

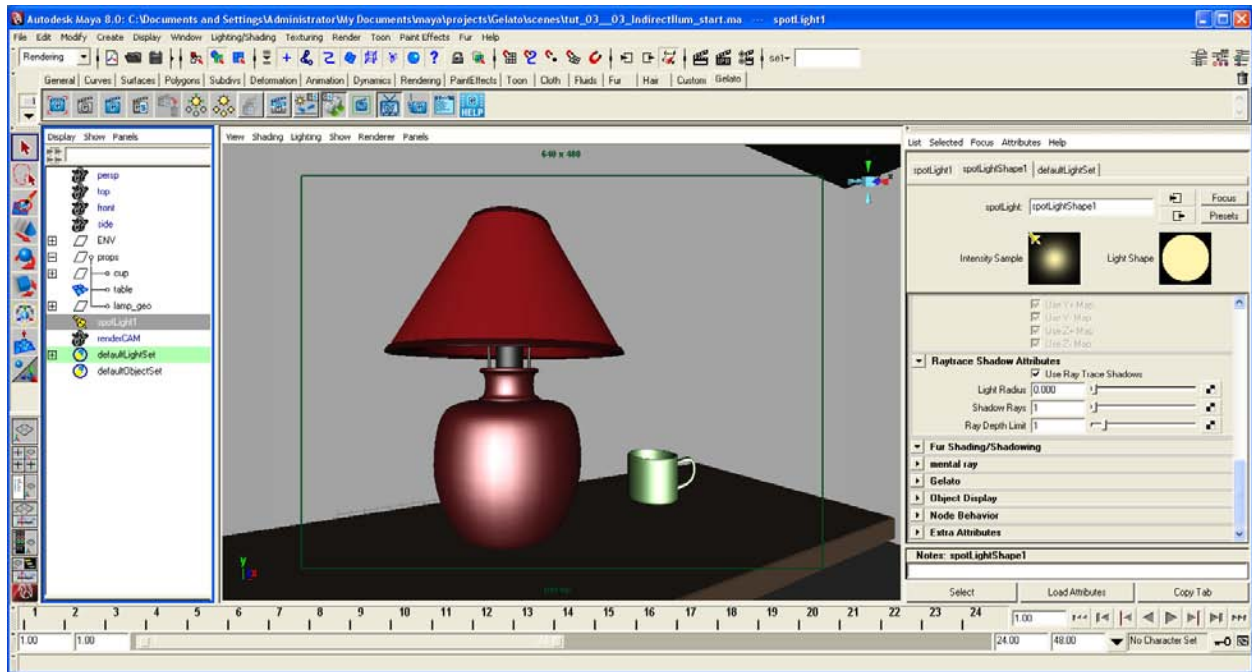
Tutorial 3.3

INDIRECT ILLUMINATION



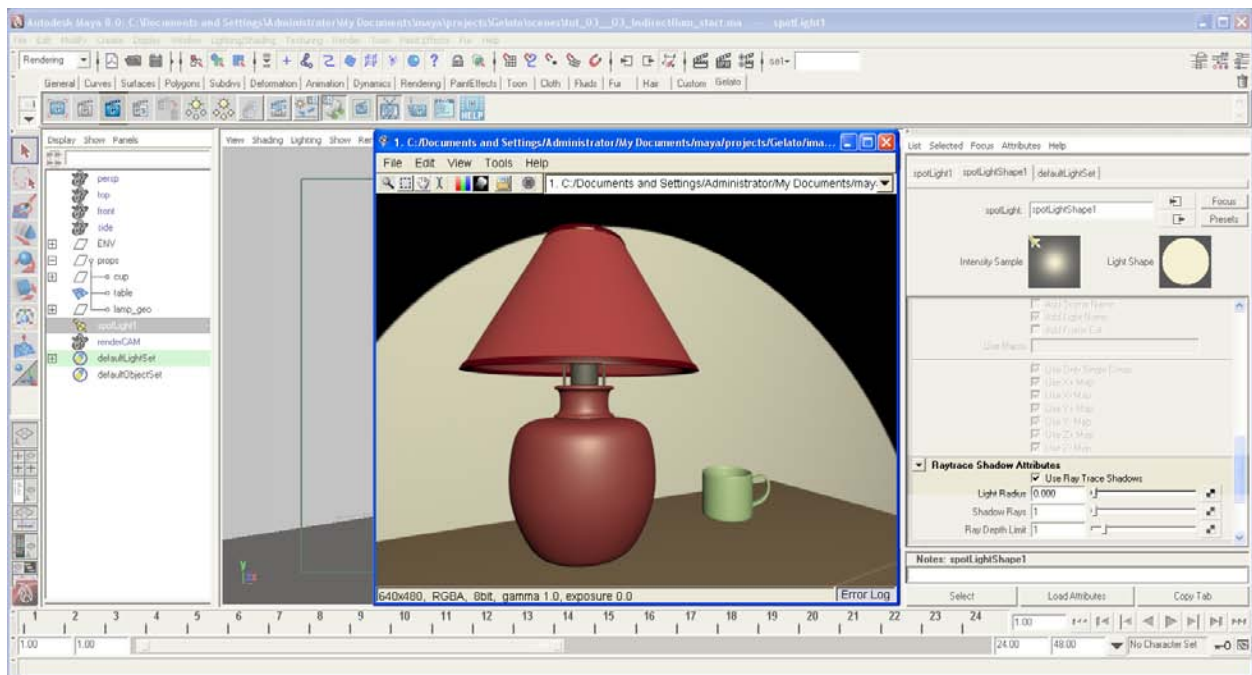
This is the companion to the movie, tut_03_03, part 3 of 8 NVIDIA® Gelato® Advanced Tutorials.

In the tutorial, we will be exploring indirect illumination. This type of illumination accounts for bounced light. What is bounced light? You're sitting in your house, no lights are on, but the windows are open... Light is coming in through the windows, whether from the sun or a street light, and though the light source isn't directly beaming into your rooms, the inside of your house is still lit because the light entering the windows is bouncing around. This is indirect illumination - no direct light source, just bouncing light waves lighting up the areas they can reach. The bounced light also results in color spills. A red lamp, for instance, will cause some red color to be picked up on the wall next to it. Recreating this lighting in the CG world can result in long render times, so let's take a look at how Gelato can help us reduce this render hit...



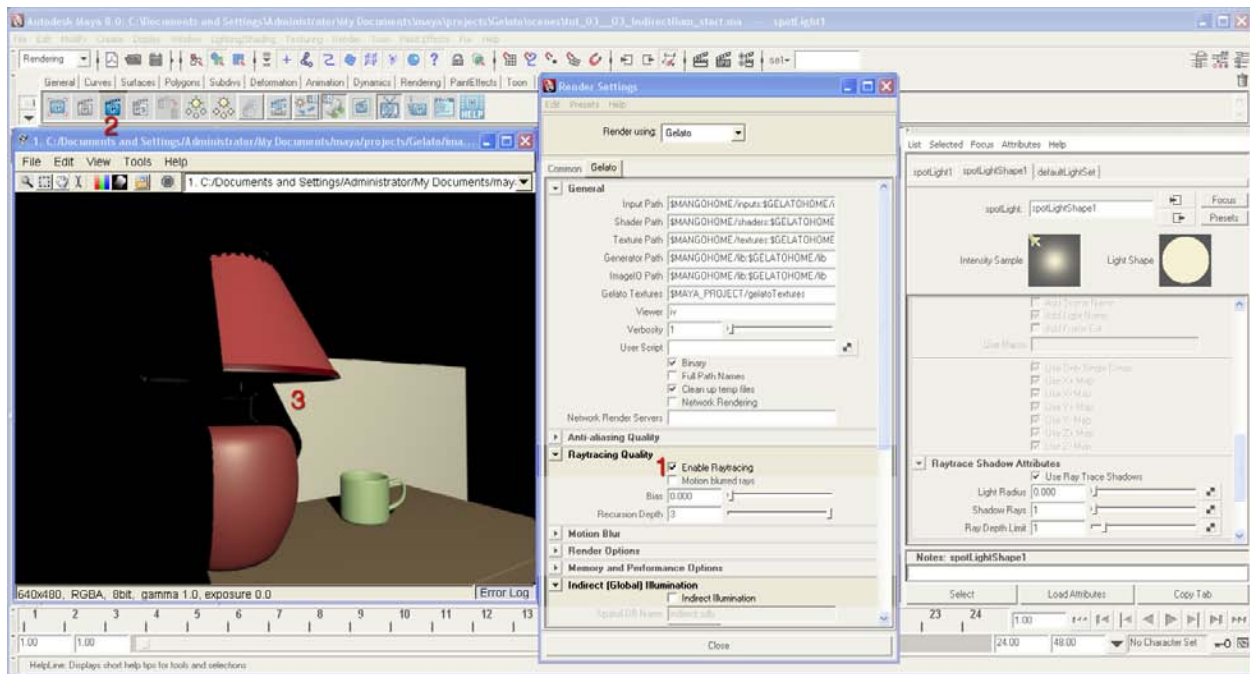
- Open “tut_03_03.”

We have one light, a spotlight, and a lamp and cup sitting on a table next to a wall.



