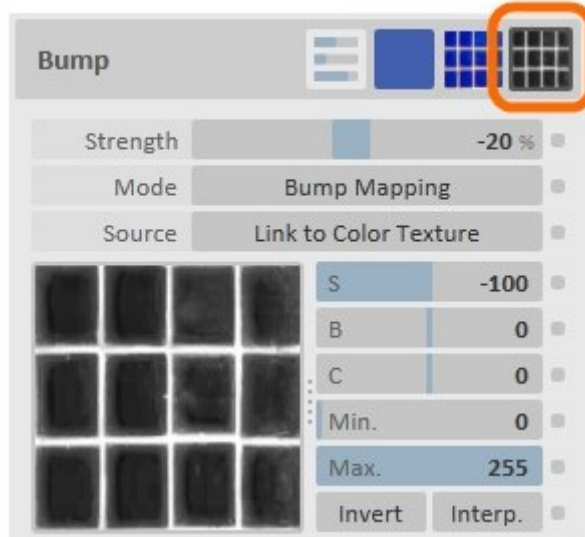
Figure 6.2.10: The *Bump* sub-panel.

Strength

Bump values in Maxwell range from -100% to 100%; setting a value of -50% is the same as inverting the texture and using a bump value of 50%. When the bump mode is set to *Displacement*, then this parameter specifies the displacement height in millimeters.

Mode

The Bump texture may use one of the following modes: *Bump Mapping*, *Normal Mapping*, *Displacement (On The Fly) and Displacement (Pretesselated)*. Normal mapping should be selected when the specified map is a normal map.

If Displacement is used, then the map should be a black and white map, preferably 16-bit or better. As mentioned previously, when Displacement mode is used, the Strength parameter specifies the displacement height in millimeters, rather than in percent, as is the case for the Bump and Normal mapping modes.

Pretesselated displacement may render **significantly** faster than *On The Fly* displacement, but it may also require **substantially** more memory.

CAUTION: use of *Pretesselated* displacement may easily cause SketchUp to run out of memory and crash.

Source

Similar to the way that a material's Color texture may be linked to the associated SketchUp material's texture, the material's Bump texture may be linked to its Color texture. If it is desired that a specific bump map be used, switch *Source* to *Use Specific Texture* and browse to the desired texture file.

6.2.7 MXM Mode

What has been discussed up to this point is known as the *Embedded* material mode. *Embedded* refers to the fact that the parameters which will define the material in Maxwell are stored directly in the SketchUp document, and are edited, as has been explained above, entirely from within the plugin's user-interface.

Optionally, it is possible to switch a material into its *MXM* mode; in this mode, the built-in parameters will not be used, and the material will reference an MXM file instead. To switch to MXM mode, click the *MXM* toggle-button at the top-right corner of the Materials page:
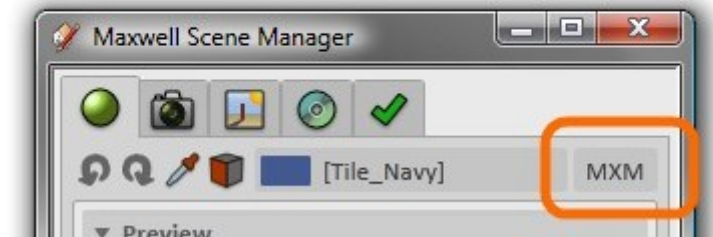
Figure 6.2.11: The *MXM Mode* switch.

When MXM mode is activated, the page will 'spin' around to reveal a different interface:

Figure 6.2.12: The material panel in *MXM Mode*.

Here, an MXM file has been loaded from the local disk. The preview image for the MXM file has been shown, and the *Copy Color to SketchUp Material* button, found near the top-right, has been clicked; the color chip next to the material's name in the material list has been updated (it was previously blue), as a result of the material's color having been changed in SketchUp.

There are five buttons in the MXM mode interface:

Browse

Click this button to choose an MXM file.

Edit

This button is only enabled when an MXM file is present. When clicked, it will open the MXM file in Maxwell MXED for editing. When MXED is closed again, the plugin will check to see whether the

file has been update or not; if it has, the MXM preview image will be updated to reflect the new state of the MXM file.

Clear

This simply clears any current MXM file.

MXM Information

Clicking this button shows a listing of details about the currently-selected MXM file:
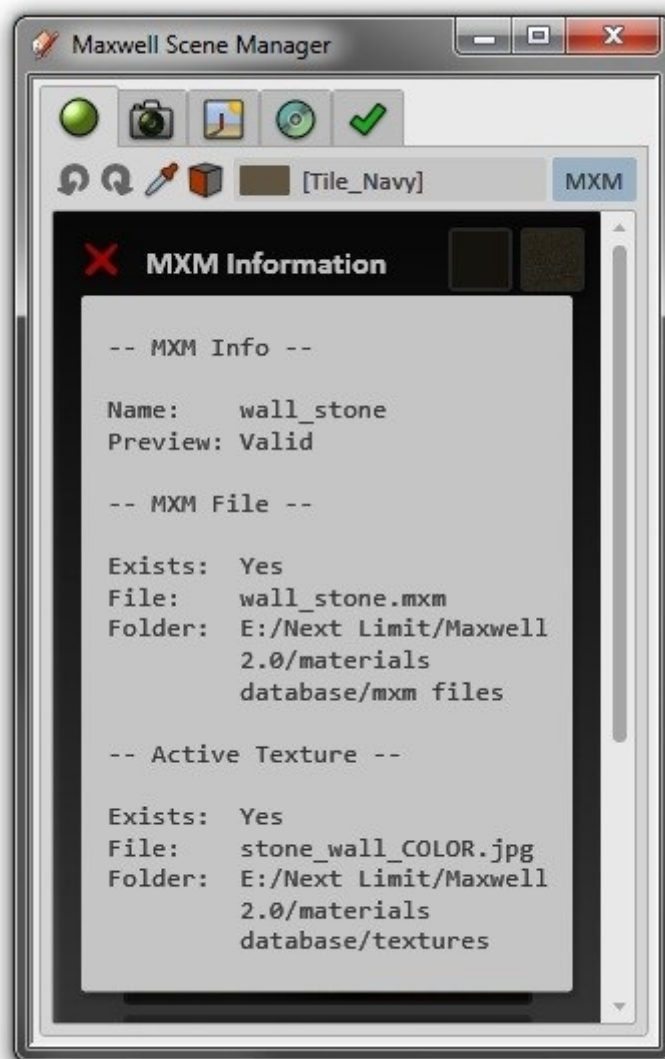
Figure 6.2.13: The *MXM Information* panel.

Copy Color to SketchUp

When an MXM file is present, this button will be visible. Clicking it will copy the basic color of the MXM file into this material's associated SketchUp material.

Copy Texture to SketchUp

Similar to the previous item, this button will copy the MXM file's selected texture into the associated SketchUp material's texture. This button will only be shown if the MXM file has a selected texture, and if that texture is able to be found in the file system. An MXM file's selected texture is set using the drop-down list of textures next to MXED's *Refresh Preview* button.

Notes on the use of MXM files

The Maxwell MXM specification includes the concept of *real scale* textures (this is the case when you set an MXM texture's *Method* to *Meters*), in which it is assumed that the plugin used will ensure that the UV coordinates exported for objects are sized in such a way as to ensure that a texture Tile value of 1.0 will correspond in the rendering to 1 meter.

This can be quite useful in some cases, but in the case of SketchUp, it is both unnecessary and incompatible with the way that SketchUp works. This is because SketchUp:

1. has no concept of a texture repeat value.

2. always creates texture UVs in terms of real-world scale sizes.

For these reasons, it is best to use MXM files which simply specify 1.0/1.0 in their texture *Repeat* values, and which do not use the *Meters* method. If MXM files used from the plugin have values other than these, the result will be that the texture mappings seen in SketchUp's viewport will not match those in the rendered image.

6.3 Camera

For each Scene in your SketchUp document, the plugin will create and maintain an associated Maxwell camera.
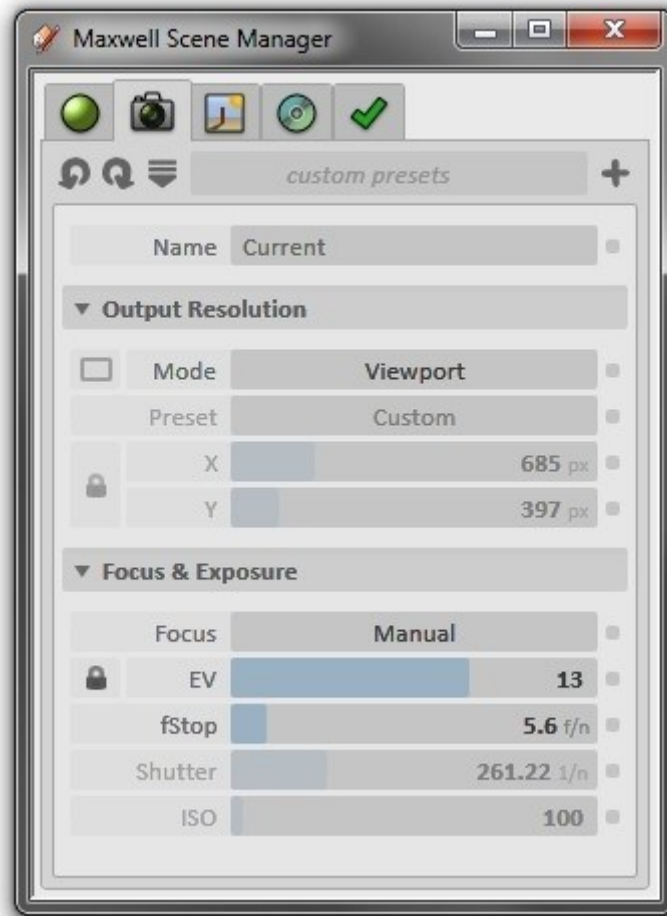
Figure 6.3.1: The *Camera* panel.

6.3.1 Toolbar

The Camera panel's toolbar contains the following items:

Undo/Redo

These two drop-down lists hold the history of actions which have been executed in the camera panel. They are cleared when a new document is opened, or when a different camera is selected.

View

This button toggles the Camera panel between its *Minimal* and *Advanced* views. When the Minimal view is active, only the most often used camera parameters are shown.

Presets List

This drop-down provides a list of camera presets which have been stored previously. To remove a particular preset, click the red **X** next to its name in the list.

Add Preset

Click this button to store the current settings as a new camera preset.

6.3.2 Output Resolution

This section determines the output dimensions of the rendered image. It operates in two basic modes: *Viewport* and *Custom*.
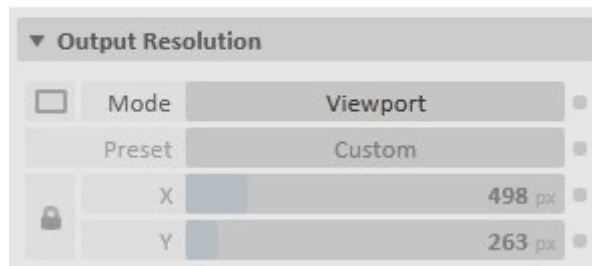
Figure 6.3.2: The *Output Resolution* sub-panel.

In *Viewport* mode, the plugin will match the camera's output resolution to the size of the associated SketchUp viewport. In *Custom* mode, the camera's output resolution may be defined independently of the physical size of the viewport. A list of common resolution sizes is provided in the *Preset* drop-down. Additionally, there are two other parameters which come into play in *Custom* mode.

