itDD

_Introduction to Techniques in Digital Design

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(refer to image T08_ms_1.tif within the images folder of the tutorial's project)

Raytrace Shadows

By default, the edges of the Raytraced shadows that a light creates are sharp. The user can manipulate the **Light Radius** values of the light to control the softness of the Raytraced shadows, and is dependent upon the scene size (here we use .5). **Shadow Rays** control the graininess of the edges of a softer shadow. Increasing the number of Shadow Rays also increases rendering times, so set it to the lowest value that produces acceptable results. The slider only goes up to 40, but any number can be typed in (*for the included images we use 15*). **Ray Depth Limit** specifies the maximum number of times a light ray can be reflected and/or refracted and still cause an object to cast a shadow (*for the included images we use 1*). To alter these values, select the shadow casting light in your scene and open the **Attribute Editor** of that light. All of the aforementioned values are listed under **Shadows** and within **Ray Trace Shadow Attributes**.
(refer to image T08_ms_2.tif within the images folder of the tutorial's project)

Mental Ray

Mental Ray an advanced plug-in renderer that allows interactive and batch **Mental Ray** rendering from within the Maya user interface.

Mental ray offers all the features traditionally expected of photorealistic rendering, and includes functionality not found in most rendering software, such as area light sources for soft shadows, global illumination, and caustics (light patterns).

Enabling the Mental Ray Plug-in:

1. Click Window *>Settings/Preferences > Plug-in Manager* in the **Main Menu**
2. Check on the **loaded** and **auto-load** button adjacent to the heading **Mayatomr.mll**

Mental Ray Rendering Presets

When one begins to get into more advanced rendering procedures, more and more variables need to be considered. It is a good practice to establish **Presets** for your renderings so you only have to set them once to optimize your rendering for a certain situation. Therefore, if you wish to render an image with the same settings, you would only have to go back and **Load** your previously established **Preset**, which would prevent you from having to go back through your **Render Settings** to change all of the appropriate values.

Saving Settings as Preset:

1. Click Window *>Rendering Editors > Render Setting* in the **Main Menu**
2. In the **Render Using** pull down menu change that value to **mental ray**
3. Within the **Common** Tab and under **Image File Output**, set **Image Format** to **.iff** because that is what Maya will render out as raw data and then you can save it to whatever file format you like
4. Within the **Common** Tab and under **Resolution**, alter the **Resolution** to be whatever you would like the resolution of your image to be
5. Within the **Common** Tab and under **Render Options**, uncheck **Enable Default Lighting**. This is overridden as soon as lights are created in your scene. But if you were to create an object that emitted light as opposed to an actual light, Maya would not recognize the object as a light. Therefore, Maya would illuminate its default lights in your scene along with your object light.
6. Within the **Mental Ray** Tab and under **Anti-Aliasing Quality** and within **Number of Samples** set the **Min Sample Level** to 0 and the **Max Sample Level** to 2. These are the settings that are to be used in a final rendering. If you wanted to generate quick test renders, drop these values down to -2 and 0 respectively. Aliasing artifacts, or jagged edges in an image, result from point sampling, a process used in all computer graphics applications that determines the information about each pixel. Anti-aliasing is the process of removing or reducing these artifacts, and Min Sample Level and Max Sample Level control that.
7. Within the **Mental Ray** Tab and under **Anti-Aliasing Quality** and within **Multi-Pixel Filtering** choose **Mitchell** from the pull-down menu. This has commonly been found to have the best output for amount of time spent. . If you wanted to generate quick test renders, choose **Box** from the pull-down menu. Also, uncheck **Sample Lock**.
8. Within the **Mental Ray** Tab and under **Anti-Aliasing Quality** and within **Contrast Threshold** leave those values as they are**.** The lower these values are the more detailed the rendering will be. Within the **Mental Ray** Tab and under **Raytracing** check on **Raytracing. Set Reflections** to 6, **Refractions** to 6, **Max Trace Depth** to 2, **Shadow Trace Depth** to 2. If you wanted to generate quick test renders, lower these values to their default states. **Reflections** are light waves being reflected off of a surface. The smoothness of the surface determines the sharpness of the reflection (the smoother the surface the sharper the reflection). **Refraction is** the bending of light waves as they pass through an object.
9. Finally, under **Translation** change **Export Verbosity** from **Warning Messages**, to **Progress Messages**. This will give you a more detailed description of what is happening while the computer is rendering the image.
10. Once all of the values are changed, select *Presets > Save Settings as Preset…*
11. Give the preset a name, such as **initialSettings**. Now whenever you wish to start a rendering with those settings go to *Presets > Load Preset* and select the preset that you just created.
12. These values are a good starting point for a **Mental Ray** rendering, but they are by no means final. They should be modified to suit your individual scene.