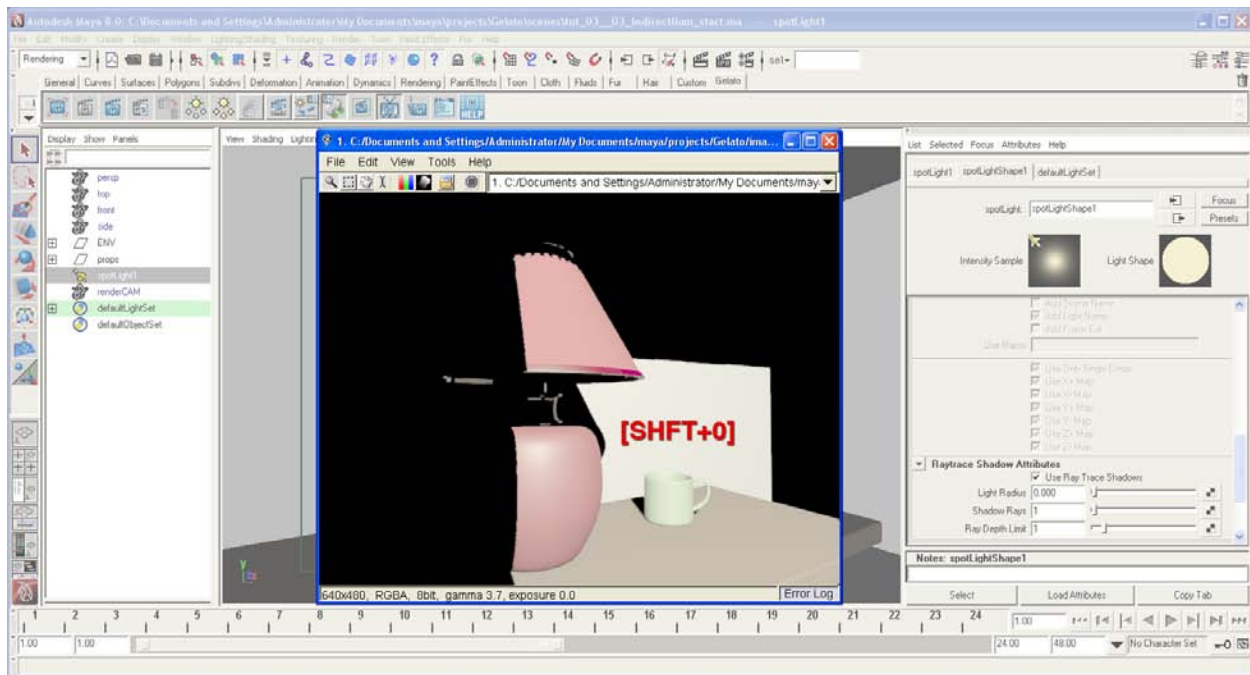
- Select the spotlight.
- Spotlight's Attribute Editor > Shadows > Raytrace Shadow Attributes > Use Ray Trace Shadows – notice that this is turned on.
- Gelato Render.

So, where are the shadows?



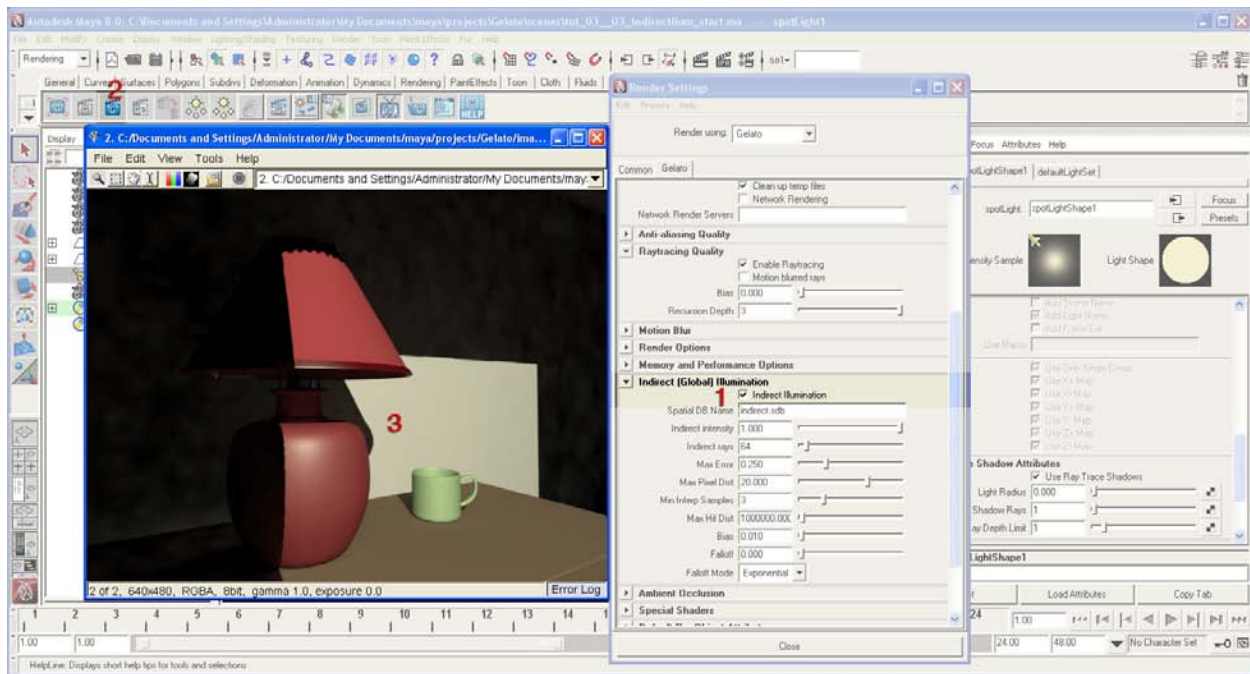
- Render Settings > Gelato > Raytracing Quality > turn on Enable Raytracing.
- Notice that Indirect Illumination has not yet been enabled.
- Gelato Render.

Now we see shadows. *In order for ray-traced shadows to render, they must also be enabled in the Render Settings.*



- Image Viewer > **[SHIFT+O]** to increase the gamma of the image.
- Notice that no matter how bright the scene gets there is nothing but black in the shadow areas.
- When convinced, **[SHIFT+9]** to bring the gamma back down to 1.

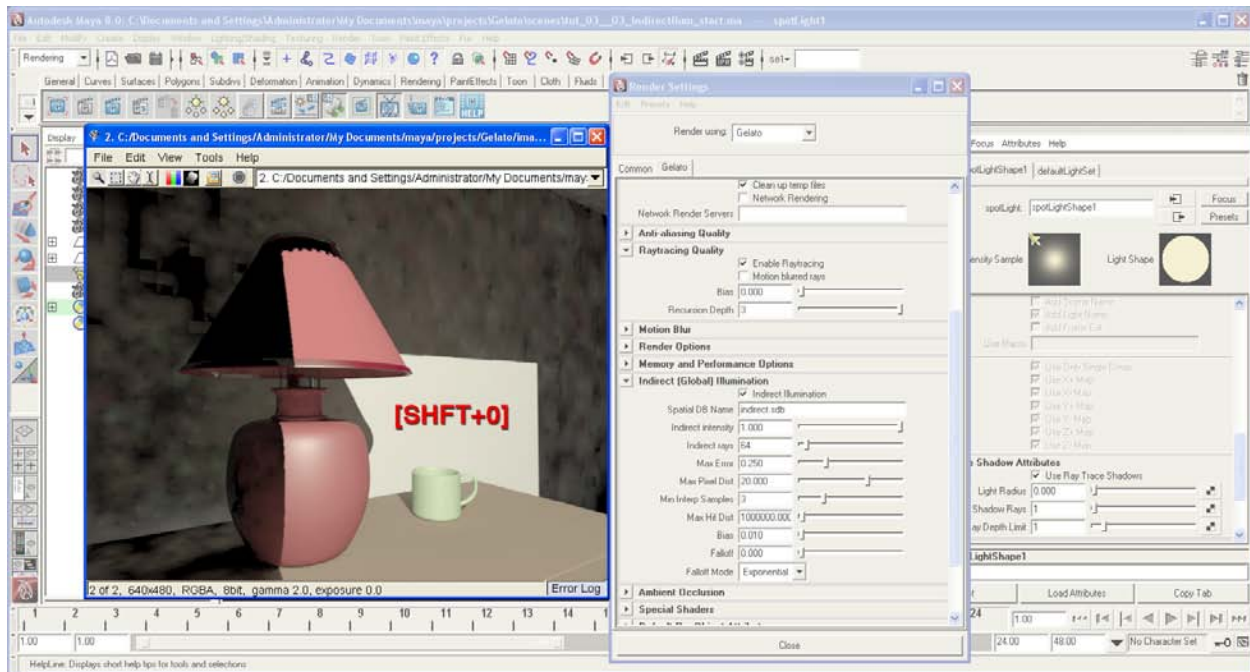
The illumination in the scene is completely due to direct illumination. There is no bouncing of light rays as would be seen in the real world, hence no information in the shadow areas.