Lock Aspect Ratio

When enabled, aspect ratio of the output resolution will be maintained during adjustment of either its values.

Show Aspect Ratio in Viewport

When using *Custom* mode, it is likely that the aspect ratio of the Maxwell output will not match that of the SketchUp viewport. In order that you might be able to accurately predict the composition of your image, the plugin provides the *Show Aspect Ratio in Viewport* feature. When this is enabled, grey bars will appear in the SketchUp viewport, framing the area which will appear in the render.

[SA] Notes on Output Resolution in the *Standalone* Plugin

The *Standalone* plugin renders images using Maxwell Fire. If the output resolution specified in the camera is larger than Maxwell Fire's *Max. Resolution* (7.2), it will be adjusted, with its aspect ratio being maintained. The *Free* license allows a *Max. Resolution* of 800 pixels, and the *Commercial* license, 1920 pixels.

6.3.3 Focus & Exposure

A camera's exposure is the result of the combination of its *fStop*, *Shutter*, and *ISO* values. As the fStop value is decreased, more light enters the camera, brightening the exposure. Conversely, as the Shutter value is decreased, the film is exposed for a shorter duration, darkening the exposure. As the ISO value of the film is increased, a given exposure brightness is achieved in a shorter amount of time. The camera may be focused manually, or automatically by the plugin, using one of three different strategies.
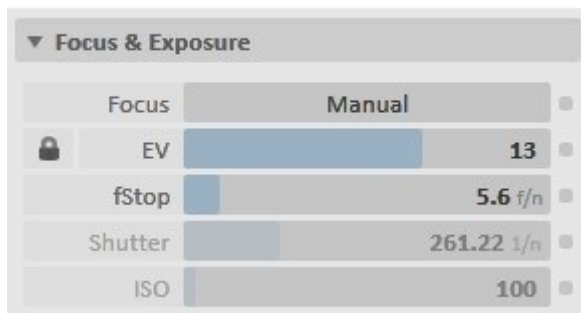
Figure 6.3.3: The *Focus & Exposure* sub-panel.

Focus

By default, camera focus is defined manually, using the *Set Focal Distance* (5.3.4) tool. Optionally though, you may elect to have the plugin auto-focus the camera for you. There are three auto-focus sampling modes available:

- **Spot:** samples focal distance using a single ray located at the center of the viewing plane.

- **Average:** samples focal distance using a circular set of rays, the diameter of which is roughly half the size of the viewing plane, and arranged around its center.

- **Average + DOF:** identical to *Average* mode, but also takes control over the camera's fStop, automatically setting the camera's near and far focal distances.

As such, *Spot* sampling mode will focus based on the distance of the object it finds located directly in front of the camera. *Average* mode will focus based on the average distance of objects it finds near the image's center. *Average + DOF* mode performs an *Average* sampling, and uses the nearest and furthest distances to set the camera's fStop; as a result, direct fStop adjustment is disabled when using this mode.

In extreme cases, the *Average + DOF* mode may have difficulty finding the desired focus range; when this happens, it will usually be best to revert the use of *Manual* or *Spot* mode.

Exposure

The *fStop*, *Shutter*, and *ISO* values may combined together mathematically to express an *EV* (**E**xposure **V**alue, 10) number, which describes the overall exposure of the camera in terms of a single number. Lower *EV* values are generally suitable for lower-light scenarios, and vice versa. Where a candle-lit scene may require an *EV* of 4-6, a bright sunlit scene may require something more on the order of 13-16. A chart of *EV*s (10) for various scenarios can be found at the end of this manual.

Additionally, where *Shutter* and *ISO* primarily affect the brightness of the exposure, the camera's *fStop* also affects its DOF (that is, **D**epth **O**f **F**ield: the distance between the nearest and farthest distances which will be in focus in the image). This often becomes an issue, because it is many times desirable to adjust the *fStop* for purposes of achieving a desired DOF in the composition; however, when this is done, the exposure is also affected, due to the change in *fStop*, even though this is not part of the desired effect.

To address this, the camera provides the *Lock Exposure to EV* feature. When activated, it is not possible to directly alter *Shutter* and *ISO*; these values will be managed by the plugin as either *fStop* or *EV* are changed, maintaining a consistent final exposure. This makes it possible to adjust the camera's DOF without also affecting the exposure, or to adjust the exposure directly by adjusting *EV*, without being concerned with the somewhat complex relationship between *fStop*, *Shutter*, and *ISO*.

6.3.4 Advanced View

When the Camera panel's *Advanced View* is enabled, several additional parameter groups are shown. For more detailed information on the following parameters than is given here, please consult the regular Maxwell Render manual.
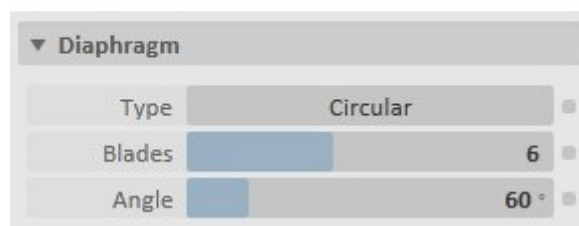
Diaphragm

Figure 6.3.4: The *Diaphragm* sub-panel.

Diaphragm refers to the type of aperture used by the camera; there are two types: *Circular* and *Polygonal*. When a Polygonal is used, the shape of so-called *Bokeh* effects will be determined by the number and *Angle* of the Diaphragm's *Blades*.

Z-Clip Planes

Figure 6.3.5: The *Z-Clip Planes* sub-panel.

If you wish, you can choose to clip geometry at render-time, using a near and far plane, which are both set perpendicular to the camera's direction. The *Near* distance specifies how far from the camera the near plane is located; any geometry between this plane and the camera will be clipped from view. Similarly, any geometry farther away from the camera than the *Far* plane will also be clipped from view.

The Z-Clip Planes may be set interactively using the *Set DOF, Z-Clip, or Z-Buffer Tool* (5.3.3); to do so, press SHIFT while selecting points with the tool.

Shift Lens
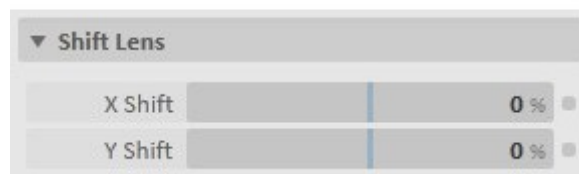
Figure 6.3.6: The *Shift Lens* sub-panel.

It is possible to shift the camera's film along its X and Y axes, with respect to the lens. This is often useful when rendering tall buildings; the camera can be set such that its direction is parallel with the ground, with its height being a meter or two above the ground. The film may then be shifted downward, moving the building more into the center of the view, while avoiding the perspective distortion which would result from angling the camera upward to achieve a similar composition.

Although this is similar to using SketchUp's two-point perspective, the effect of the shift lens cannot be visualized in the SketchUp viewport, due to SketchUp API limitations. It can, however be visualized using Maxwell Fire (7.5).

6.4 Environment

The Environment panel contains settings that determine which environment will be used in Maxwell when the scene is rendered.
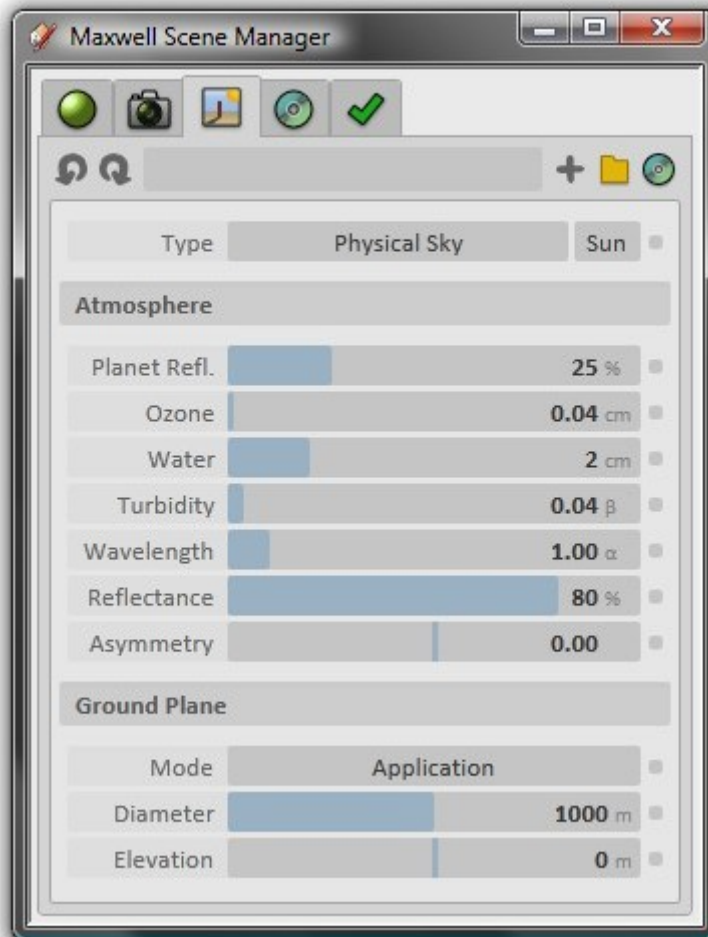
Figure 6.4.1: The *Environment* panel.

6.4.1 Toolbar

The Environment panel's toolbar contains the following items:

Undo/Redo

These two drop-down lists hold the history of actions which have been executed in the Environment panel. They are cleared when a new document is opened.

Presets List

This drop-down provides a list of environment presets which have been stored previously. To remove a particular preset, click the red **X** next to its name in the list.

Add Preset

Click this button to store the current settings as a new environment preset.

Load .SKY File

Click this button to load a Maxwell .SKY file from your file system.

Save .SKY File

Click this button to save the current environment as a Maxwell .SKY file.

6.4.2 Type

There are four *Types* of environment available in Maxwell.

Sky Dome

Figure 6.4.2: Parameters for the *Sky Dome* type.

When Sky Dome is active, the scene will be lit with a dome of light. The overall brightness of this dome can be adjusted using the *Intensity* parameter. The *Horizon* and *Zenith* colors of the dome may be set independently, with the transition rate between them being determined by the *Mid Point* parameter.

Physical Sky
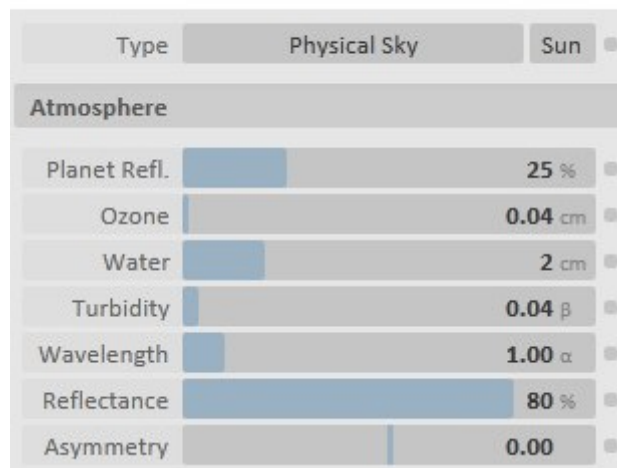
Figure 6.4.3: Parameters for the *Physical Sky* type.

Following are descriptions of what effects the various parameters contained in this panel have on the rendered environment.

