Rendering with mental ray®: Tips and Tricks
Ramy Hanna – SHW Group

AV2002-L
Lighting and rendering large, complex architectural interiors can be a daunting task. In this hands-on lab, I will take you through the steps for creating a simple lighting solution and render complex architectural interior spaces in minutes using Autodesk® 3ds Max® software. You will discover how efficient mental ray software can be and how simple it is to use. We will also go through the steps to render different lighting effects as separate render passes, such as ambient occlusion, z-depth, and glare.

Learning Objectives
At the end of this class, you will be able to:

• Light and render complex scenes efficiently using mental ray
• Distinguish differences between Final Gather and Photon Mapping
• Identify four different types of render passes
• Combine different passes together in a post process

About the Speaker
Ramy Hanna is an Associate and Head of Visualization at SHW Group, and has been in the arch-viz industry for the last decade creating architectural renderings and animations using a combination of 3D software. He is also an architectural photographer for his firm, and has won several design awards including AIA Design Awards. Ramy has spoken at several Autodesk University presentations, is an online instructor for The Gnomon Workshop, Blackspectacles.com and for the last 4 years has been on the 3dsmax Beta team providing valuable input to Autodesk. In 2003 he was involved in an animated short nominated at SIGGRAPH, and in 2006 his animated short played in AMC movie theatres nationwide. Most recently Ramy spoke at the inaugural VisDay 2012 in Australia.

ramy02@gmail.com
www.ramyhanna.com
@ramy3D
Lab Overview

The intent of this lab is that you will have an understanding of how to efficiently texture and light an interior scene of a 3D model using 3ds Max 2013. Along with creating a good rendering, this lab also goes through the different rendering passes needed to composite in post so your images will really shine!

Materials

Every material is unique, but there are some general qualities about materials that apply to certain types. In this handout, I chose to highlight 6 different materials that possess unique traits, hopefully covering all aspects of materials. The goal in this handout is to simply highlight the unique settings for each material.

Brick

This is perhaps the simplest type of material as it is a matte material, meaning it doesn’t have any reflective or refractive qualities. However, in real-life, every material has reflective properties, but for the efficiency of a rendering, and the way we perceive materials, certain materials don’t need reflection such as things like brick, fabrics, or drywall.

1. Add Brick Map into Diffuse Slot
2. Adjust Size of map to 4’x4’
3. Copy and paste map into bump slot

Glass

This may be the most asked about material, and is much simpler than people think it is. There are essentially two properties to glass: reflection and refraction. That’s it. The factor that comes into play is the geometry that it is applied to; ie: is it thin geometry (a plane) or is it thick (a box)?

1. Diffuse color at 0% (0.0)
2. Set reflection to 60% (0.6)
3. Refraction to 100% (1.0)
4. You can set color of light passing through glass by changing the refraction color
5. Under Advanced rollout, choose whether your glass material is applied to a thin or thick geometry
Anodized Metal
A lot of metal and plastic materials have very reflective parameters but not refraction. In this case an anodized metal is not only reflective, but because of the grain on the material casts reflections in a certain direction (anisotropy).

Any % in the numeric spinner looks to the color or map properties. In this example 100% of the reflection is looking to the color grey (0.3). This would be the same as setting Reflectivity to 0.3 when the color swatch is white.

Anisotropy is also set to 0.25, this controls how the reflections spreads.

I also adjusted the reflection falloff to 0.54

Perforated Metal
There is nothing different about this material from my anodized metal example except for the way that it is perforated.

The only thing that is unique is that I applied a tile map into the Cutout slot of the A&D material. The tile is black / transparent, and the grout is white / opaque.

Tile
This material can be achieved by applying an image map or a 3dsmax procedural tile map into the diffuse slot. Tile has some interesting characteristics in that the tile itself is typically more reflective than the grout. The tiles are also usually higher in reveal than the grout. To tackle all these parameters we have to control the reflection, and the bump through maps. For this example I went with an image of tile, plugged this into the diffuse slot. For the reflection and bump maps they are best driven by greyscale images. So I used a color correction map to filter the diffuse map into a greyscale b/w image.
For the color correction map settings, I set the Saturation to -100, making it a b/w image. However doing this made the tiles black and the grout white. I wanted the inverse of this as white gives higher reflection and bump effects, hence the choosing of “Invert”. I also played with the brightness and contrast to really push the black and whites to pop giving the most amount of control.
Light
The last material that I wanted to cover is actually a light material. I apply this material to any object / geometry that emits light; so a light bulb, or 2 x 4 ceiling lights.

For this material, be sure to turn off the diffuse color setting it to 0.0 or black. Leaving a color in the diffuse slot is not so much a problem for mental ray, but tends to cause fireflies in iray, so it’s good practice. Turn on Self Illumination and change the Luminance to Physical Units. I also check both “Visible in Reflections” and “Illuminates the Scene”. If you want a color other than white, like a warm incandescent bulb, you can change the filter color to a light yellow orange.