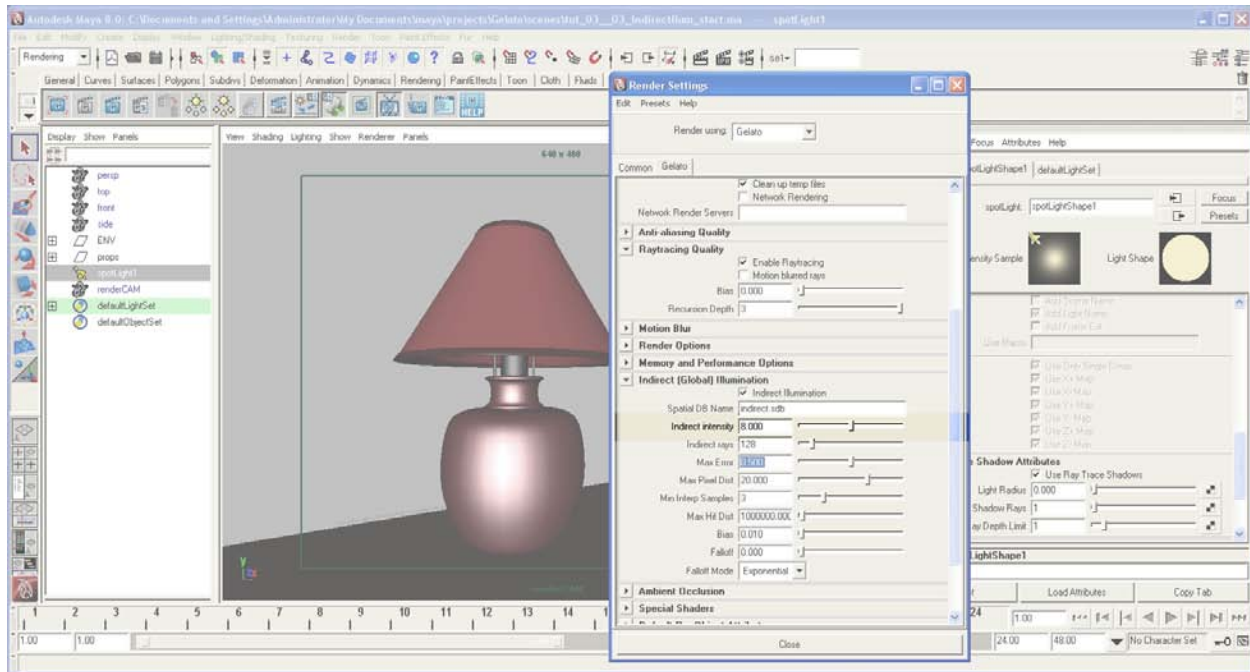
- Render Settings > Gelato > Indirect (Global) Illumination > enable Indirect Illumination*.
- Gelato Render.

We now can see something happening in the shadow areas.

*The default Indirect Illumination settings are rather low, but this is an expensive calculation, so it's wise to start low, then increase as needed.

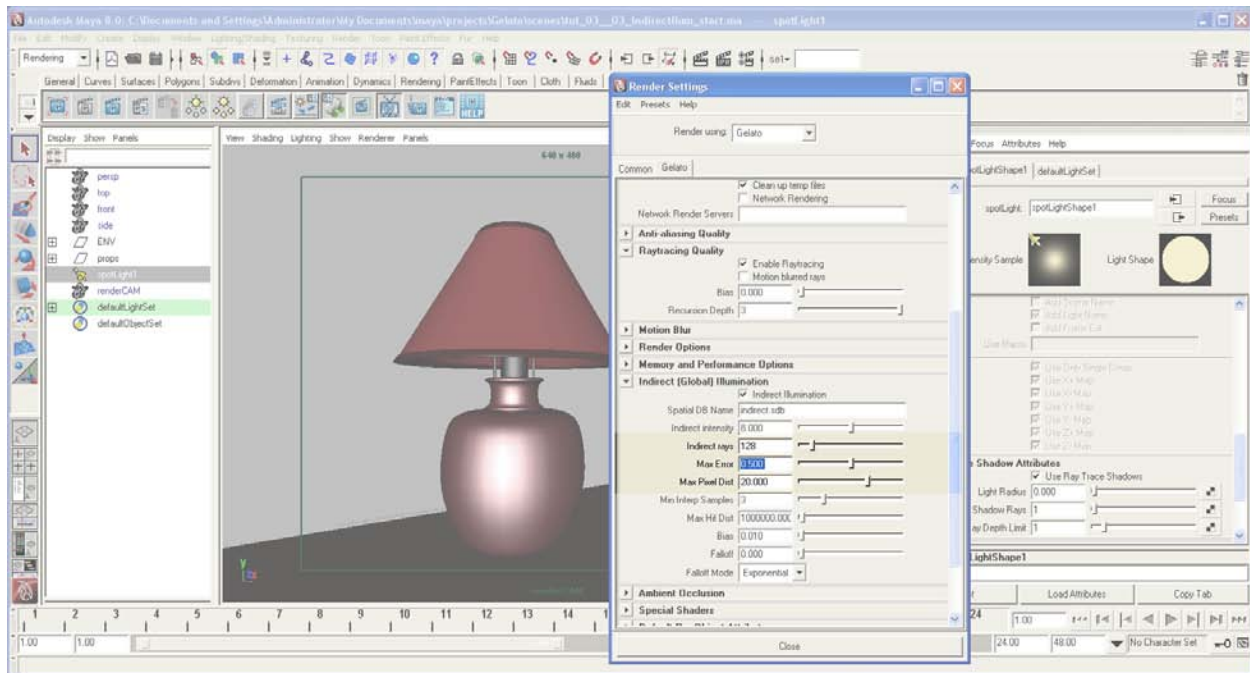


- Image Viewer > **[SHIFT+0]** to increase the gamma of the image.
- Notice that now there is information lurking in the shadows.
- When you're convinced, **[SHIFT+9]** to bring the gamma back down.



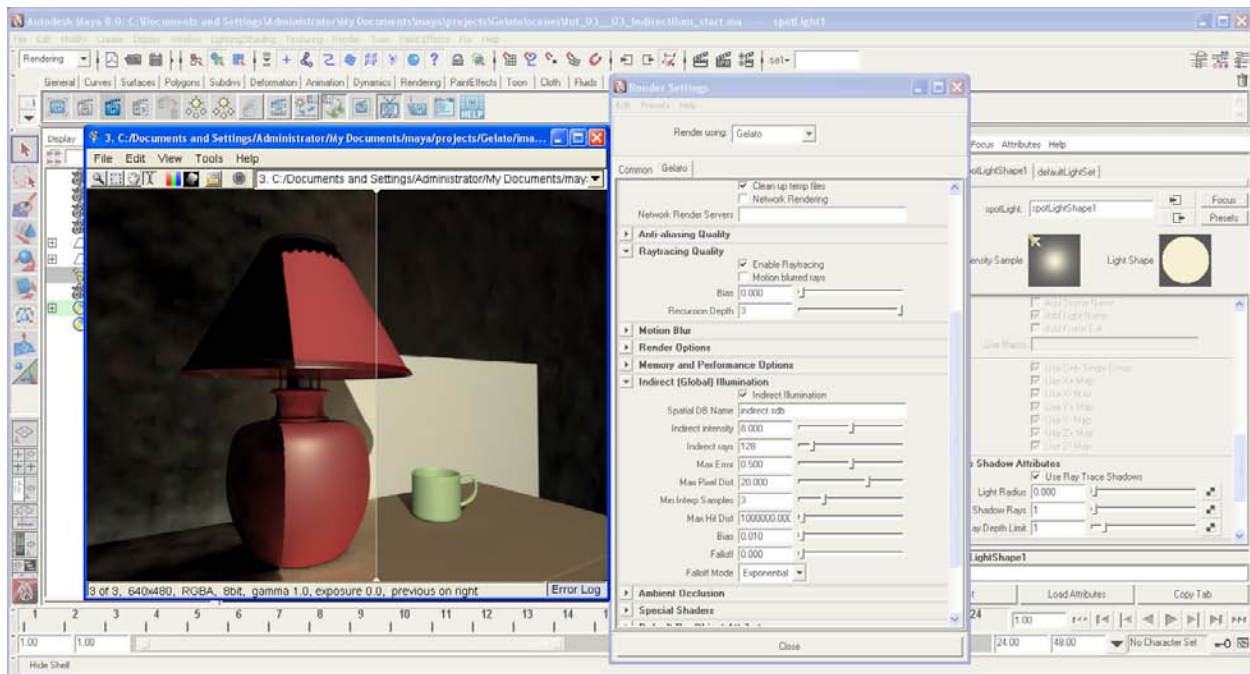
- Back in the Indirect Illumination settings, change the Indirect Intensity to 8.

This increases the intensity of the effect, making it more visible. It has no effect on the render time. Now let's address the artifacting - those ugly blotches in the shadows...