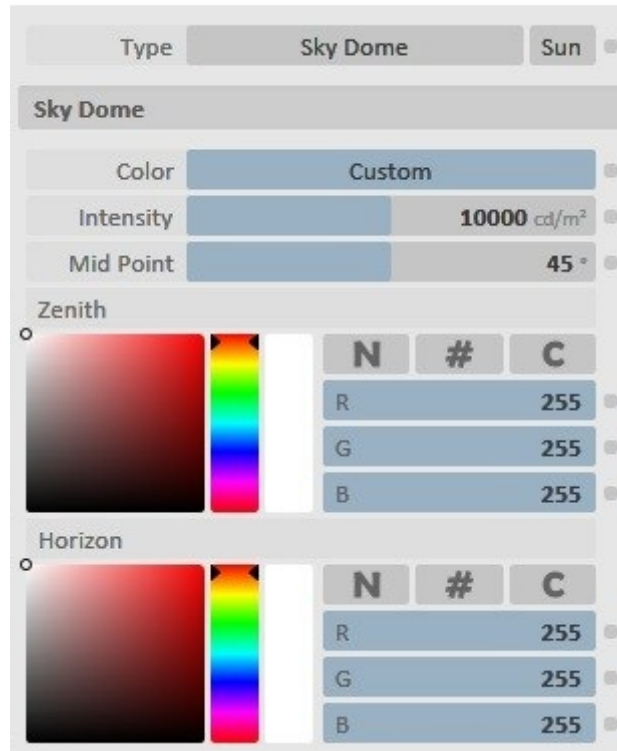**Planet Reflectance**   This controls the percentage of light reflected from the planet surface back into the atmosphere.

Ozone   This defines the amount of ozone gas in the atmosphere, measured in the centimeter-height of a column of atmosphere. The default value is 0.04.

Water   This defines the amount of water vapor in the atmosphere. It is measured in centimeters, in the same way as ozone.

Turbidity Coefficient   This defines the concentration of particles in the atmosphere. A value of 0.0 means a perfectly clear sky (in which case the next three parameters won't have any effect). 0.01 is a good value for low turbidity, e.g. a sky containing very few aerosols, which will appear almost clear. 0.04 is a good medium value and 0.3 is a fairly high value:
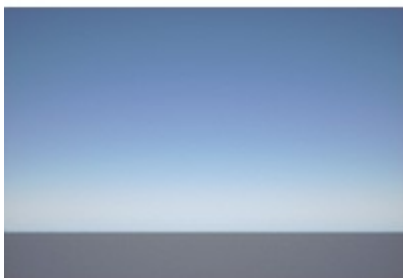
| *Turbidity 0.0* | *Turbidity 0.04* | *Turbidity 0.3* |

Raising the turbidity coefficient in sunset situations will darken the sky. By lowering the camera's *EV* (6.3.3) , it is possible to create an interesting sky:

| *Turbidity 0.0, EV 15* | *Turbidity 0.1, EV 15* | *Turbidity 0.1, EV 12* |

Wavelength Exponent   This defines the average size of the particles in the atmosphere. The particle size influences which wavelengths of light are absorbed and which are scattered. Higher values than the default will increase the saturation of the sky, until gradually it turns first green and then orange.
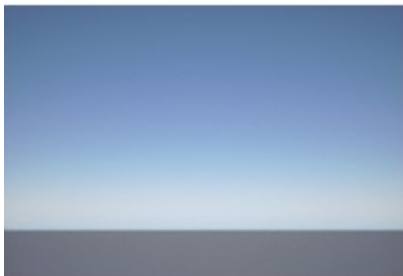
Wavelength 1.2   *Wavelength 5.0*   *Wavelength 10.0*

Reflectance   This refers to the albedo of the aerosols, or the rate of energy scattered and absorbed by the aerosols.

Scattering Asymmetry   This controls the anisotropy of atmospheric particles; that is, in which direction most of the light will be scattered. Positive values will produce a halo effect around the sun, brightening the area around it.
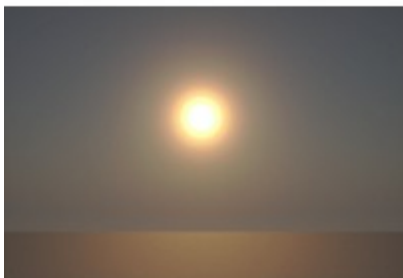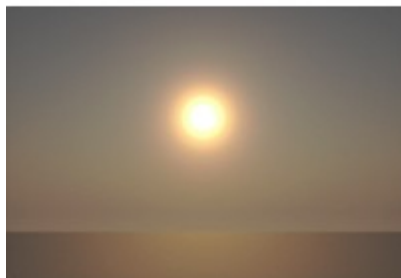
Asymmetry -0.7   *Asymmetry 0.0*   *Asymmetry 0.7*
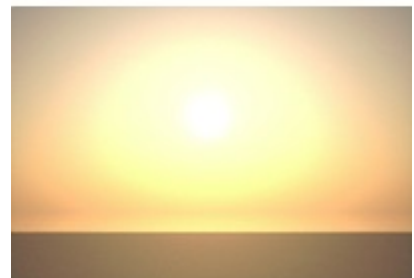
Image Based

When the Image Based environment type is selected, environmental lighting in Maxwell will be provided by the specified HDR image, which will be mapped onto a dome which encompasses the scene.
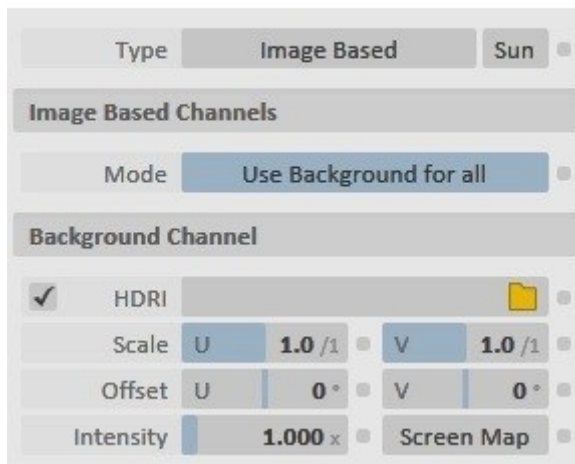
Figure 6.4.4: Parameters for the *Image Based* type *(Use Background for all)*.

By default, Image Based environment in the plugin uses its *Use Background for all* mode. In this mode, the settings specified in the *Background Channel* panel will be applied to all four of Maxwell's Image Based channels: *Background*, *Illumination*, *Reflection*, and *Refraction*. If it is necessary to use different HDR images and/or settings in one or more of these channels, simply switch the *Mode* to *Use Separate Channels*.

Figure 6.4.5: Parameters for the *Image Based* type *(Use Separate Channels)*.

It will now be possible to enter different *HDRI*, *Scale*, *Offset*, and *Intensity* values for each Image Based channel. Any channel that remains disabled when the scene is rendered will use whichever environment type is specified in the *Disabled* parameter. As a convenience, it is possible at any time to *Copy* all parameters from one channel to the others.

None

In this mode, no environment will be used; all lighting will come from any emitter materials which are contained in the scene.

6.4.3 Sun

The Sun may be enabled by clicking the toggle-button at the top-right corner of the Environment panel:
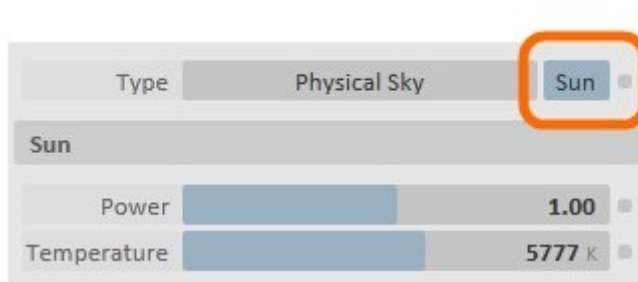
Figure 6.4.6: The *Sun* toggle-button and sub-panel.

The *Sun* in Maxwell, while taking its physical position from the position of the sun (i.e. from the Shadows settings) in SketchUp, is enabled or disabled separately. This is done mainly because it is not always desirable to have shadows enabled in SketchUp, even when it may be desired to render with the Sun enabled in Maxwell.

Date & Time

Date and time are always inferred from the SketchUp Scene, and therefore do not appear in the Environment panel.

Power

This is a multiplier which controls the amount of light emitted from the sun. Values higher than the default 1.0 will cause the sun emit more light, and vice versa.

Temperature

Temperature of the sun's spectral radiation. The default value of 5777 is the most common value measured outside the Earth's atmosphere.

6.4.4 Ground Plane

This is a plugin feature which dynamically generates a ground plane:
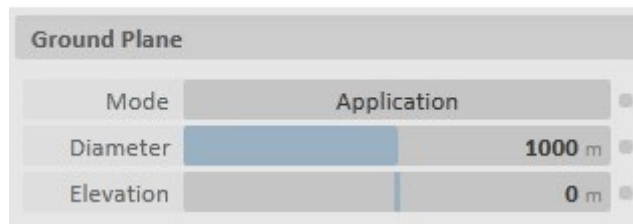
Figure 6.4.7: The *Ground Plane* sub-panel.

The plane is centered along X/Y axes on the camera's position, at the specified elevation in world XYZ space in the scene, and operates in one of four modes:

Application

In this mode, the color of the plane is determined by the combination of the current SketchUp Style's Sky, Ground, and Background colors.

If Ground is enabled in the SketchUp Style, then its color will be used for the generated Ground Plane's color. If, on the other hand, Ground is disabled in the SketchUp Style, the decision of whether a Ground Plane will be generated depends on whether or not Sky is enabled in the SketchUp Style. If Sky is enabled, a Ground Plane will be generated, but it will use the SketchUp Style's Background Color. If both Sky and Ground are disabled in the SketchUp Style, then no Ground Plane will be generated in the exported MXS.

Custom Color

In this mode, the Ground Plane will always be generated, and its color will be determined by the color chosen here.

Custom MXM

This mode is similar to the Custom Color mode, but it uses the specified MXM for the Ground Plane's material. If the MXM is textured, the texture will be mapped onto the plane using a one-meter size.

Disabled

This simply disables the Ground Plane option.

Diameter & Elevation

6.5 Output

The Output panel provides settings which control the various non-physical aspects of how the image will be rendered in Maxwell.
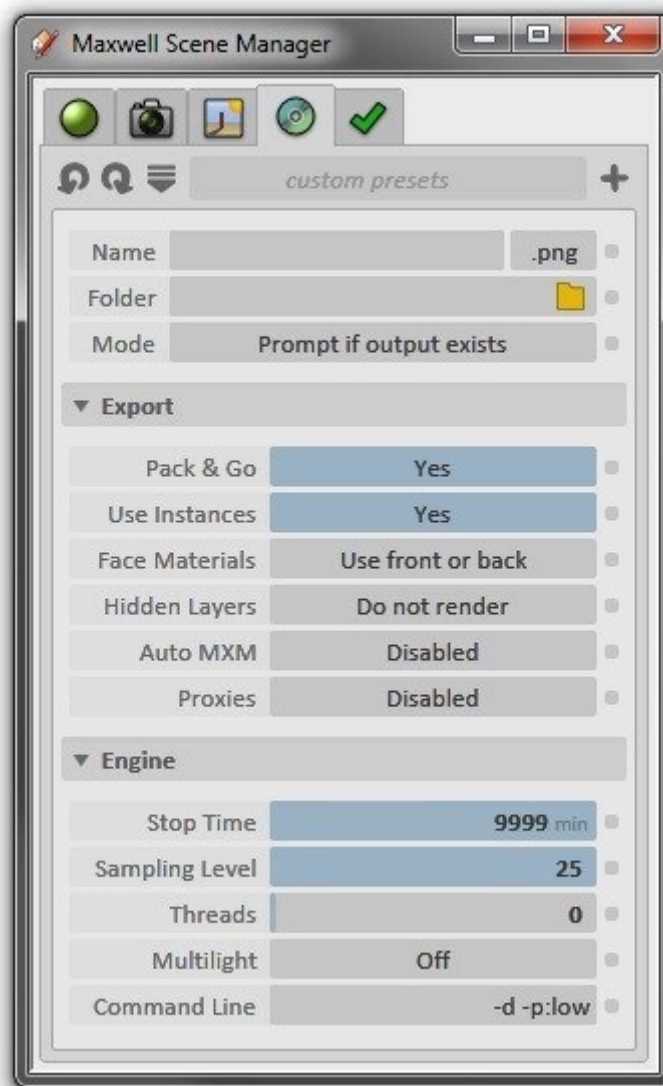
Figure 6.5.1: The *Output* panel.