(refer to image T08_mr_1.tif within the images folder of the tutorial's project)

Global Illumination

Global Illumination simulates indirect lighting. This is accomplished through selecting a light or series of lights to emit photons (packets of energy) that have a certain amount of energy. These photons can either bounce off an object (such as a wall) or pass through an object (such as a glass) in the scene creating a point cloud of light/shadow information. This information is then translated into shade/shadow, brightness/contrast,…

Due to the bouncing of the photons, only one light is truly necessary in a scene that is using Global Illumination (more lights can be added for effect or light coverage). The emission of photons is best done in conjunction with lights that have a specific direction (**Directional Light** or a **Spotlight)**. Creating these lights is the same as creating a point light. The only additional item to remember is that these lights need to be strategically aimed in your scene in order to optimize their role in the scene.

Initializing Global Illumination:

1. Create a spotlight or Directional Light and aim it at the object in the scene so that the scene has a good amount of light coverage.
2. Open that lights Attribute Editor. Within the lights Shadow properties, click on Raytraced Shadows, and leave the default values as they are (Light Radius – 0.000, Shadow Rays – 1, Ray Depth Limit – 1. This will give you nice crisp shadows
3. Still within the Light's Attribute Editor, under Caustic and Global Illumination, turn on Emit Photons.
4. Open the Render Settings within your scene and under the mental ray tab, check on Global Illumination under the Caustics and Global Illumination Tab
5. Global Illumination Accuracy should be set to 500 and the Photon Volume Accuracy should be set to 30.
6. By default Maya sets the Global Illum Radius to 0.000, which means that Maya will determine the radius of each of photon based upon your scene size. (It is best if you play with different values ranging from 0.000 to 2.000 to optimize your rendering. 1.000 is a good starting point.)
7. In order to get rid of the fragmentation within an image rendered at this point more Photons need to be added. Therefore, open the Attribute Editor of the Spotlight in your scene. Under the Caustic and Global Illumination pull-down menu alter the number of Global Illum Photons from the default 10,000 to a higher number such as 50,000.
8. Manipulate any combination of the values to tune your renderings

(refer to image T08_mr_gr_1.tif within the images folder of the tutorial's project)
(refer to image T08_mr_gi_2.tif within the images folder of the tutorial's project)

Final Gather

Final Gather works much the same way as Global Illumination in that emissions bounce around the scene calculating shade and shadow and also colors from materials blend into one another. Final Gather differs in that it does not emit Photons from a light source. It instead emits rays from the camera position. It also, does not need as many emissions in order to create a successful rendering as did Global Illumination. Therefore, the rendering times are much faster. Also with Final Gather checked on, any object can emit Final Gather Rays if its Ambient value is turned up.

Mental Ray's Final Gather illuminates your scene by taking samples of light from two potential locations:

1. Light emitting from nearby surfaces whose materials have an **Ambient Value** and/or **Incandescent Value** assigned to them
2. The color of the **Environment** assigned to the camera.

Final Gather takes samples from the **Environment** color, which is specific to each camera, for lighting purposes. Maya uses the color of your Environment (by default this is set to black) to determine the color and brightness of the Final Gather lighting. If there is no other light source in the scene, the **Environment** color will need to be changed to a value other than black (*for these images we chose a light grey*).

Changing the Color of the Environment:

1. In the **View Panel** that is to be rendered (Top, Side, Front, Persp,…), Click *View > Camera Attribute Editor*
2. Under the **Environment** pull down menu change the **Environment** color to something other than black. The lighter the color the brighter the scene will be. Grey, white and very light blue are common color values assigned to the **Environment**.

The number of **Final Gather Rays** determines the quality, because it specifies how many Final Gather samples will be calculated for your scene. The higher this number is the longer the rendering will take (*for these images the rays were left at 100*). The **Max Radius** value determines the maximum distance apart that Final Gather samples can be from each other. The **Min Radius** value determines the closest they'll be taken from each other. The default **Min** Radius and **Max Radius** settings of 0 and 0, let Mental Ray decide automatically what it thinks are the best radius settings, based on the size of your scene. Usually, the **Max Radius** setting will be about 10% of the size of your scene, and the **Min Radius** is 10% of the **Max Radius.**
(refer to image T08_mr_fg_1.tif within the images folder of the tutorial's project)

Final Gather creates light by sampling **Objects** and the **Evironment**, so if we have a really bright object in our scene, Final Gather will sample that object and apply its brightness to other objects, essentially making the object a light source. This effect works very well, the only downside is that you need to have quite a lot of Final Gather rays in your scene for the effect to look smooth, which can mean long render-times.

Creating an Object Light Source:

1. Create a material that will be used specifically for this **Object Light Source**
2. In the material's **Attribute Editor**, click on the **Color's** color sample. Make sure that our color palette is in **HSV Mode** (H-Hue, S-Saturation, **V-Value**).
3. To control the brightness of the material (in turn the object) alter the **V-Value** (*in the included images we use a value of 2*).
4. The number of **Final Gather Rays** may need to be increased to accommodate the Light Emitting Object (*in the included images we still use a value of 100*).

(refer to image T08_mr_fg_2.tif within the images folder of the tutorial's project)
(refer to image T08_mr_fg_3.tif within the images folder of the tutorial's project)