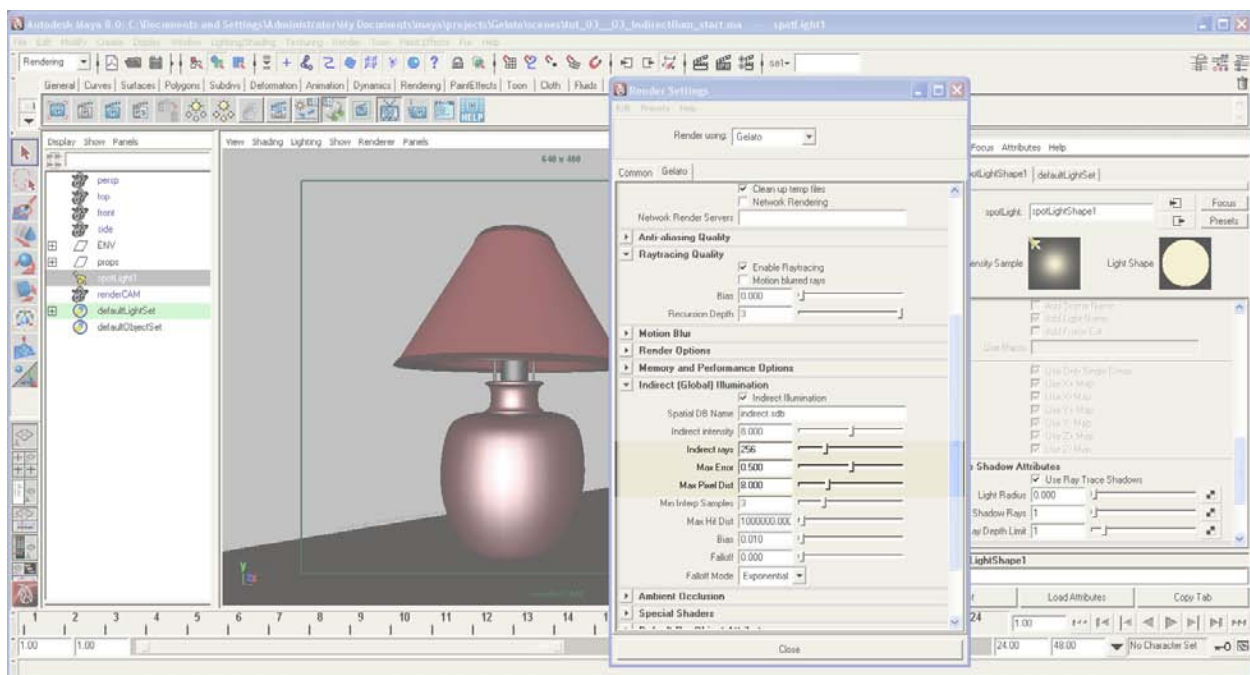
- Change: Indirect Rays to 128
Max Error to 0.5000

Indirect Rays is the number of samples being used to calculate the indirect lighting. **Max Error** has to do with the interpolation of the points; if the error exceeds this value, the points will be re-sampled. **Max Pixel Dist** is the frequency of the Indirect Rays being sampled. Keeping this higher will keep the blotchiness, but for the moment, we'll leave it as is so that we can see the effects of the changes made so far.



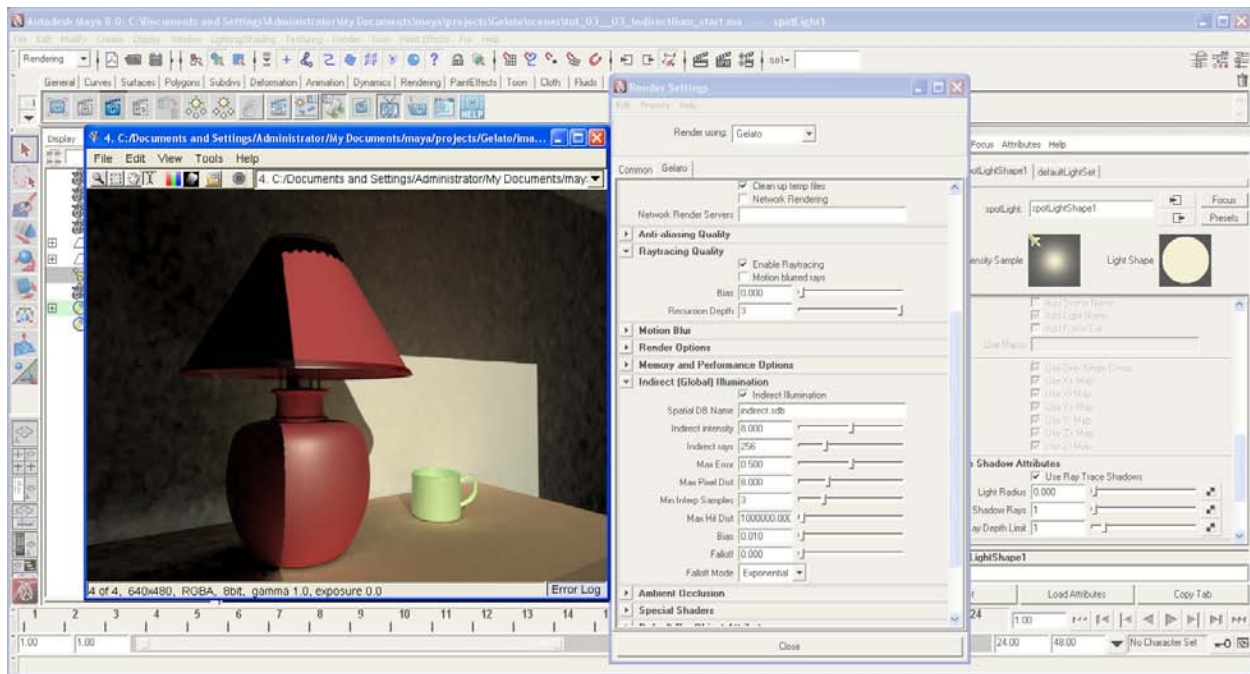
- Gelato Render.
- Use the Wipe tool to compare this image to the last.

The increase in the Indirect intensity has resulted in the lighter shadows. This also allows us to see the artifacts more clearly, making it easier to address them.



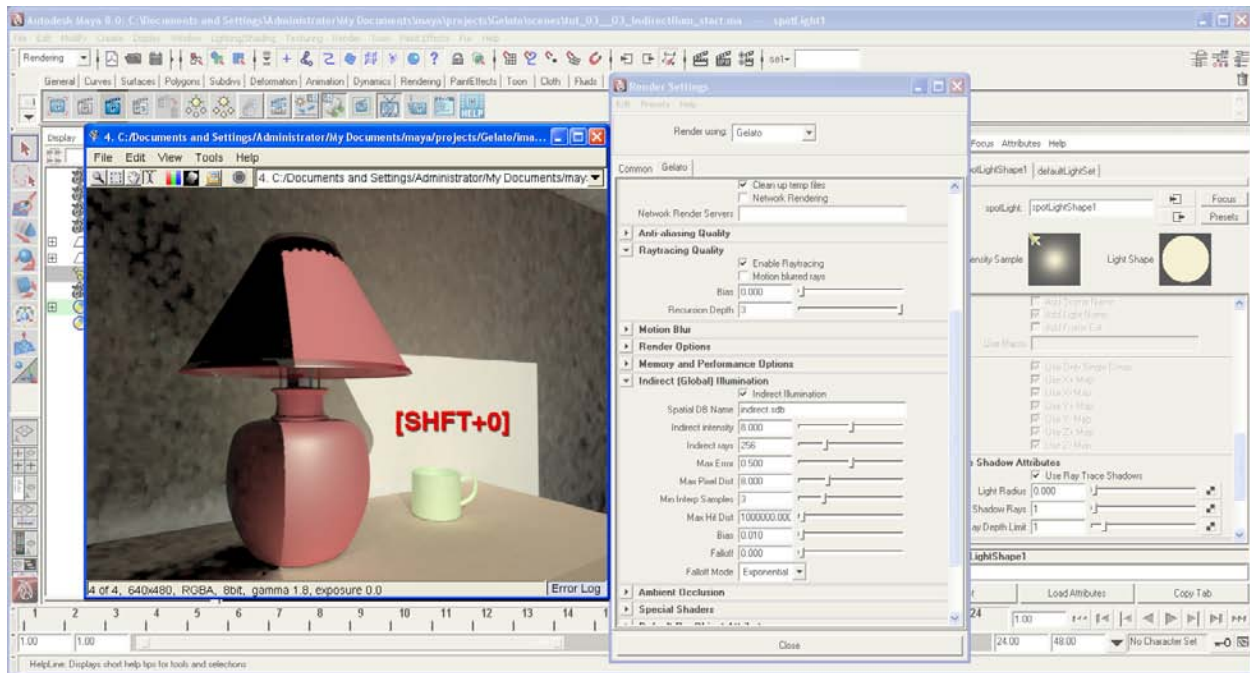
- Change: Indirect intensity to 0.256.
Max Pixel Dist to 8.000.

Since there are no cracks and crevices, we'll leave the Max Error at 0.500.