6.5.1 Toolbar

The Output panel's toolbar contains the following items:

Undo/Redo

These two drop-down lists hold the history of actions which have been executed in the Output panel. They are cleared when a new document is opened.

Presets List

This drop-down provides a list of output presets which have been stored previously. To remove a particular preset, click the red **X** next to its name in the list.

Add Preset

Click this button to store the current settings as a new output preset.

6.5.2 [RS] Name

The name entered here will be used to name the various output files generated by Maxwell: the output MXS, MXI, and image files. If no *Name* is specified, then the name of the current SketchUp document will be used. If the SketchUp document has not yet been saved, the output will be named *Untitled*.

The format of the output image is determined by the value selected in the drop-down on the right.

6.5.3 [RS] Folder

The output will be written into the folder specified here. If no Folder is specified, output will be written at the same location as the current SketchUp document. If the SketchUp document has not yet been saved, output will be saved in the *[user's documents]/Maxwell/output* folder, located in the current user's *Documents* directory.

6.5.4 [RS] Mode

The *Mode* parameter controls the plugin's behavior in exporting MXS files when the target file already exists. By default, the plugin will prompt you to indicate whether or not you wish to overwrite the existing file. Optionally, by setting the *Mode* parameter appropriately, you can choose to always overwrite, and thereby avoid the overwrite prompt, or to have the plugin scan the target folder and generate a new, unique output name. When this last option is chosen, an incrementing four-digit number will be appended to the specified *Name*, i.e. *Untitled.mxs* will become *Untitled_0001.mxs*, *Untitled_0002.mxs*, and so on.

6.5.5 Export

The Export sub-panel contains settings pertaining to the plugin's behavior during MXS export.
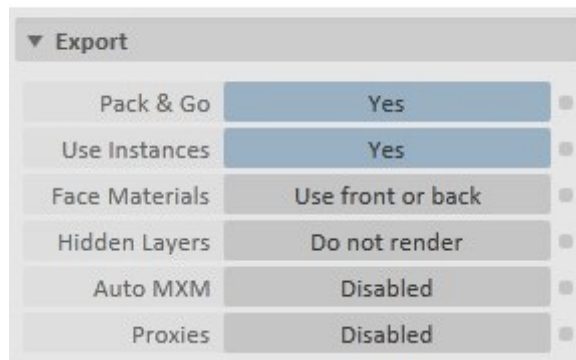
Figure 6.5.2: The *Export* sub-panel.

[RS] Pack & Go

When this option is enabled, the plugin will copy all files referenced by the output MXS into a *textures* directory, located in the output folder. Additionally, all file paths contained in the MXS file will be transformed into relative paths, in order that an MXS file may more easily be moved from machine to machine.

[RS] Use Instances

When this option is enabled, the plugin will attempt to replace any possible Components and Groups with Maxwell Instances in the output. This can result in drastically reduced memory requirements, as well as greatly improved export performance. This option is always enabled in the *Standalone* plugin, since there exists no reason to disable it.

Face Materials

Where SketchUp supports different front and back materials for faces, Maxwell does not. Therefore, as the model is being exported, the plugin first attempts to find a face's front material and to then build a Maxwell material for the face using this SketchUp material. If the face has no front material, the plugin will check to see if it has a back material, and if it does, then that material will be used.

Setting this option to *Use Front Only* will cause the plugin to disregard back materials entirely.

Hidden Layers

By default, the plugin will not render geometry located on layers which are hidden in SketchUp. Setting *Hidden Layers* to *Render* disables this check, such that all geometry contained in the scene will be exported, regardless of the visibility state of its layer. This can be useful in cases where high-resolution geometry has been placed on a hidden layer for the express purpose of keeping SketchUp more responsive.

Auto MXM

When this option is enabled, the plugin will attempt to match SketchUp material names with the names of MXM files found in any of the *Search Paths* specified in the Options panel (standard Maxwell installation directories will also be searched). When a match is found, the MXM file will be used in the MXS.

Proxies

When this option is enabled, the plugin will attempt to replace Component Definitions with the suffix *_proxy* in their name with definitions whose names match, but without the *_proxy* suffix. This allows for export-time replacement of low-poly geometry with hidden high-poly geometry.

For example, assume that a Component is shown in the viewport, and the Definition for this Component is named *'airplane_proxy'*. During export, the plugin will search for a different Definition in the document named *'airplane'*. If such a definition is found, then any occurrence of *'airplane_proxy'* will be replaced with the geometry contained in the *'airplane'* Definition during export.

6.5.6 [RS] Engine

The Engine sub-panel contains settings which control various aspects of Maxwell Render itself, and therefore does not appear in the *Standalone* plugin.
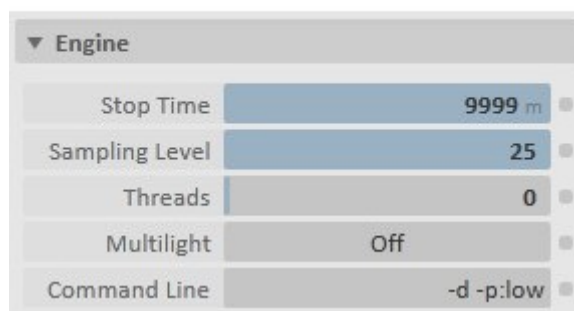

Figure 6.5.3: The *Engine* sub-panel.

Stop Time

This value controls the amount of time, in minutes, that Maxwell Render will continue calculating the output image. Generally, for single frames, this should be left at a very high value, with Maxwell being stopped manually only when the image has reached the desired level of quality.

Sampling Level

This value controls the Sampling Level at which Maxwell Render will stop the calculation. Generally, this should be left at a high value to prevent Maxwell stopping before the image is finished. For unattended batch rendering, however, it is useful to set this to the lowest acceptable value for the scene in question. This will provide a time-independent method for rendering multiple frames to a common quality level.

Threads

This value controls the number of Threads that Maxwell Render will use. While named *Threads*, this usually means how many CPU cores will be used by Maxwell Render. When Threads is set to 0, Maxwell will auto-detect and leverage all available resources.

Multilight

This drop-down controls whether Maxwell's Multilight feature will be enabled during rendering. There are two Multilight modes available: *Intensity* and *Color + Intensity*. Note that the use of Multilight will greatly increase the memory required to render the scene, since separate output buffers must be maintained for each emitter contained in the scene. The *Color + Intensity* option multiplies this requirement even further.

Command Line

Anything entered here will be added to the command-line used to start Maxwell Render. By default, it contains the **-d** flag, which causes Maxwell Render to start in GUI mode, and the **-p:low** flag, which causes it to run in *low-priority* mode. There are many other command-line flags available, and you can get the current list by opening a command prompt, navigating to the Maxwell directory, and typing **maxwell /?**.

6.5.7 Advanced View

When the Output panel's *Advanced View* is enabled, several additional *Output* parameter groups are shown. For technical details regarding any of the parameters mentioned here, consult the standard Maxwell Render manual (5.4.2).

Materials

Figure 6.5.4: The *Materials* sub-panel.

If an *Override MXM* is specified, it will be used instead of any materials otherwise defined in the scene, with the exception of emitters. This is useful for running quick light studies. If a *Default MXM* is specified, it will be used in place of the standard light-grey diffuse default material (i.e. the material used for objects which have no explicit material).

[RS] Channels
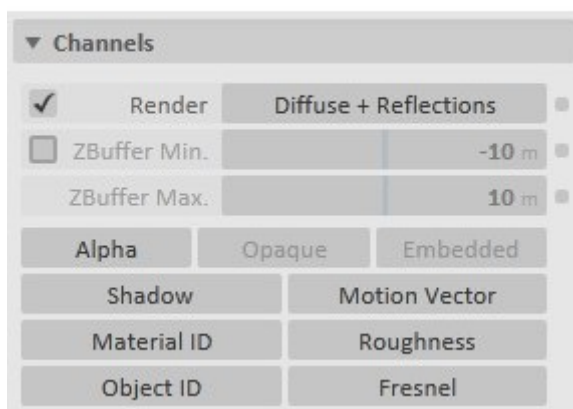
Figure 6.5.5: The *Channels* sub-panel.

This panel is used to control aspects of the various image outputs which are available in Maxwell. When the Render channel is activated, it is possible to render one of the following: *Diffuse*, *Reflections*, or *Diffuse + Reflections*. Additional channels may be enabled or disabled as desired; for each one that is enabled, an additional corresponding image will be generated at the output location.

ZBuffer Min. and *ZBuffer Max.* may be set interactively using the *Set DOF, Z-Clip, or Z-Buffer Tool* (5.3.3); to do so, press CTRL /Option(Win/OSX) while selecting points with the tool.

For more information, consult the standard Maxwell Render manual (5.4.2).

Tone Mapping
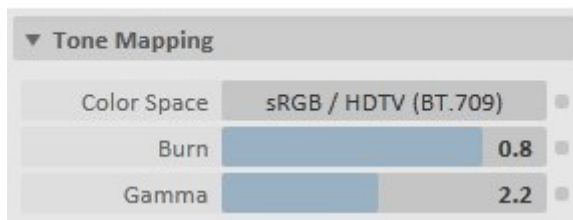
Figure 6.5.6: The *Tone Mapping* sub-panel.

These parameters control the *Color Space*, *Burn*, and *Gamma* values which will be used by Maxwell Render as it calculates the output image. For more information, consult the standard Maxwell Render manual (5.4.2).

Simulens
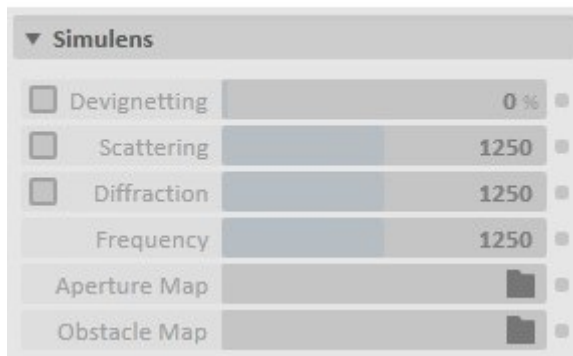
Figure 6.5.7: The *Simulens* sub-panel.

This sub-panel is used to enable, disable, and configure the various *Simulens* effects which are available in Maxwell Render. For more information, consult the standard Maxwell Render manual (5.4.2).