Lighting and Rendering – The Beauty Pass
There are many different ways to light a space in 3dsmax using mental ray. However there are very few methods to create a fast efficient and impressive rendering. The most efficient method I’ve found that works for all interior scenes is creating a daylight system, and then turning on GI (Global Illumination) and FG (Final Gather). Both GI and FG are using the default settings, with exception to setting the FG Noise Filtering to “None”. This rendering that is the base rendering is called the beauty pass.
Below are the steps for creating this beauty pass:

1. **Create a Daylight System**

When you first click on Daylight it will ask to change your Exposure settings under your Environment dialogue. Choose Yes. Simply click and drag to set the scale of the compass. When you release your mouse it will ask to create a mr Sky map in the Environment Map slot. Choose Yes. Now when you move your mouse it will move the height of your Sun. The location is irrelevant, and just a visual indicator.

2. **Adjust Exposure**

Open your Environment dialog by going to Rendering->Environment or hitting “8” on your keyboard. Adjust your EV (Exposure Value) to 9. The standard for interior daylight is 10, but I prefer 9 to give it a little more light.
3. **Adjust Indirect Illumination Settings**

FG (Final Gather) is already on by default. However, the Noise Filtering default is set to Standard. Set it to None. In all scenarios, this will shoot all of the calculated rays back to the camera, making the render brighter. Sometimes this does create some artefacts. If so, you can switch back to Standard.

![Final Gather Settings](image)

Also, Turn on GI (Final Gather). Typically, the default values work for most scenes. If not, check Maximum Sampling Radius, and specify a size that's very large like 30'. When off, the default sample size is 1/10th of the scene size.

![Global Illumination (GI)](image)

4. **Place your Lights**

Often it's not the light fixtures in 3D that light your scene but rather the Indirect Illumination. Now that your overall lighting is where you want it, we can add lights to show interior light fixtures your scene. These do cast shadows and make your scene brighter, but are more for the visuals of the render than anything else.
For lights I always use Photometric lights. For their Shape/Shadow, often I will change it from Point to Disc. Point renders the fastest, but the other shapes give nice soft shadows at the cost of rendering time. So I also lower the Shadow Samples to something like 4. I make the Light Shapes Visible in the rendering…but it just depends on if you want to visually see the disc or not.

One more setting that I change that is under the mental ray Indirect Illumination rollout. I turn off Automatically Calculate Energy and Photons. This eliminates the lights from the GI calculation, and I’ve found turning it off to actually make the GI solution brighter. GI will also calculate faster as it’s not including the lights and shadows into the calculation. This still lets FG use the lights in the FG calculation though.

**Other Passes – Z Depth, Ambient Occlusion & Glare**

There are other passes that can be added in post software such as Photoshop to really make your rendering that much better. There are 3 that I believe are essential for creating that wow factor in your finished image. They are Ambient Occlusion, Glare and Z-Depth. Below is a description on creating these passes.

Before jumping into the passes, there was a little scene prep to make the passes as effective as possible. I set all of my interior glass onto a separate layer, and hid the glass before rendering the passes. Otherwise, Z-Depth and Ambient Occlusion would treat the glass just like another opaque wall.
**Z-Depth**

Z-Depth is an image of your rendering that represents 3D space. It assigns a black to white pixel color based on distance from the camera. This makes the z-depth image extremely useful for making selections based on distance, and is most commonly used to create effects like Depth of Field. However, it can also be used to color grade based on distance and add atmospheric effects as well.

The Z-Depth pass can be created by going to the rendering settings and going to the Render Elements tab. Hitting the Add… button brings up a list of many different passes that can be created.

The Z Depth pass is at the very bottom of this list. Choose it and hit enter.
The default settings for Z Depth work great for depth of field. However if you need a more gradual z depth image with more information, you can always increase the Z Max to something like 100’ or more depending on the size of your model.

**Ambient Occlusion**
Ambient Occlusion (AO) is an effect that creates soft shadows based on the distance of objects from each other. It’s a fast way to add detail and depth to a rendering. However if used incorrectly it will make an image appear unnatural.
Just like Z Depth, the easiest way to create an AO pass is through Render Elements. There are so many different mr A&D elements, but the one you want is “mr A&D Raw: Ambient Occlusion”. A caveat with this render element though: it will only create AO on objects that have an Arch & Design material assigned to them where AO is turned on.

There are maxscripts that can globally set the AO value in all scene materials, if the scene has AO off and hundreds of materials. You can always use a material in the override material slot to manually render an AO pass, however the advantage to using AO Render Elements versus going the material override route is that it will respect material cut-out transparency, which can be very tricky to overcome when creating an AO pass. This is a script that I like to use that controls AO settings globally. It can be found at www.ramyhanna.com
Glare
This is simply the effect of adding a glow or flare to the highlights of an image, and stems from images taken with a camera. If there is dust or grease, or moisture on a lens, then a camera will create this effect when taking a picture. We intentionally put it in our renderings however to add realism.

This effect can be added to your rendering simply by turning on the Output in the Camera Shaders section. This is located in the Render Setup dialogue (F10), under the Renderer tab, and is found under the Camera Effects rollout.