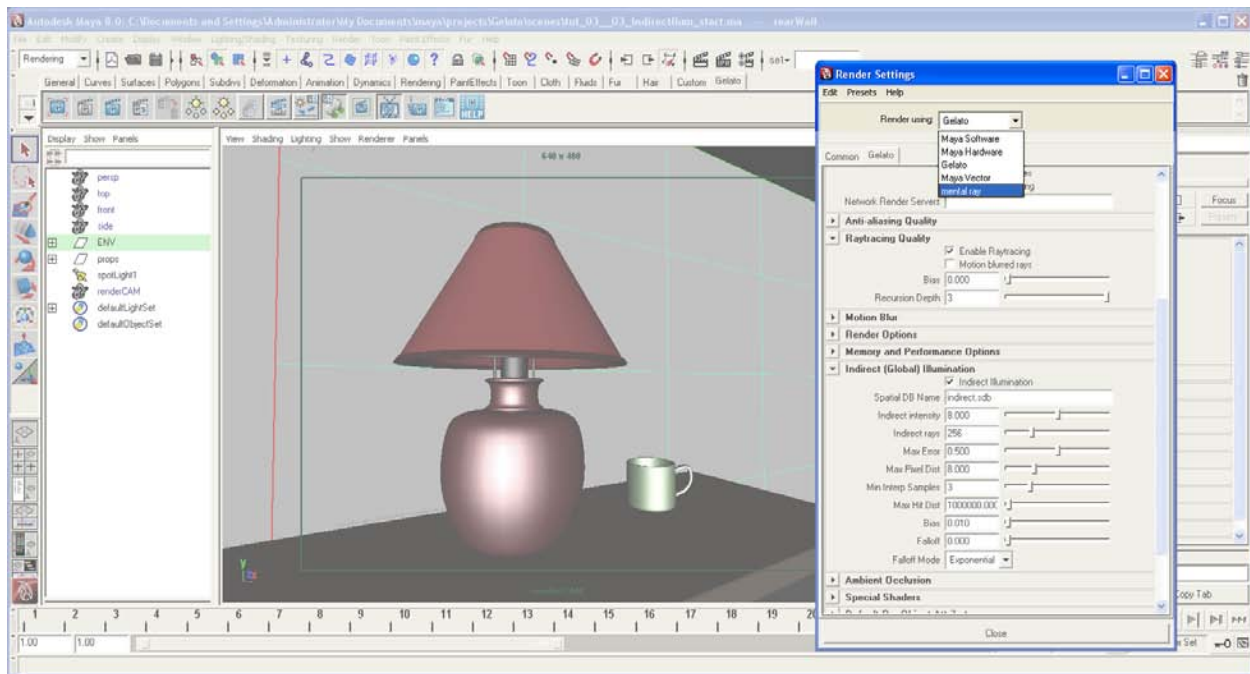
- Gelato Render.
- Use the Wipe tool to compare this render to the last.

We can now see some color spill from the mug and the lamp onto the table.



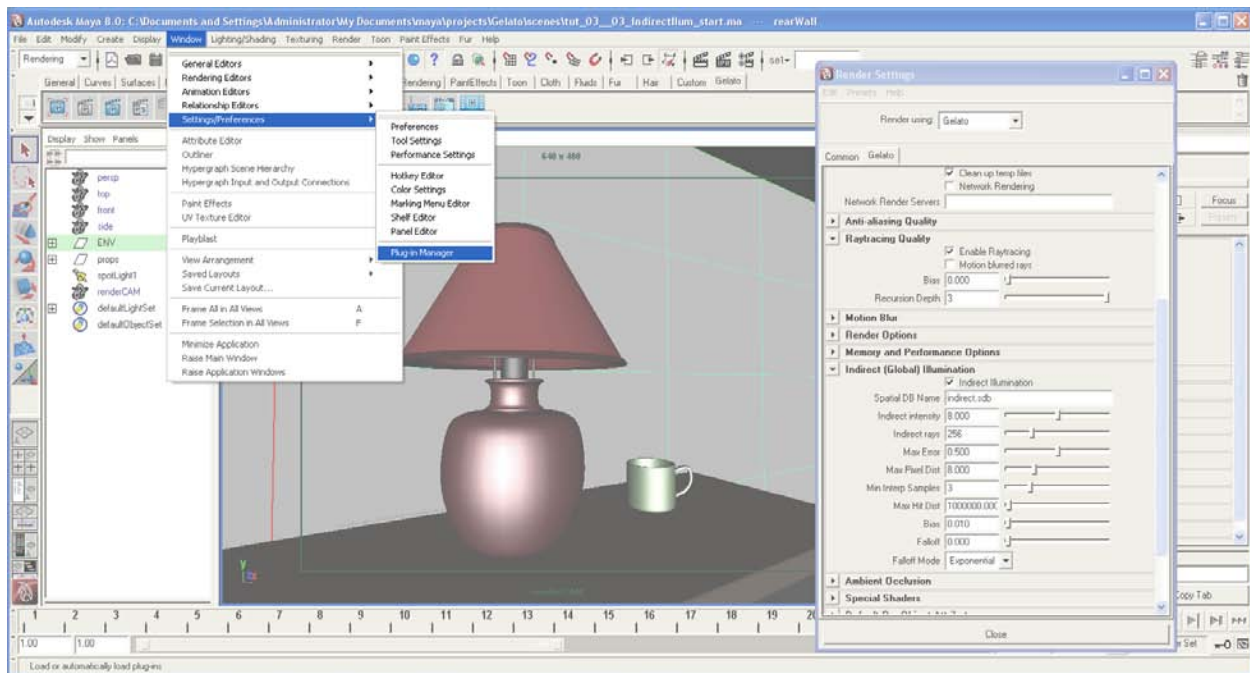
- **[SHIFT+0]** in the Image Viewer to raise the gamma, peer into the shadows and see some red color spill on the wall.
- **[SHIFT+9]** when you're done to return the gamma to a value of 1.0.

So... we've got some settings to use, but for an animation this is a very expensive computation. A smart way of handling this potential problem is to use texture baking. Lighting and shadows can be "baked" into texture maps, then be re-applied as textures. Let's take a look...



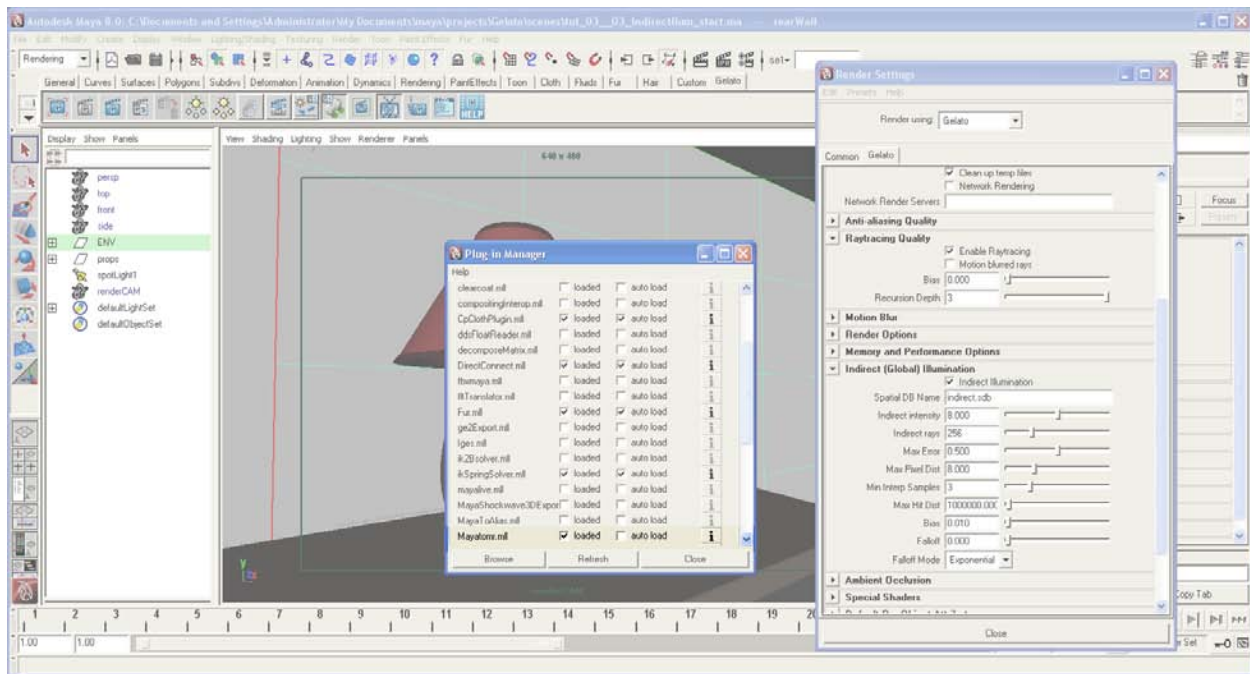
Bake sets are not native to Maya, they are a feature of Mental Ray, so in order to set up our bake set, we need to confirm that the Mental Ray plug-in is loaded.

- Render Settings > Render using > **[CLK+HOLD]** to view the options here. We want to see that Mental Ray is listed. Don't change anything.