[RS] Render Layers

Figure 6.5.8: The *Render Layers* sub-panel.

Using these parameters, you can control which layers will be rendered for the Illumination, Reflection, and Refraction layers. For more information, consult the standard Maxwell Render manual (5.4.2).

6.6 Options

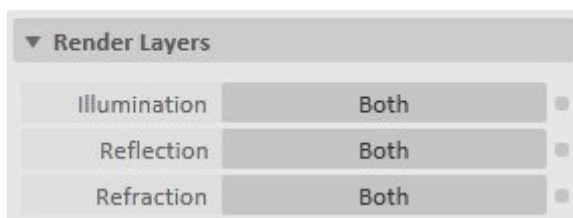The Options panel contains settings which apply on a global basis; they are not related to any particular SketchUp document.
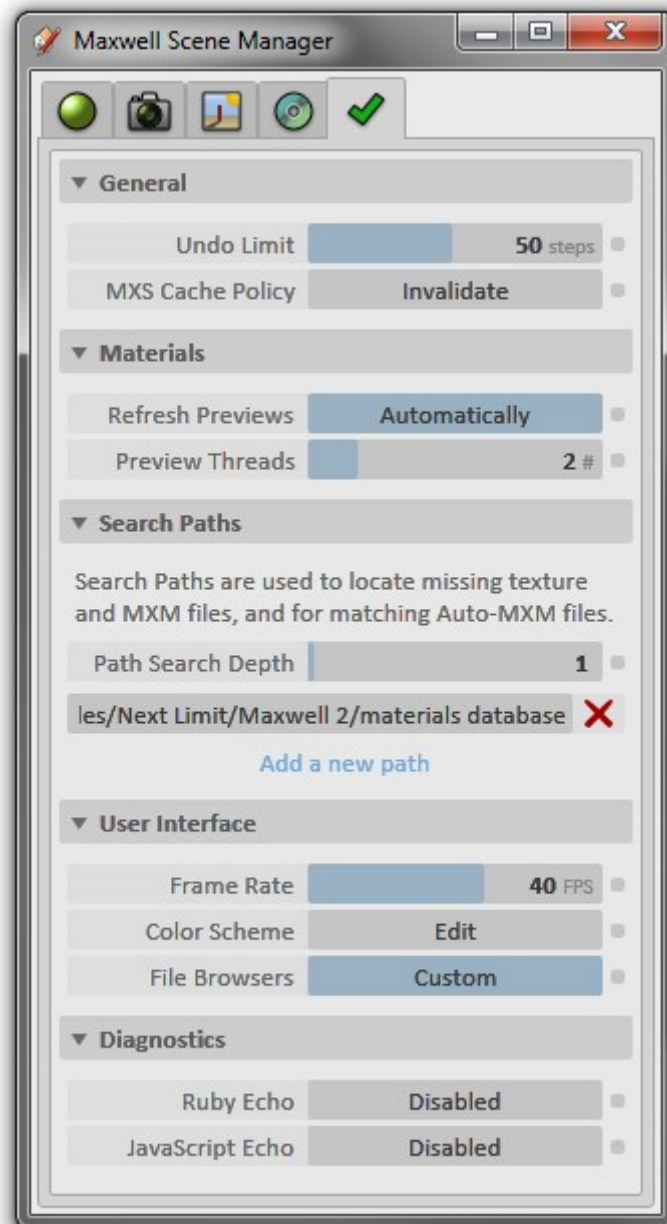

Figure 6.6.1: The *Options* panel.

6.6.1 General

- **Undo Limit***: This controls the maximum number of Undo and Redo steps which will be allowed in each of the other Scene Manager panels.

- **[RS] MXS Cache Policy***: This determines the behavior of MXS Export when Maxwell Fire is active. If set to *Use Cache*, MXS files will be written using data currently held in Maxwell Fire. If set to *Invalidate*, a fresh export will be performed. If set to *Prompt*, the plugin will ask which method to use. It is usually when using *Export to Studio* 5.1.2 that it may be necessary to invalidate the data, since its having been rendered in Maxwell Fire can sometimes result in objects appearing in odd positions in Maxwell Studio.

6.6.2 Materials

- **Refresh Previews**:This controls whether or not the plugin's material editor responds in real-time to material parameter changes. When set to *Automatically*, the preview will be rendered immediately, whenever the material is altered. When set to *Manually*, it will be necessary to click the *Render Preview* button(6.2.2) to render a new preview for the material.

- **Preview Threads**: This controls how many processor threads are used by the material preview render-engine.

6.6.3 Search Paths

Using this section, it is possible to add paths which will be searched when the plugin cannot find texture, MXM, and other files. These paths are also used by the Auto MXM feature. In addition to the paths specified here, there are several standard paths which will always be searched; typically, this would include several of the folders contained in your Maxwell installation folder.

The *Path Search Depth* parameter controls how many sub-directories will be searched for each specified Search Path.

6.6.4 User Interface

- **Frame Rate**: The user interface is implemented using Microsoft Silverlight; Silverlight renders using a certain frame-rate, which you can control using this parameter. Higher frame rates result in smoother user-interface animations.

- **Color Scheme**: It is possible to customize the color scheme of the Scene Manager user-interface. Clicking the *Edit* button will bring up a floating sub-dialog which provides color pickers for each different element class used in the interface. Custom color schemes may also be read from and written to file using the Color Scheme Edit dialog.

- **File Browsers**: This option determines whether the plugin will use SketchUp's file-browsing functions or ones specifically called from the host operating system. This option is only used on Windows.

6.6.5 Diagnostics

Ruby Echo and *JavaScript Echo* are used to enable message-tracing in the plugin during runtime. In general, these features will only be used by customer support to assist in diagnosing any possible issues which may arise with the plugin's behavior. These options should never be enabled during normal use, as they may cause the general performance of the plugin to be significantly degraded.

7 Maxwell Fire

Maxwell Fire provides interactive rendering within the SketchUp user-interface. Its functionality is contained in the *Maxwell Fire* window:

Figure 7.0.1: The Maxwell Fire window.

The *Maxwell Fire* window may be opened or closed using the *Maxwell Fire* menu item or toolbar button:

Figure 7.0.2: Open or close the *Maxwell Fire* window.

[SA] Note: since the *Standalone* plugin does not depend on the presence of Maxwell Render Suite, it performs all rendering using the Maxwell Fire window. Maximum output resolution and

the render engine used are set using *Engine Settings* 7.2. Finished images are saved using the *Save Image* button(7.1) .

7.1 Overview

The implementation of Maxwell Fire in the plugin serves two main purposes, depending on the plugin version in question:

- **[SA]** In the *Standalone* plugin: Maxwell Fire is both used for scene setup, and for rendering of final images. When the *Standalone* plugin is licensed, you can choose whether Maxwell Fire uses its *Draft* or *Production* render engine.

- **[RS]** In the *Render Suite* plugin: While Maxwell Fire can be used to render final images, its primary purpose is to provide real-time feedback during scene setup. It is assumed that an MXS file will subsequently be written, and rendered in Maxwell Render.

The operation of Maxwell Fire in the plugin has been kept as simple as possible. To use Maxwell Fire, simply use the toolbar or menu to open the Maxwell Fire window:
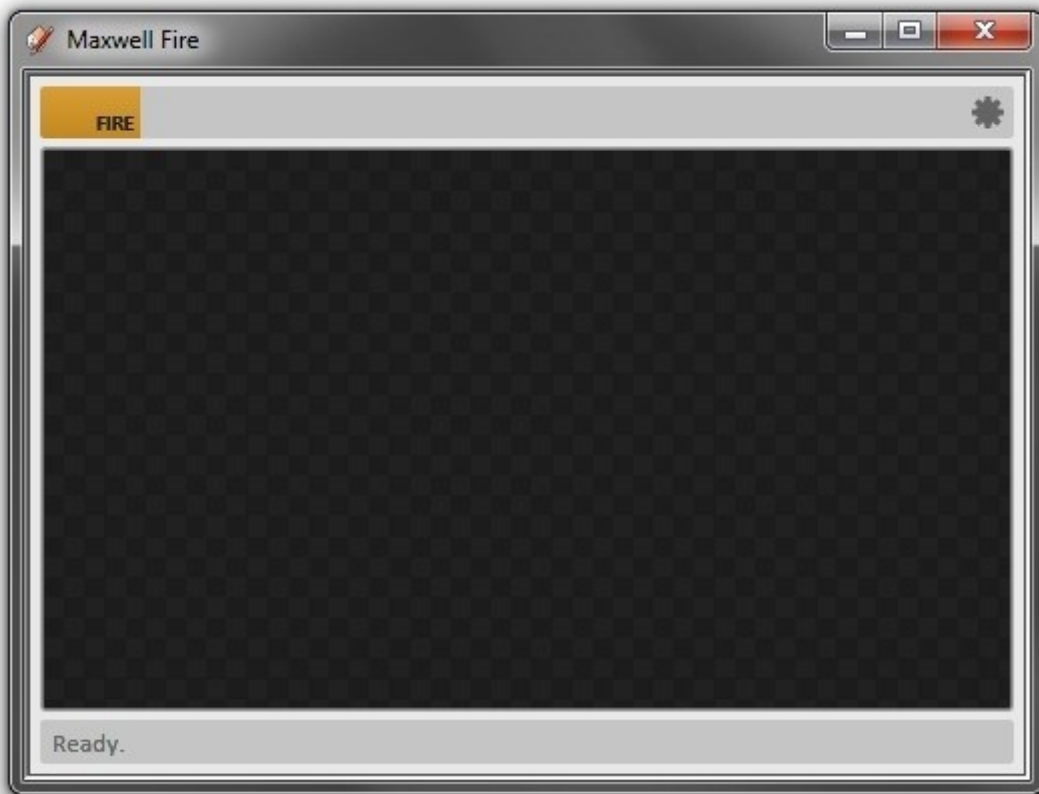

Figure 7.1.1: The Maxwell Fire window's initial state.

The toolbar at the top of the window contains different buttons, depending on various conditions. When Maxwell Fire is active and rendering, it appears like this:

Figure 7.1.2: The toolbar, as it appears when rendering.

At the left side of the toolbar, there are two buttons:

- **Fire/Stop**: when Maxwell Fire is disabled, this button is yellow, and reads **Fire**. Clicking it in this state will perform an export if necessary, and begin rendering the scene in Maxwell Fire. If, on the other hand, Maxwell Fire is currently rendering, this button is red, and reads **Stop**. Clicking it in this state will disable Maxwell Fire. To completely unload Maxwell Fire and its data from memory, close the Maxwell Fire window.

- **Re-export Scene**: this button is only shown after the scene has initially been exported. Clicking it will cause the data currently in memory to be released, and a new export will be performed. It is necessary to do this when objects have been moved, material assignments changed, or UV coordinates modified.

At the right side of the toolbar, there are also find two buttons:

- **Save Image**: this button is used to save the current image to disk. It is only shown when an image exists. Maxwell Fire supports saving images in 8-bit RGB formats only; the format written is determined by the file extension specified.

- **Engine Settings**: shows the Engine Settings window (7.2), which is used to control various Maxwell Fire settings.