However, the default settings add this to the beauty pass, and we want it as a separate pass. To access the settings of the Glare Map simply click and drag it into a slot in the Material Editor (choose Instance). This gives us access to all the settings in the Glare Map to customize it to our liking.
These are the settings I typically use to create a Glare Pass. The important one to pay attention to is the Resolution. You always want to keep it the same size as your render size, otherwise you get strange effects.

**Post Production**

Now that you know how to create all the passes, we will now look at putting them all together. In this example I will use Photoshop, but there are many other post production programs.

The essence of post-production and layering images comes down to understanding how their blending modes work. Blending modes are used to determine how two layers are blended together. These are what I think are the essential blending modes to understand:

**Multiply:**

Everything that is white is transparent, and everything that is black is opaque.

**Screen:**

Everything that is white is opaque, and everything that is black is transparent.

**Overlay:**

Is a combination of Screen and Multiply. Light parts of the picture become lighter, and dark parts become darker (S-Curve).
In Photoshop we will start with the beauty pass as your base layer.

The next layer to add would be ambient occlusion. Set the blending mode in the layer window to multiply.
The third layer is the glare pass. Set the blending mode to Screen.

In Photoshop, I create one more mask layer using the gradient tool and add it on top. This layer gives the illusion of a lens filter working and adds some natural vignetting as well. Set the blend mode to Overlay for the mask.
I will often turn down the opacity to somewhere between 25-50% for the mask layer.

After adding all these layers, I will add Adjustment Layers for color correction and grading. Start with the Levels. Adjustment Layers in Photoshop are a way to make color changes to an image without destroying the original image. For example, if you want to change the Brightness and Contrast to an image, after doing that you can only undo in your current session. Adjustment Layers puts the action of the Brightness and Contrast change into its own layer, and you can always go back and adjust it.

There are two flavors of creating Adjustment Layers. You can create one with a clipping mask, and one without.
Without the clipping mask, the Adjustment Layer applies the effect to all of the previous, underneath layers. But with the clipping mask, the adjustment layer applies only to the layer beneath it. This can be useful if you want to make adjustments to a transparent layer, but want everything else underneath to remain as is.

The primary Adjustment Layers I use are Levels, Color Balance and Curves. Tweak these to enhance your image.

Typically you want your levels to look like a nice bell curve. If you have all of your color information only on one side, then the chances are your image is either over or under exposed and won't look that good. I also adjust each RGB channel individually to allow me to control the color that I'm looking for. Essentially levels are controlling the overall brightness though.

I will also tweak the color balance settings. Starting with the shadows, I adjust the colors, and then move onto the Midtones, then finally the Highlights. Then I will go back to the Shadows, just to make sure that I'm happy with the color tones.
Get to know curves! This is a powerful way to control your brights and darks, and often is much more successful than Brightness & Contrast. Typically an S-Curve is the desired result, but every image is different.

After color grading, I will add a Lens Distortion Filter. Unlike other production programs, filters in Photoshop are destructive and cannot be reversed. My solution for this is to take all of the layers, copy them and flatten them to make a new layer to add the filters. I do this for every filter I add, so I can go back later to each filter that was applied.
In CS5 lens correction has moved simply to Filters->Lens Correction.

There are many features here that are helpful for tweaking and adjusting images. Typically this tool is used to correct flaws in a photograph, however because we’re making a rendering to look like a photo, we are adding these “flaws” to our image. Use this tool with much discretion as overdoing this can cause images to look worse not better.

Now for the Depth of Field…this can always seem a mystery in Photoshop, and can be a bit tricky, but it is much faster to create in post than in 3d. Here is the process:

Add your Z-depth pass to your composition as a top layer.
Now click on the Channels tab. This will show you’re the RGB channels for the current layer.

Click and drag one of your channels into the new layer button to create a new channel.

This new channel is an Alpha Channel, and is used to control selections of your composition. Name it to stay organized as you will need to reference it in your blur filter later. I usually call it z-depth. Now turn on your RGB channel, and turn off the z-depth channel, and go back to the Layers tab. You can actually delete the z-depth layer \textbf{that is in the Layers tab.} It will not delete your z-depth in the channels.
Now select the layer you want to blur (in this case the top layer that we applied a lens correction filter to), and choose Filter->Blur->Lens Blur.

This gives you a series of settings to create depth of field. Next to Source, choose z-depth (the channel that you created). You can click your mouse now and select the area of the image that you want to remain in focus. You can also adjust the amount of blur by changing the Radius size.
Because this is a post process I’ve often been unhappy with Photoshops lens blur tool. A way to create believable results that seems to work is to add a Gaussian Blur filter on the z-depth channel. I have found this to work well for some cases. However, there are other plugins that handle DOF much better such as http://www.frischluft.com/.

Lastly, I will sharpen the image with an Unsharp Mask, to give the image more clarity.

There are plenty of resources on the internet for creating images with post work for architectural visualization. Some websites that are chalk-full of knowledge are:

- evermotion.org
- area.autodesk.com
- jeffpatton.net
- ronenbekerman.com
- bertrand-benoit.com

You can also visit my website:

http://www.ramyhanna.com/

If you ever have any questions, feel free to contact me and I almost always reply 😊