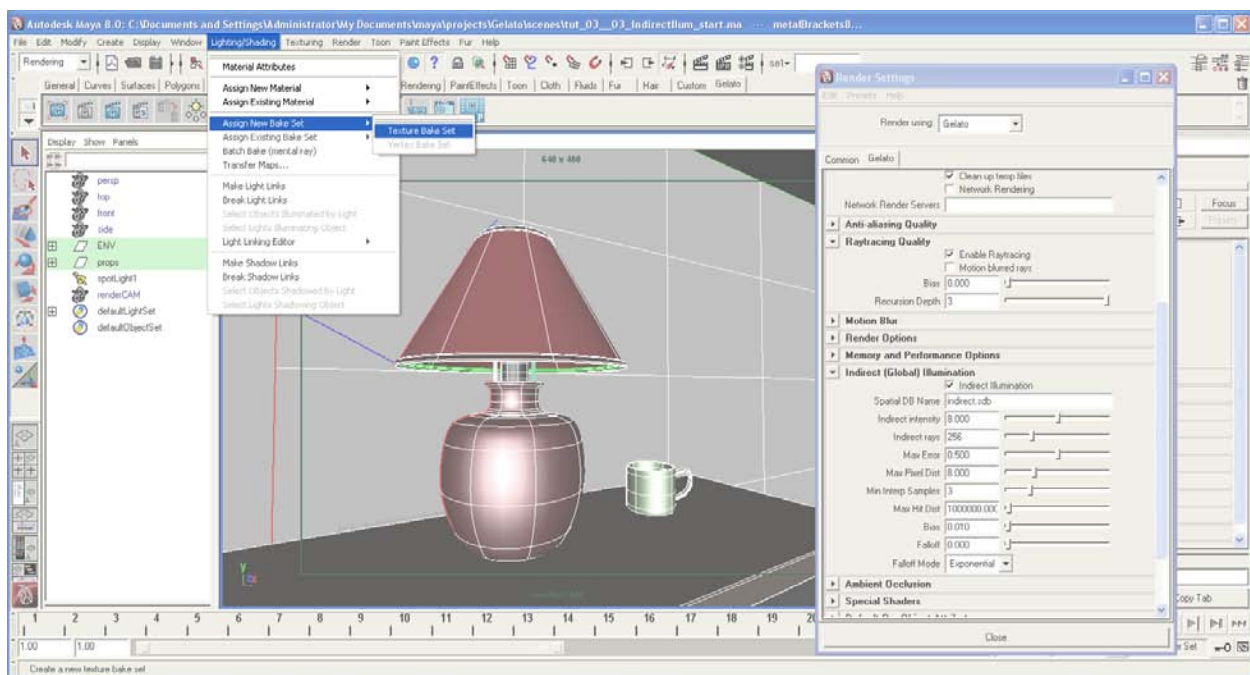


Alternatively, or if there is an issue:

- Main Menu > Settings/Preferences > Plug-in Manger.

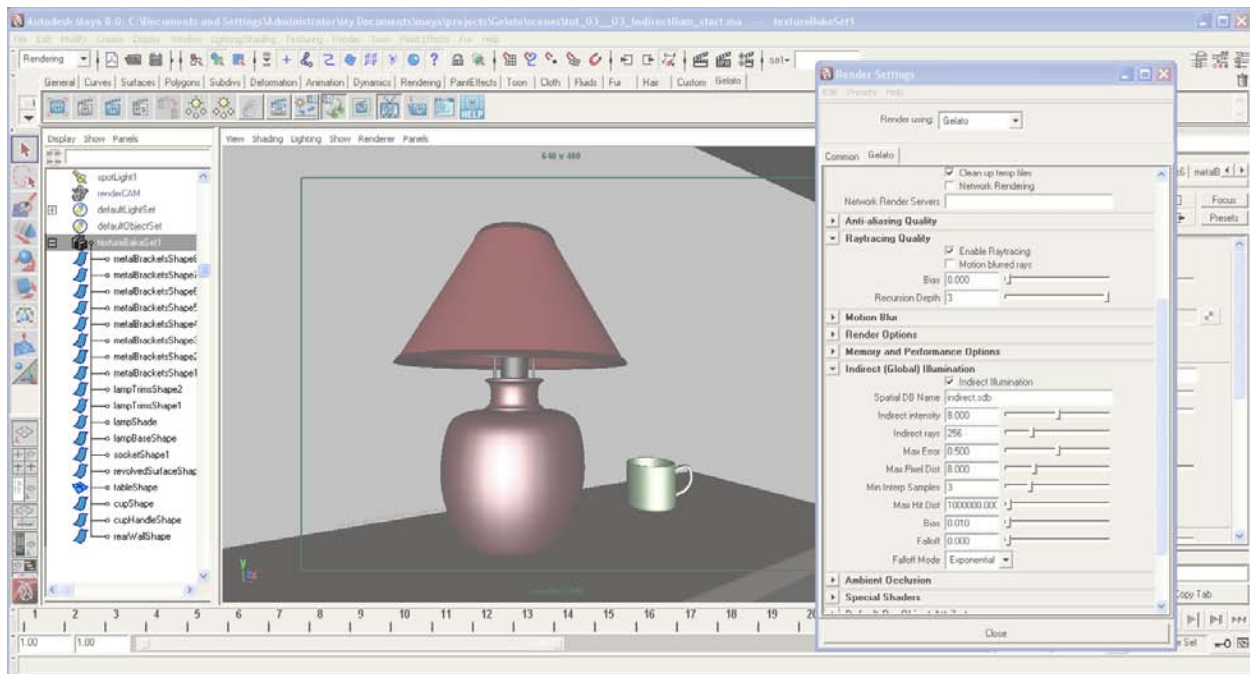


- In the Plug-in Manager, find “Mayatomr.mll” and make sure that this is loaded.
- This will give access to the Mental Ray features, important for the upcoming steps.

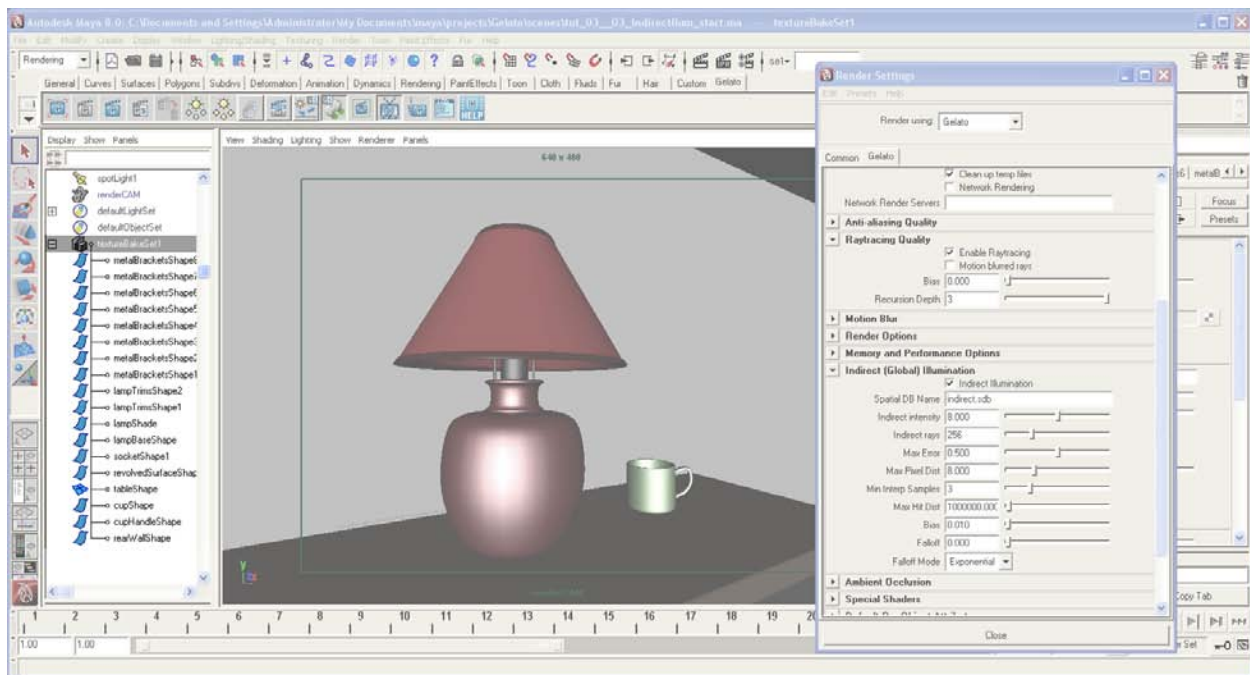


To create a bake set...

- Select the objects which will be baked, in this case, all the objects in the scene.
- Main Menu > Lighting/Shading > Assign New Bake Set > Texture Bake Set.



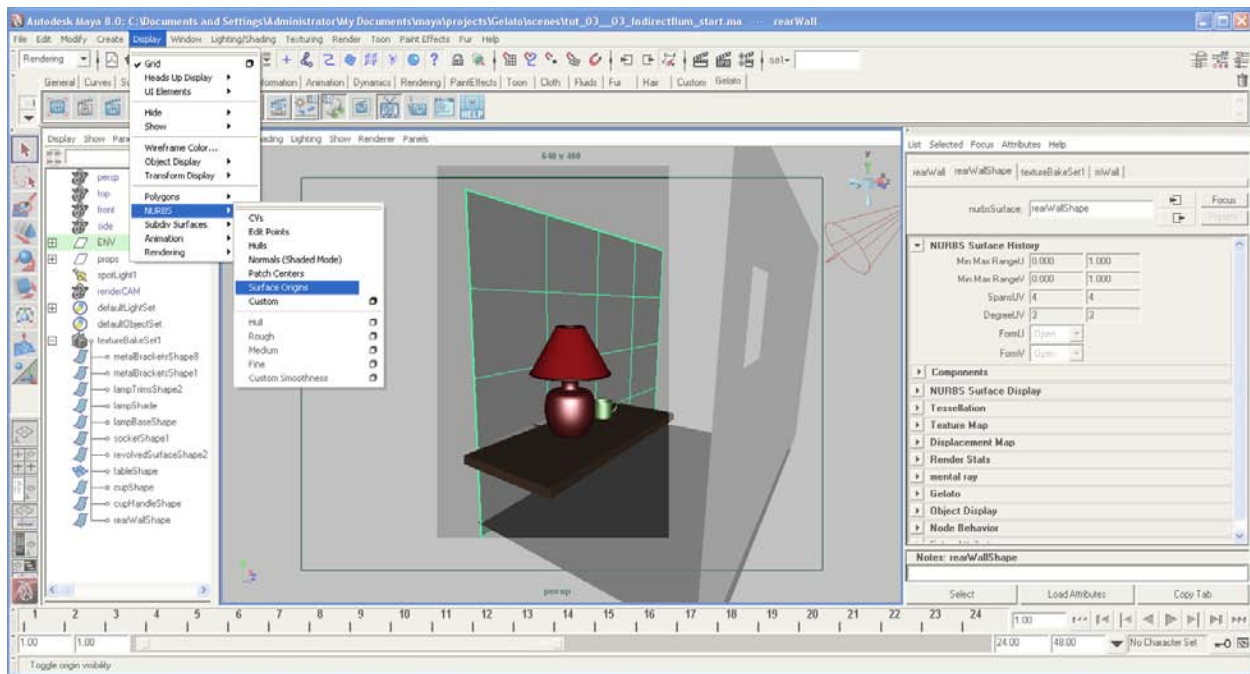
- Notice the addition of “textureBakeSet1” in the Outliner.