As mentioned above, toggling the **Fire** button at top-left causes the model to be exported from SketchUp into the Maxwell format. Once this process is complete, rendering will begin. Rendering progress and status messages are shown in the progress bar at the bottom of the window; if errors are encountered, a button will be shown to the right of the progress bar:
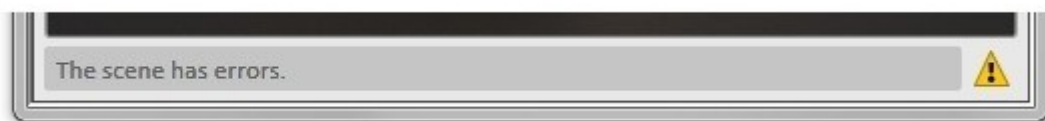
Figure 7.1.3: The error report button.

In this case, the error was caused deliberately by changing the Environment type to None, when there were no emitters in the scene. Clicking the error report button, we see what the render engine is reporting:
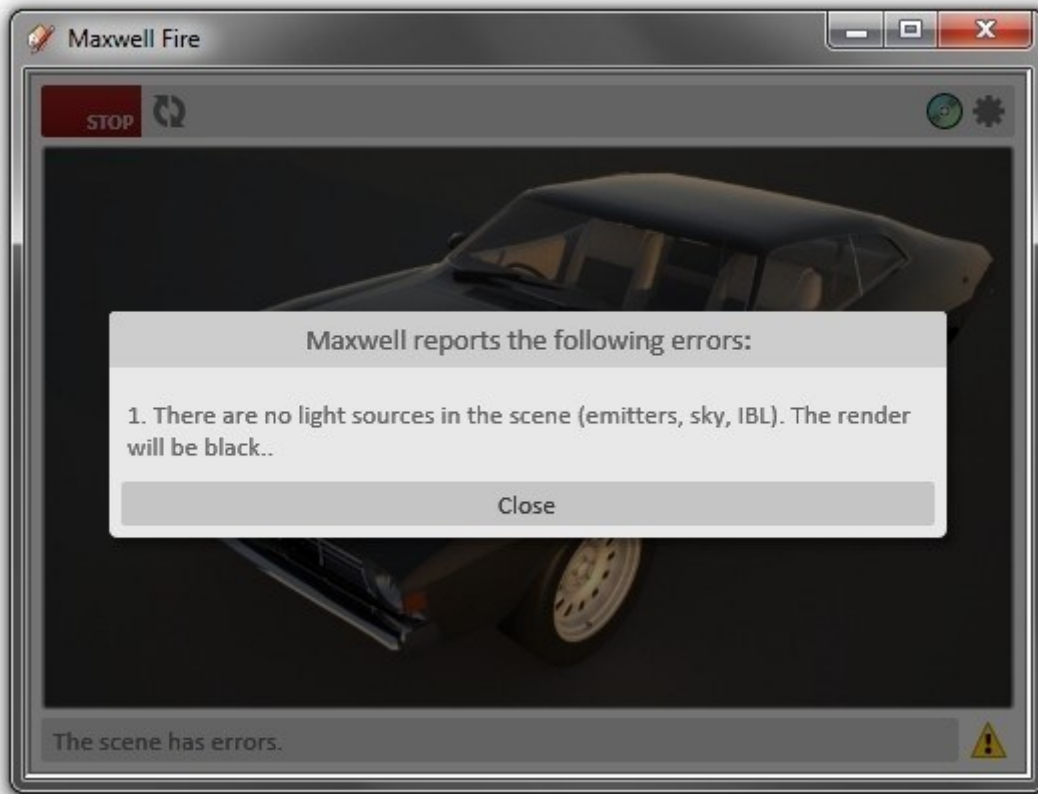
Figure 7.1.4: An error report.

The engine will resume rendering once the error is corrected, though in some cases, it may be necessary to re-export the data. To do this, click the **Re-export Scene**(7.1) button.

7.2 Engine Settings

Clicking the *Settings* (gear) button pops up the Engine Settings window:
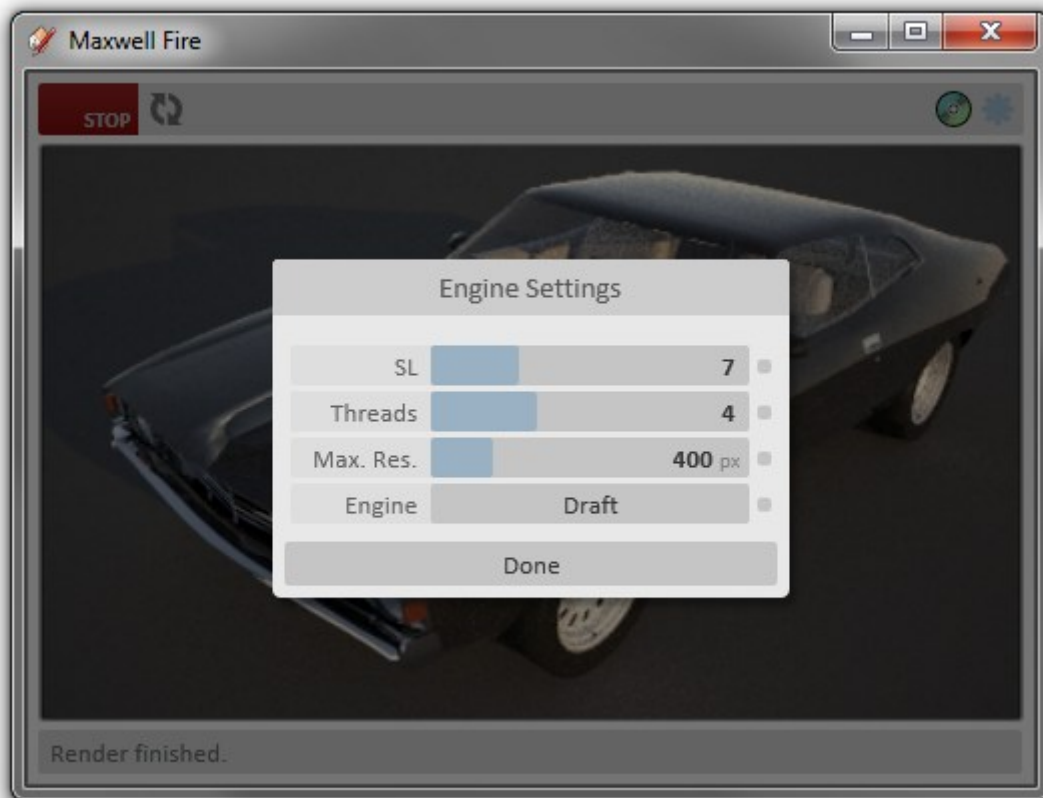
Figure 7.2.1: The Engine Settings window.

These settings roughly correspond to the similar settings found in Maxwell Render:

- **SL:** Sets the sampling level at which rendering will be stopped.

- **Threads:** Sets the number of threads which will be used by the render engine, where zero means *auto-detect*.

- **Max. Resolution:** Sets the actual size of the largest dimension of the rendered image. The aspect ratio of the output is determined by the aspect ratio of the *Output Resolution* (6.3.2) of the currently-rendering camera. Unlicensed plugins are restricted to 800 px maximum resolution, and licensed to 1920 px.

- **Engine:** It allows you to specify whether rendering be done using Maxwell Render's *Draft* or *Production* render engine. While both engines are entirely unbiased, and will eventually converge to produce the same image, they use very different calculation strategies, which are suited to very different purposes:

  Draft: This is the default engine used by Maxwell Fire. It gives a basic idea of the final image as soon as possible, and also updates very frequently, in order to provide responsive real-time feedback.

  Production: While the *Draft* engine is very good for real-time work, it will not, in fact, render a finished image faster than the *Production* engine, in many cases. This is especially true in situations which involve more complex light interactions: caustics and indirect lighting, heavy depth-of-field, etc.

The *Engine* parameter is only available in licensed installations; unlicensed installations are restricted to using the *Draft* engine.

7.3 Interactivity

Not all types of changes can be handled in real time; currently, there are two different classes of scene alteration:

1. **Physical:** changes to geometry (topology or location), assignment of materials, alteration of UV coordinates, etc.

2. **Conceptual:** changes to materials, cameras, environment, output settings, and so on.

Conceptual changes are accomplished in real time, and therefore, do not require the model to be re-transferred. Physical changes do. So, for example, changing the color of a material, the position or exposure of a camera, or the time of day are all things which will be reflected in real time in Maxwell Fire. Painting a face with a new material, or moving/deleting a component, on the other hand, are not handled in real time, and require that the scene be re-exported.

7.4 [RS] MXS Files & Memory

Whenever the Maxwell Fire window is opened, and the model has been exported, the MXS-writing functions of the plugin will behave slightly differently than normal; rather than performing a full model export, they will use the data currently held in the Maxwell Fire scene. This data will also remain in memory for as long as the Maxwell Fire window is opened, or until a different model is opened in SketchUp.

This is done both in the interest of saving time (it takes much less time to write an MXS file from existing data than it does to transfer the entire SketchUp model), and to ensure that what you see in the Maxwell Fire window is what you will see in your MXS file. If you wish to perform a full export, or to free the memory currently being used by Maxwell Fire, simply close the Maxwell Fire window.

The determination of whether to use cached data, or to perform a full export, is made using the *MXS Cache Policy* option (6.6.1).

7.5 Notes

2-Point Perspective

SketchUp's 2-Point Perspective camera mode is not supported in Maxwell Fire, due to SketchUp API limitations. However, this is not likely much of an issue, since Maxwell Fire allows you to pre-visualize the effects of Maxwell's own *Shift Lens* (6.3.4) feature.

Using Threads

It is worth noting that there are actually two instances of Maxwell Fire used in the plugin: one for rendering models, and one for rendering material previews. Since they can both be active at the same time, it will be necessary to set the Threads parameters for each (Maxwell Fire7.1, material preview6.6.2) in order to achieve your desired performance. If you are on a single- or dual-core machine, it may be desirable to disable automatic preview refresh (6.6.2).

8 Entity Context Menu

In the context (i.e. right-click) menu for SketchUp entities, you will find a Maxwell item:
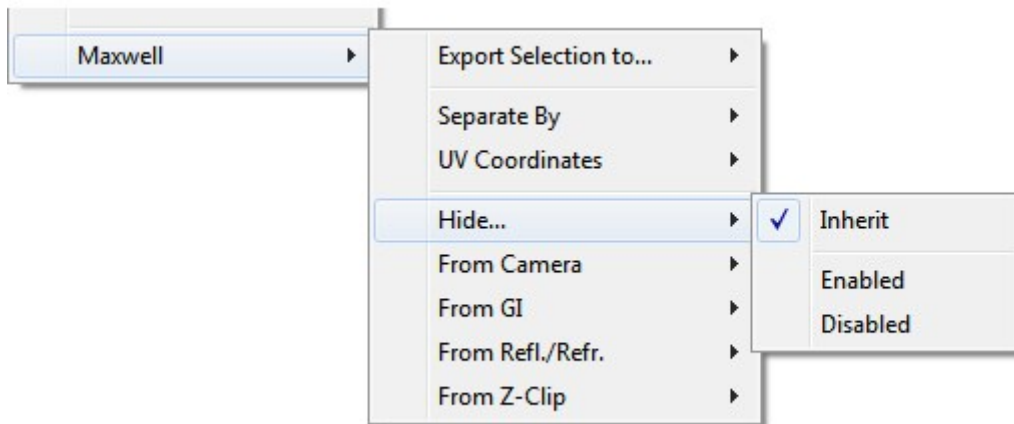
Figure 8.0.1: The Maxwell entry in SketchUp's context menu.

