Maya 2014 - Still Life Part 2 - Lighting & Rendering

With the basic materials and lights set up in our scene, let's learn how to UV unwrap objects and tweak render and light settings to give our scene that extra level of realism!

The Render Window

- Let's go into more depth about the features of the render window:

- **Render Current Frame**: Render the currently selected frame in the timeline.
- **Render Region**: Click and drag within the render window to render a region of your scene.
- **Snapshot**: Loads a wireframe snapshot of the scene into the view, from which you can render a region; does not work with IPR rendering.
- **IPR Render Current Frame**: Click and drag within the render window to select a region to IPR render. The region will re-render as you change objects, materials, lights and other scene assets.
- **Refresh IPR Render**: Reloads the current IPR render.
- **Display Render Settings**: Open the render settings window.
- **Display RGB Channels**: Right click to cycle between displaying individual R, G and B channels.
- **Display Alpha Channel**: Displays the alpha (transparency) channel.
- **Display Real Size**: Zoom in or out to show the actual image pixels.
- **Keep Image**: Keep rendered image in the render window, for comparison with future renders.
- **Remove Image**: Remove rendered image from the render window.
- **Select Renderer**: Choose between Maya Software, Maya Hardware, Maya Hardware 2.0, Maya Vector and mental ray renderers.
- **Lock/Unlock Render Layer and Render Pass Rendering**: Toggle between rendering all upstream images used by the compositing graph or rendering only the 2d compositing graph.
- **Pause IPR Render**: Pause IPR tuning.
- **Stop IPR Render**: Stop IPR tuning altogether.

**Adjusting the Shadows**
If you create a render, you'll probably notice the dark, sharp shadows cast by our lights. We can adjust these settings by selecting the lights in our **Outliner** and opening up the **Attribute Editor**:

- On the LightShape node, open the Shadow group and turn the Shadow Color up from pure black to a grey color on all of your lights.
- Re-render the scene to see how lightening the shadows can make a big difference in the realism of the lights:

![Shadow Color: Black](image1) ![Shadow Color: Grey](image2)

The shadows look better, but the ones cast by the Spotlight are too sharp

- With the **Spotlight** selected in the **Attribute Editor**, scroll down to the **Raytrace Shadow Attributes**:
  - Turn up the **Light Radius** to 2 by inputting that value in the text field.
  - Notice how the sharp edge has been replaced by a softer, gradual shadow falloff:
- To reduce the graininess of the shadows, increase the **Shadow Rays** to 30 and the **Ray Depth Limit** to 5. Increasing these two values will smooth out the appearance of the shadows but lead to a significant increase in render time. Adjust these values accordingly if your renders are taking too long.
- Our lights are looking pretty awesome! With our light setup done, let’s switch our focus to rendering.

**Render Settings Window**

- In the Render Window, Click on the Display Render Settings button to open up the Render Settings Window. You can also access this button from the Status Line next to the Render and IPR Render buttons.

- At the top of the Render Settings Window, select Render Using: mental ray to select the mental ray renderer to have access to the most realistic lighting and rendering features.

- Let’s go over some of the features of the different tabs:

  - **Common Tab:**
    - **Color Management:** Enable/Disable color management and select a color profile
    - **File Output:** Set the file name, format, compression, and other options. Set the Frame/Animation Extension to something
other than (Single Frame) to render a sequence of animated frames.

- Right click on the File Name Prefix to add a token such as Scene, Render Layer or Render Pass name

- **Frame Range**: Set the start and end of the animation sequence

- **Renderable Cameras**: Choose the camera to render from and whether or not to include the Alpha or Depth channel

- **Image Size**: Set image size, aspect ratio, and resolution from one of the presets or from custom values

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**Passes Tab:**

- Using **Render Passes** enables you to separate the different light properties of your render into layers that can be recombined in Photoshop, After Effects or other software with compositing capabilities. Using passes allows us to have much more control over the final image quality result.

  - Use the buttons to the right of the **Scene Passes** area to create a Render Pass, create a Render Pass Set, edit the selected Render Pass, delete the selected Render Pass and edit the passes with the Relationship Editor.