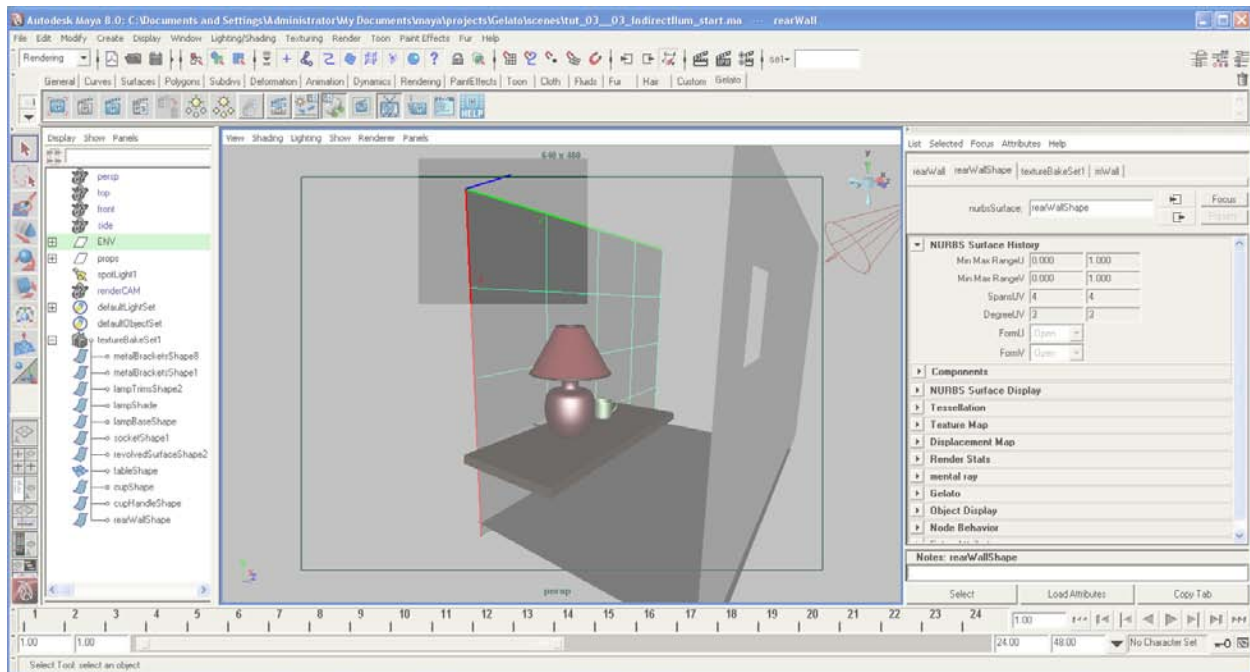
- “textureBakeSet1” Attribute Editor > Texture Bake Set Attributes > Color Mode > choose Light and Color.

Light and Color will give us the shadows, colors and global illumination. (If we wanted to render out the global illumination as a separate pass, we would choose **Only Global Illumination**.)

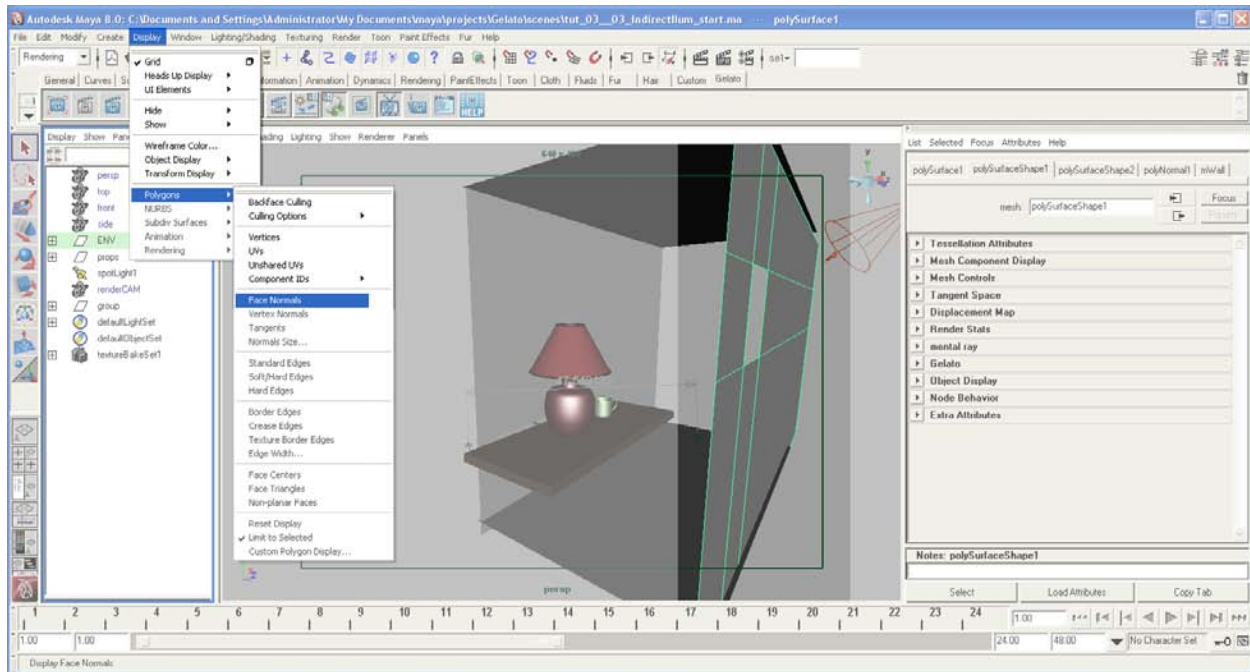
Normal Direction defaults to Surface Front. We’ll leave this as is, but we need to confirm that the normals of the objects are facing into the scene.



- Zoom out in the scene and select the wall next to the lamp, which is a nurbs surface.
- Main Menu > Display > Nurbs > Surface Origins.

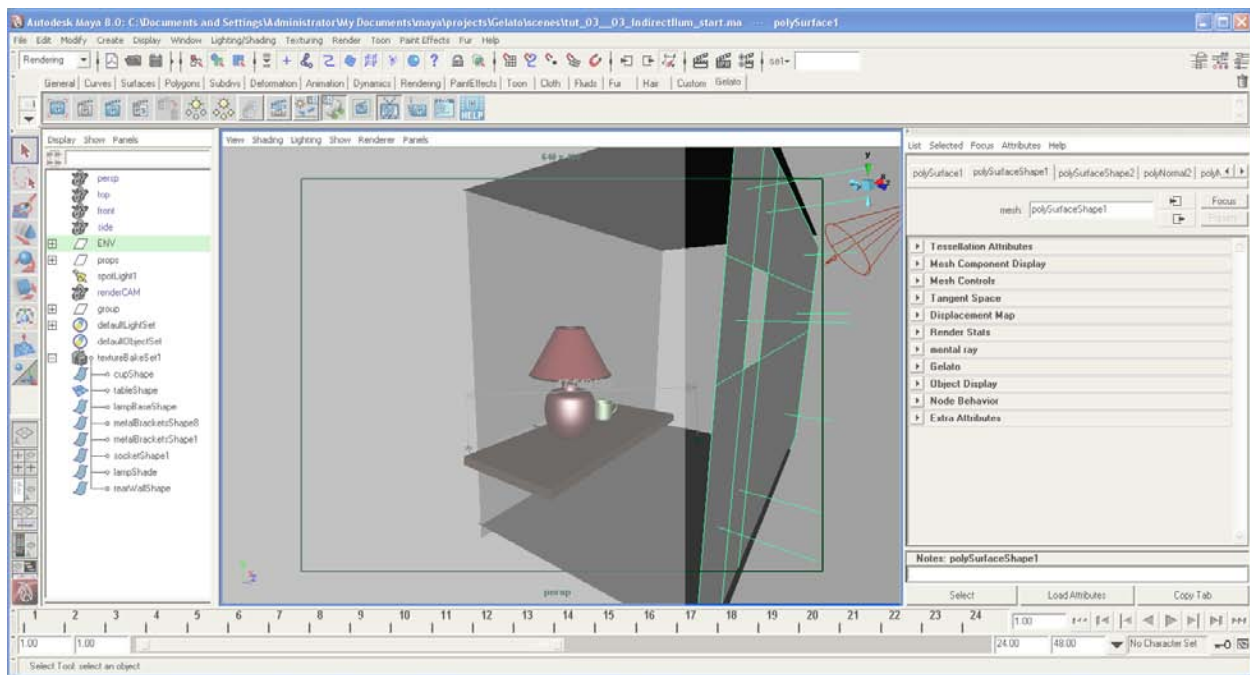


We want to see that the blue line, the Z axis, is facing into the scene. This is visible at the top front corner of the wall, and in the above image is oriented correctly.