The actual items included in the menu depend on the type of entity selected, and the version of the plugin. Each one may either be set to *Inherit*, or to a specific value. If set to Inherit, the entity will use the corresponding value set in its parent entity. If its parent also uses *Inherit*, the search will continue upward to the parent's parent. And so on, until no parent is found.

Note that this is similar to the way material assignment works in SketchUp.

8.1 Hide from

This menu applies to groups and components.
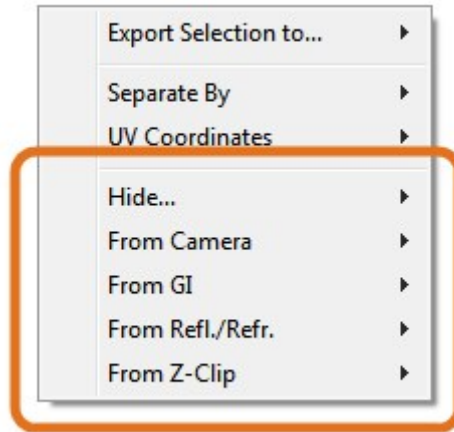
Figure 8.1.1: The *Hide from* context menu.

When the *Hide* parameter is enabled, the entity will be exported with its *Hide* flag enabled in Maxwell. This means that it will neither be seen, nor will affect how the scene is rendered in any way.

The remaining parameters correspond to the matching Maxwell *Hide from [x]* flags in the MXS file. Their functions should be fairly self-explanatory; for more details, consult the regular Maxwell Render manual. If set to *Inherit*, and no parent is found, these parameters will use their default: *Disabled*.

8.2 [RS] Separate by

This menu applies to groups and components, and is not shown in the *Standalone* plugin, since there is no reason to do so.
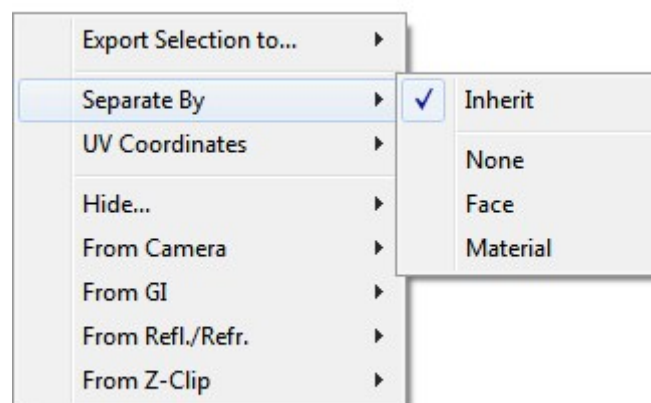
Figure 8.2.1: The *Separate by.* context menu.

8.2.1 Inherit

Attempts to use the *Separate by* value of the entity's parent. If no parent is found, the default, *None*, is used.

8.2.2 None

This is the default; when an entity uses this mode, all of the faces it contains will be exported as a single mesh.

If it contains faces with differing materials, they will be assigned using triangle selections. If the entity has multiple materials, one or more of which is emissive, then it will be switched to use the *Separate by Material* mode, since Maxwell does not support emitter materials on multi-material objects.

8.2.3 Face

When an entity uses this mode, each of its faces will be exported as an individual mesh.

8.2.4 Material

When an entity uses this mode, its faces will be separated by material, with one mesh for each material appearing in the MXS file.

8.3 UV Coordinates

By default, the plugin uses any UV coordinates which may be supplied by SketchUp. In some cases though, there are either no UV coordinates to export, or the ones which exists are of a sub-standard quality. Use the commands in this menu to override the UV coordinates provided by SketchUp with new ones, generated by the plugin at export time.
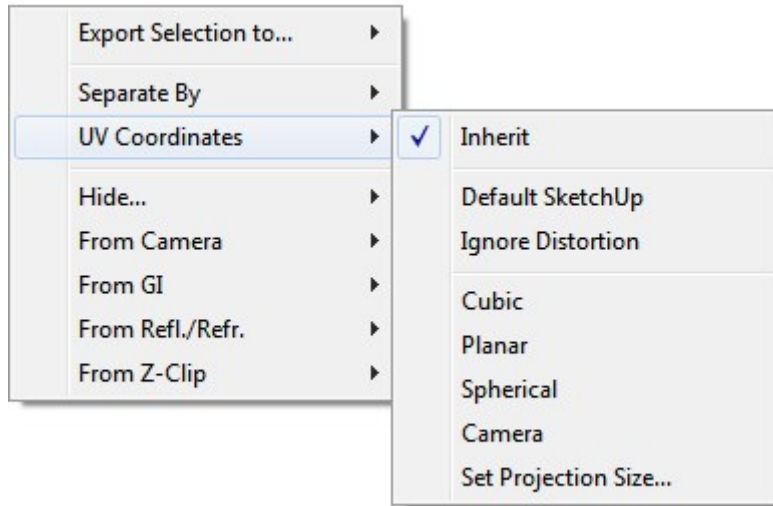
Figure 8.3.1: The *UV Override* context menu.

8.3.1 Inherit

Attempts to use the *UV Coordinates* value of the entity's parent. If no parent is found, the default, *Default SketchUp*, is used.

8.3.2 Default SketchUp

This is the default; it disables UV override for the selected entities. It is also used for any entity which lacks UV coordinates, in which case it uses the same strategy as the Camera UV override.

8.3.3 Ignore Distortion

This uses the same strategy as *Default SketchUp*, but prevents distorted versions of applied textures from being exported as unique textures. This can be useful in some cases where texture distortion is very slight; for example, given a tree model with hundreds of leaves, where the texture of each leaf is distorted by a very small amount, using this option will ensure that only one leaf material & texture is exported, rather than hundreds.

This can **significantly** reduce the time and memory required to export and render such a model.

8.3.4 Cubic

This option maps the selected entities using a cubic mapping, the size of which is determined using *Set Projection Size*. The position of the mapping cube is centered on the cumulative bounding box of the entities to which it is applied.

8.3.5 Planar

This option maps the selected entities using a planar mapping, projected from above. The size of the UV space generated is determined using *Set Projection Size*. Its position is centered on the cumulative bounding box of the entities to which it is applied.

8.3.6 Spherical

This option maps the selected entities using a spherical mapping, and is centered on the cumulative bounding box of the entities to which it is applied. Logically speaking, a spherical mapping does not have any size, so *Set Projection Size* has no effect on this mapping.

8.3.7 Camera

This option is a planar projection which is aligned perpendicular to the camera's view direction. The size of the UV space generated is determined using *Set Projection Size*.

8.3.8 Set Projection Size...

Sets the size of UV space, in meters, which will be generate for this entity. The default value is 1.0.

8.4 [RS] Export Selection

The commands in this menu roughly correspond to the *Render* (5.1.1), *Export to Studio* (5.1.2), and *Export MXS* (5.1.5) commands found in the plugin menu and toolbar.
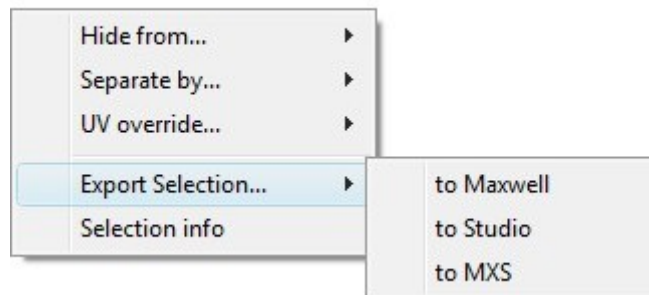
Figure 8.4.1: The *Export Selection* context menu.

When these commands are invoked, you will be prompted to provide a *Filename Modifier*; this is a name which will be appended to the normal MXS output name, as calculated according to the standard output naming rules (6.5.2). For example, if the standard output name would be

output.mxs, and a Filename Modifier of **selection** is chosen, the MXS file will be written as **output - selection.mxs**. This makes it easier keep things organized if you choose to import exported selections into Maxwell Studio.

9 General Discussion

9.1 [RS] Instances

By default, the plugin's *Use Instances* (6.5.5) option is enabled. This is a good thing, since SketchUp is still a 32-bit application, and can therefore use a maximum of 2GB of memory. Instances can drastically reduce the amount of memory required to export a model; additionally, they also enable Maxwell Render to use less memory at render time, though this is not as important, since Maxwell is offered in a 64-bit version, which effectively has no memory limit.

There are some things which are worth mentioning about how instances in SketchUp relate to instances in Maxwell. Conceptually, an instance is a reference to some other entity. In SketchUp, this relationship is generic; that is, an instance (i.e. a *Component Instance*) may reference another instance. This is not the case in Maxwell; here, there is always a one-to-many relationship between geometry and instances, where any given instance references an actual mesh object, and cannot reference another instance.

As such, the plugin must analyze the SketchUp document structure at export time, and arrange for one, and only one, physical mesh to be created for each Component Definition which is used in the document. All Component Instances which reference each Definition must then be collected into a list, where each resulting Maxwell instance's transformation takes into account any nested transformations which may be effective for the SketchUp Component Instance in question (since SketchUp Component Instances may be included in the Definitions of other Component Instances).

The ultimate result of all of this is that it is not technically possible to represent the model in MXS format using the same conceptual structure as is present in the SketchUp document. Specifically, the tree-like logical structure which is created when SketchUp Components reference other SketchUp Components cannot be represented in the MXS, since Maxwell instances cannot refer to other Maxwell instances.

The structure which will be seen in the MXS, therefore, is slightly different than one might expect. The plugin organizes objects in the MXS by type: Component, Group, and Faces. In the MXS structure, these objects may end up having any number of Maxwell instances which refer to them. If a particular Component Definition is used in multiple other definitions in SketchUp, it will still appear only once in the MXS file – the remaining references in SketchUp will appear in the MXS as Maxwell instances attached to whichever SketchUp entity had its definition exported first.

This maximizes the use of memory, since each physical definition will only ever exist as actual mesh geometry once in the MXS file.

[SA] Note: instances are always enabled in the *Standalone* plugin, as there is no reason for them to be disabled.

9.2 [RS] Groups

In SketchUp, Groups are really a special kind of Component Instance. As such, it is entirely possible for the plugin to export any recurring instances of a Group using the same instance mechanism as is described above (9.1) with regards to Component Instances.

That is to say, only one copy of any particular Group in SketchUp will be exported as actual mesh geometry; any other occurrences can and will be exported as a Maxwell instance (assuming the plugin's *Use Instances* (6.5.5) option (6.5.5) is enabled).

9.3 [RS] Faces

Faces in SketchUp may be owned by a Group, a Component Definition, or the Document itself. During export, the fate of any given face depends on which of these it belongs to. Faces contained in Groups and Components may be separated by material (8.2.4), face (8.2.3), or not at all (8.2.2).

9.4 [RS] Naming

Objects

The MXS format requires that objects each be given unique names. As such, objects in the MXS are named for their corresponding SketchUp entity, along with a bracketed number:

> **<Component#1> [1.2.1.19]**

The bracketed number encodes information about how the object was exported. The first number indicates how faces were separated (8.2), where:

> **0:** Separate by None
> **1:** Separate by Face
> **2:** Separate by Material

<Component#1>, then, was exported with its *Separate by Face* flag enabled. The second number indicates if UV coordinates (8.3) were overridden, where:

> **0:** Default SketchUp
> **1:** Ignore Distortion
> **2:** Cubic
> **3:** Planar
> **4:** Spherical
> **5:** Camera

<Component#1> was exported, then, using *Cubic* UV coordinates. The third number deals with situations in which multiple copies of the same entity are exported, and indicates with which copy any given object corresponds; this, then, was the second copy of *<Component#1>* to be exported (numbering starts at 0).