  - Use the buttons between **Scene Passes** and **Associated Passes** to associate or disassociate passes with your scene. Disassociated passes will not be rendered.

  - Use the buttons between
Associated Passes and Associated Pass Contribution Map to associate/disassociate passes with a given Pass Contribution Map. Render pass contribution maps give you finer control over light and objects and their passes relationship.

- Create, edit or delete Render Pass Contribution maps with the buttons to the right of the Passes Used by Contribution Map area.

- Features Tab:
- Rendering Features: These settings are very important and will drastically change both render quality and render time.
- Contours: Enable Contour Rendering to draw wireframes on your render. Use Hide Source to fill your objects with a color and remove all materials.
- There are two options for Contour Rendering:
  - Draw by Property Difference: Define the locations at which mental ray for Maya detects and draws contour lines.
  - Draw by Sample Contrast: Draw contour lines by looking at the contrast between different pixels’ values.
- **Indirect Lighting Tab:**
  - **Environment:** Create a Physical Sun and Sky or Image Based Lighting Environment and add it automatically to your scene.
  - Below, you will find tabs to enable/disable and adjust the specific settings for **Global Illumination, Caustics, Photons,Importons, Final Gathering, Irradiance Particles** and **Ambient Occlusion**. We will go over some of these later.
- **Options Tab**: Contains various options and settings to control your renders. For the most part, you will not need to adjust this tab.
Now that we’re familiar with the different tabs and settings of the Render Settings Window, let’s use them to spruce up our renders!

**Using and Adjusting Rendering Features**
- Under the **Features** tab, make sure that **Raytracing** is on and **Render Using** is set to **mental ray**.
- First, turn on **Final Gathering**, a process that allows for indirect lighting and effects like color bleeding. Here’s a comparison:

- The difference is subtle, but if you look at the bowl’s shadow on the left you can see some of the red paint color reflecting and bleeding into the tablecloth.
- In the **Indirect Lighting Tab** under **Final Gathering**, you can enable/disable Global Illumination and change the **Accuracy**, **Point Density/Interpolation**, **Primary/Secondary Diffuse Scale** and **Secondary Diffuse Bounces** values to adjust render quality and rendering time.
- Next up, let’s add even more indirect lighting bouncing around our scene by enabling **Global Illumination**. This setting functions by shooting Photons that simulate actual light particles out from our lights that bounce around our scene.
- To actually see a difference in our renders, select the lights in our scene individually with the **Outliner**. Open up the **Attribute Editor** and under the **lightShape node**, select **mental ray** and under **Caustic and Global Illumination**, enable **Emit Photons**. Repeat for all the lights in our scene.
- You can change the **Photon Color**, **Photon Intensity**, **Exponent** and number of **Caustic and Global Illumination Photons** to adjust your render times and quality.
- If you render your scene, you will see a crazy result where it looks like the table is on fire! Clearly, Global Illumination needs to be turned down considerably.
- To reduce the overall contribution of Global Illumination to your scene, you can either reduce the Caustic and Global Illumination settings on your lights or go to **Global Illumination** in the **Indirect Lighting Tab** of the **Render Settings Window** and turn down the **Scale** dramatically by several orders of magnitude. Here’s a comparison:
As you can see from these renders, when it comes to Global Illumination is best used in small quantities but can really add some extra realism to your scene.

- Next up, let’s add some more indirect lighting with Caustics to simulate light being reflected and refracted through transparent surfaces like a wine glass or a body of water. As with Global Illumination, reduce the Scale under the Caustics tab of Indirect Lighting to pair back the amount of caustic light reflection. Here’s a comparison:

![Comparison of Caustics Scale](image)

Notice the bright area to the left of the wine glass. Great! Only a couple more steps to bump up those renders over the top!