The fourth number will only appear when the object is exported using *Separate by Face* or *Separate by Material*, and indicates to which face the mesh corresponds, inside the parent Component or Group.

Additionally, an instance's name will have a fifth number, indicating which of several copies it is.

Materials

Materials in an MXS are also required to have unique names. In an MXS, you may find more than one copy of the same SketchUp material, where the SketchUp material name has been changed, similar to this:

Material [5]

Material here corresponds to SketchUp's name for the material, and *[5]* to the index of the material's texture inside of the SketchUp *TextureWriter*, which is a SketchUp API tool used by plugin code to obtain unique textures for faces which require them.

When a face has a distorted texture, it is necessary to create both a unique texture, on disk, and a unique Maxwell material for use with that texture, in the exported MXS. This is because when a texture is distorted on a face, SketchUp uses a combination of modified UV coordinates and modified texture pixels to accomplish the effect.

9.5 [RS] Layers

The SketchUp concept of layers cannot be represented in the MXS format. In SketchUp, an entity's Layer is unrelated to its position in the document hierarchy; rather, it is more like an attribute attached to an entity.

Therefore, the way in which the plugin uses SketchUp Layers for organization in the MXS differs conceptually from the way it is used in SketchUp. When entities are exported, the plugin will attempt to place them under a node in the MXS which is named for the SketchUp Layer that they use. For faces, this will generally work fine, but when dealing with instances, the situation becomes slightly more complicated.

As discussed above in the Instances (9.1) topic, only one actual mesh will be exported for each Component Definition, regardless of how many references to this definition exist in the SketchUp document. This presents an issue with the organization of objects by layer name, because only an actual mesh may be categorized in the MXS structure; instances are always attached to the mesh they reference. That is to say, instances cannot be organized by layer name in the MXS. To demonstrate, consider the following SketchUp document:
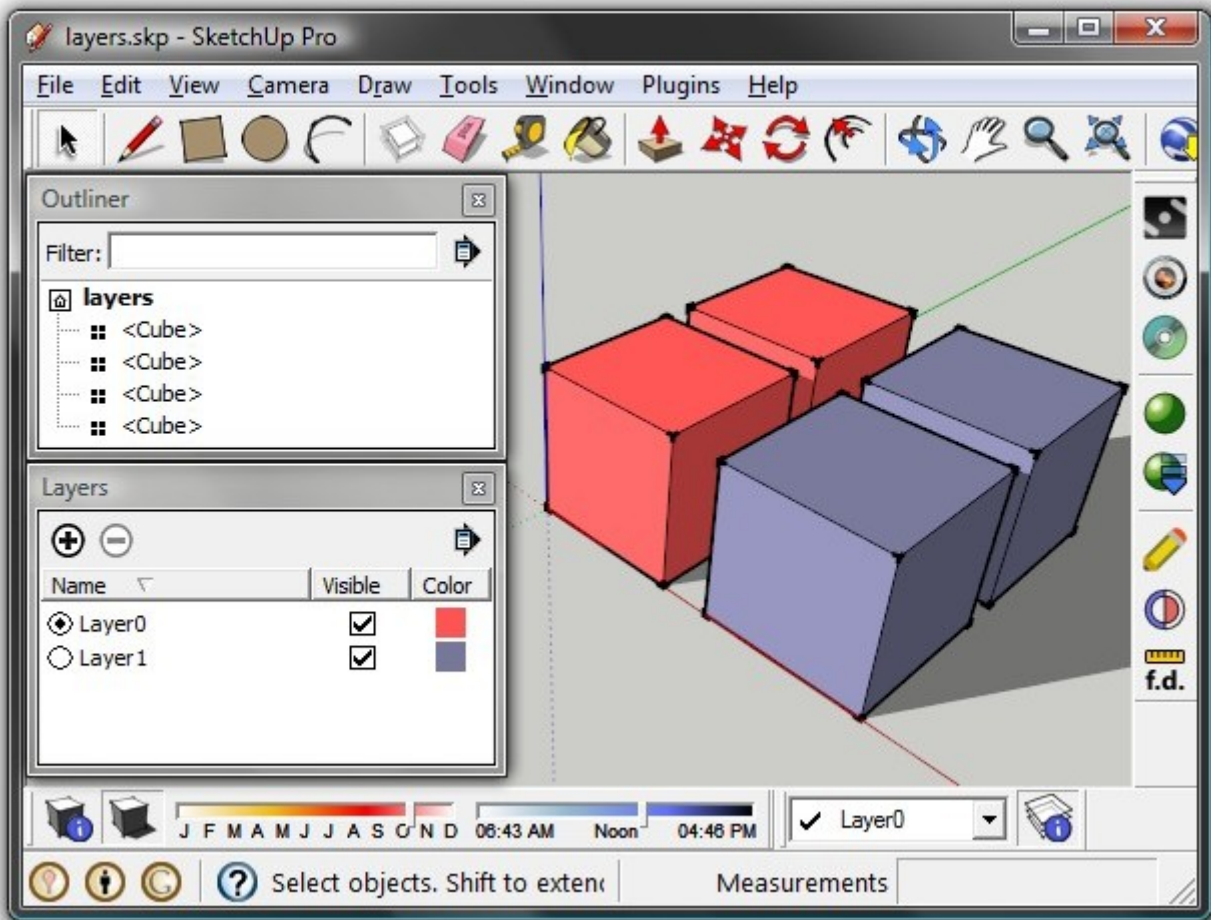
Figure 9.5.1: One Component Definition being used with multiple layers.

If the plugin means to export the definition for *Cube* only once, and if all instances of the mesh for *Cube* must be attached to its mesh definition, then we can see that it will not be possible to respect the per-Layer organization being used in the SketchUp document. When exported to MXS, this document may therefore have a structure that looks more like this:
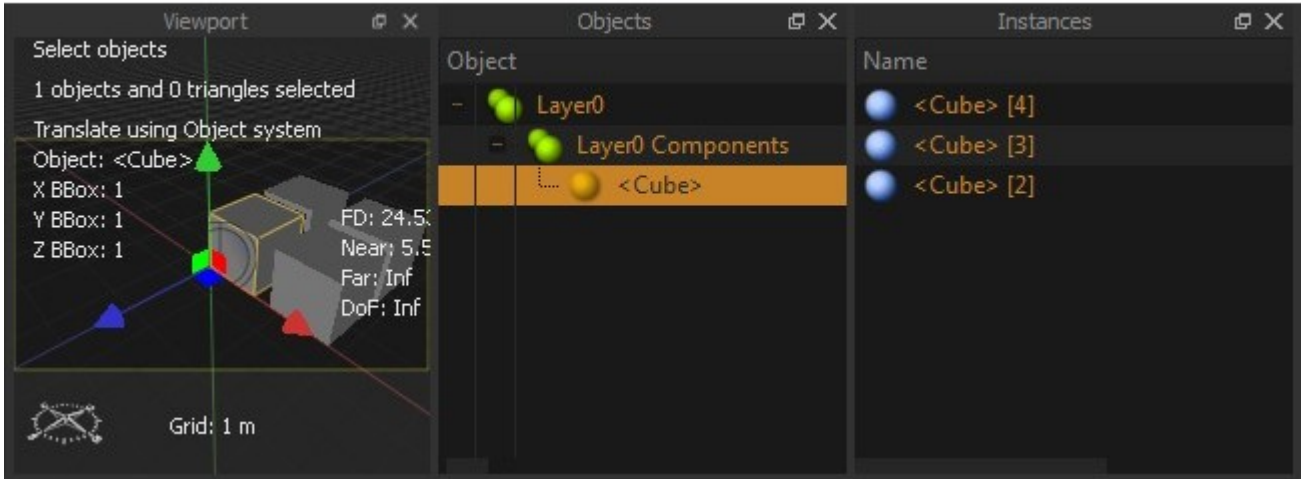
Figure 9.5.2: How the structure appears in MXS format.

So, as can be seen, the 'layer' node (the one in the MXS which will be given a SketchUp Layer name) which appears in the MXS is the one for the Layer of the *Cube* instance which was encountered first during the export, and was therefore exported as a mesh object, rather than an instance. The other three instances of *Cube* appear in the MXS as instances attached to that mesh, and being instances, have no parent which can be used to indicate their SketchUp Layer.

9.6 Interactivity

Following is a short discussion regarding various aspects of the design-time experience of using the plugin.

9.6.1 In General

One of the first things you may notice using the plugin is a general absence of what may be referred to as the *action > confirmation* paradigm. This is commonly seen in applications when you change a setting, and before being allowed to continue working, are asked to confirm whether you would like the change to be committed.

Rather, actions you execute in the plugin take effect immediately; there is neither any need to confirm the change, nor to update the state of the document. The need for confirming such changes is handled through the provision of a generalized undo/redo system, which is implemented on a per-object basis in the plugin (*per-object* here refers to the fact that each page in the Scene Manager (6) manages its own individual undo/redo list).

The effect of all of this is that it is not possible to render a scene with 'stale' settings; since changes to settings take effect immediately, you simply change the desired parameter and then render. If it turns out the change did not accomplish what you intended, simply undo the change to return to where you were before.

9.6.2 Materials

By default, plugin materials (6.2) also interact actively with the SketchUp scene, when their applicable *Link to Application* options (6.2.4, 6.2.5) are enabled. Changes made to a material's color are applied to the color of the SketchUp material to which it is associated. Conversely, color and texture changes made via SketchUp's material editor are reflected in the plugin material, as they are made.

9.6.3 Environment

The plugin responds to changes in SketchUp's environment automatically. Specifically, always retrieves the date, time of day, and any scene rotation from SketchUp's own settings. This is not so much interactive, since no indication of these changes need be shown in the plugin user-interface. Rather, it is more the case that the plugin checks the applicable settings in SketchUp at export-time, ensuring that they are always synchronized in the rendered image.

10 EV Chart

Following is a chart of typical exposure values for various lighting conditions:

Lighting Condition	EV @ ISO 100
Daylight	
Light sand or snow in full or slightly hazy sunlight (distinct shadows)	16
Typical scene in full or slightly hazy sunlight (distinct shadows)	15
Typical scene in hazy sunlight (soft shadows)	14
Typical scene, cloudy bright (no shadows)	13
Typical scene, heavy overcast	12
Areas in open shade, clear sunlight	12
Outdoor, Natural light	
Clear sky background	15
Cloudy sky background	14
Sunsets and skylines	
Just before sunset	12-14
At sunset	12
Just after sunset	9-11
e Moon, altitude > 40°	
Full	15
Gibbous	14
Quarter	13
Crescent	12
Outdoor, Artificial Light	
Neon and other bright signs	9-10
Night sports	9
Fires and burning buildings	9
Bright street scenes	8
Night street scenes and window displays	7-8
Night vehicle traffic	5
Fairs and amusement parks	7

Christmas tree lights	4-5
Floodlit buildings, monuments, and fountains	3-5
Distant views of lighted buildings	2
Indoor, Artificial Light	
Galleries	8-11
Sports events, stage shows, and the like	8-9
Circuses, floodlit	8
Ice shows, floodlit	9
Offices and work areas	7-8
Home interiors	5-7
Christmas tree lights	4-5

(table from wikipedia.org @ http://en.wikipedia.org/wiki/Exposure_value)