**Adjusting Render Quality:**
- When drawing an image, Maya does what is called Anti-aliasing by redrawing parts of the image multiple times to smooth out the result and remove “jaggy” edges. The method for which it determines what part of the image to redraw is called the Sampling Mode. Under the Quality Tab, Set the Sampling Mode to Unified Sampling. This is a brand new anti-aliasing mode that greatly simplifies the number of settings we have to adjust.
- Legacy sampling modes are available, but not really necessary.
- Turn up the Quality to see an immediate improvement in image quality. Here’s a comparison of different sampling settings from a zoomed in portion of our render:
Look at how rough the glass on the left is compared to the one on the right. Keep in mind, however, that there is a law of diminishing returns when it comes to turning up Quality (as evidenced by the small difference between the middle and rightmost renders.)

- Check out the Maya help for more info on adjusting sampling options.

Almost done! Let’s add a bit of diffused Ambient Occlusion to our render on a separate pass that we can composite with Photoshop.

### Adding Ambient Occlusion

- **Ambient Occlusion** refers to the blocking of indirect or diffuse light on an object. It refers to the darker areas of the object, typically creases, cracks and crevices. Ambient occlusion is caused by indirect light’s inability to bounce around and illuminate areas that are blocked by a nearby object that absorbs the light rays. These subtle variations in lighting are visual clues for our eyes to detect surface details and distinctions that would otherwise be washed out and unnoticeable. Ambient occlusion adds realism to your scene by adding shadows in crevices, nooks and crannies, and so on. For each surface point, it calculates how much light is blocked by other geometry.

- To add **Ambient Occlusion**, check it on in the **Features tab**. You may also have to check it on under the **Indirect Lighting tab** as well.

- Ambient Occlusion will only render in Maya as a pass, so let’s add our first **Render Pass**! Switch to the **Passes tab** and click on the **Create New Render Pass** button. Navigate and select **Ambient Occlusion** and press **Create and Close** to add it to our **Scene Passes**.

- Press the **Associate Selected Passes** with Current Render Layer to add it to our scene and render it as a pass. It will now show up in the **Associated Passes** area.

- Render layers allow you to selectively render elements or passes of your scene, but will not be covered in this tutorial.

### Saving Your Image:

- Under the **Common Tab/File Output/Image Format** options, use something like **PSD** or **TIF** for an uncompressed, higher quality render result than PNG or JPG.
- Be sure to also specify a filename under **Common/File Output/File Name Prefix**.
- In the Render View, go to **File/Save Image** and save it within your images folder.

- When you render out your scene, it will not look like anything has changed. To view your rendered Ambient Occlusion (or AO) pass, go to **File/Load Render Pass/AO** within the **Render View**. The pass will appear in a separate window and look like this:

![Ambient Occlusion Pass](image)

- We will now composite this layer into Photoshop on top of our other renders!
- In the Render View,

**Compositing in Photoshop**
- Open up Photoshop CS6 and navigate to this directory:
  ```
  ../../maya/projects/Still Life/images/tmp/
  ```
- Open the TIF or PSD file with the filename you specified earlier, as well as the Ambient Occlusion pass within the AO folder.
- On the Ambient Occlusion pass, press **Command+A** to **Select All** and **Command+C** to **Copy** the image.
- On the fully rendered image, press **Command+V** to Paste the AO pass into a new layer.
- Click on the AO layer within the **Layers Panel** to select it.
- Change the blending mode (where it says **Normal** next to **Opacity**) of the AO layer to **Multiply** to properly composite your image.
- You can apply the same process in After Effects, FCPX, Motion or other video & image editing software.
- You may notice that the image has become fairly dark and shadowy with the Ambient Occlusion added. Play with the **Opacity** value of the AO layer to get the best result:

![Ambient Occlusion Opacity: 0%](image1.png) ![Ambient Occlusion Opacity: 30%](image2.png) ![Ambient Occlusion Opacity: 100%](image3.png)

Ambient Occlusion can really add some extra realism to your scene by simulating how shadows work in the real world.
After all that, let’s admire what we get after all that tweaking:

Fabulous! This concludes our two part guide on lighting and rendering. Check out my other tutorial about UV texturing to add an extra layer of realism to your models!