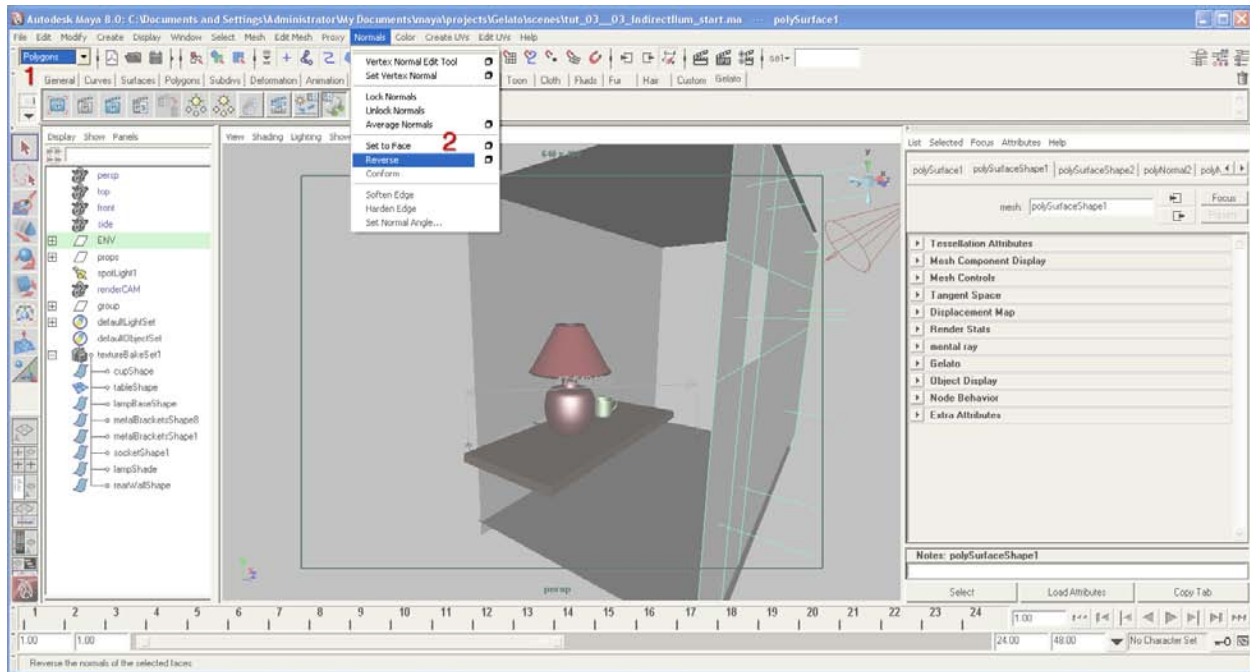
The back wall is a polygonal object. To check its normals...

- Main Menu > Display > Polygons > Face Normals

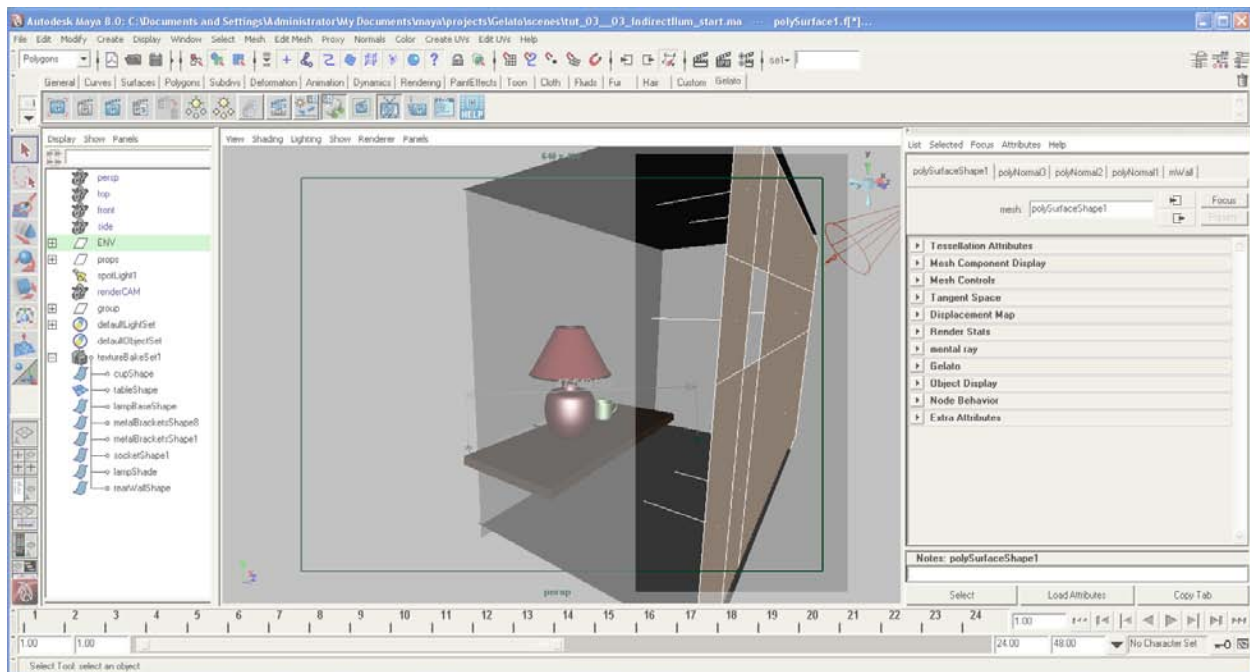


In this case, the normals are facing the wrong way. They are facing out of the scene instead of into it.

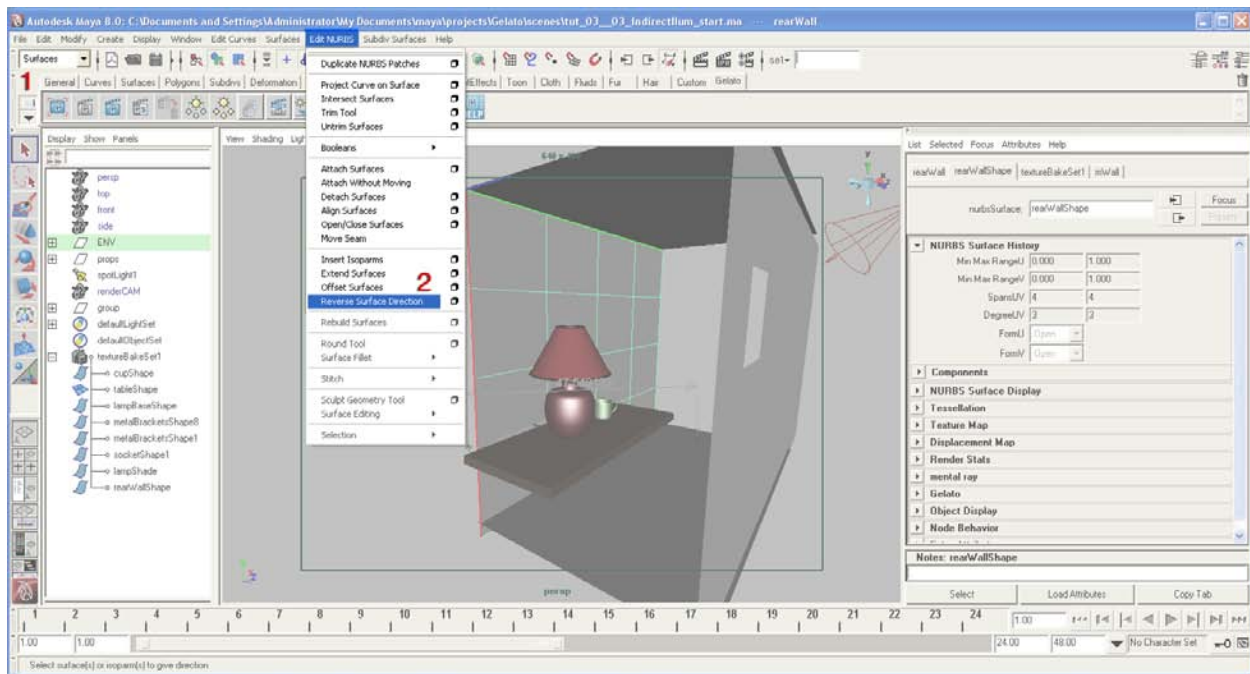
Since we won't be seeing that back wall, it's not that big a deal, but just to see how we would fix this and in case you're rusty with this aspect of Maya...



- Change the interface layout to Polygons.
- With the polygonal object still selected, Main Menu > Normals > Reverse.



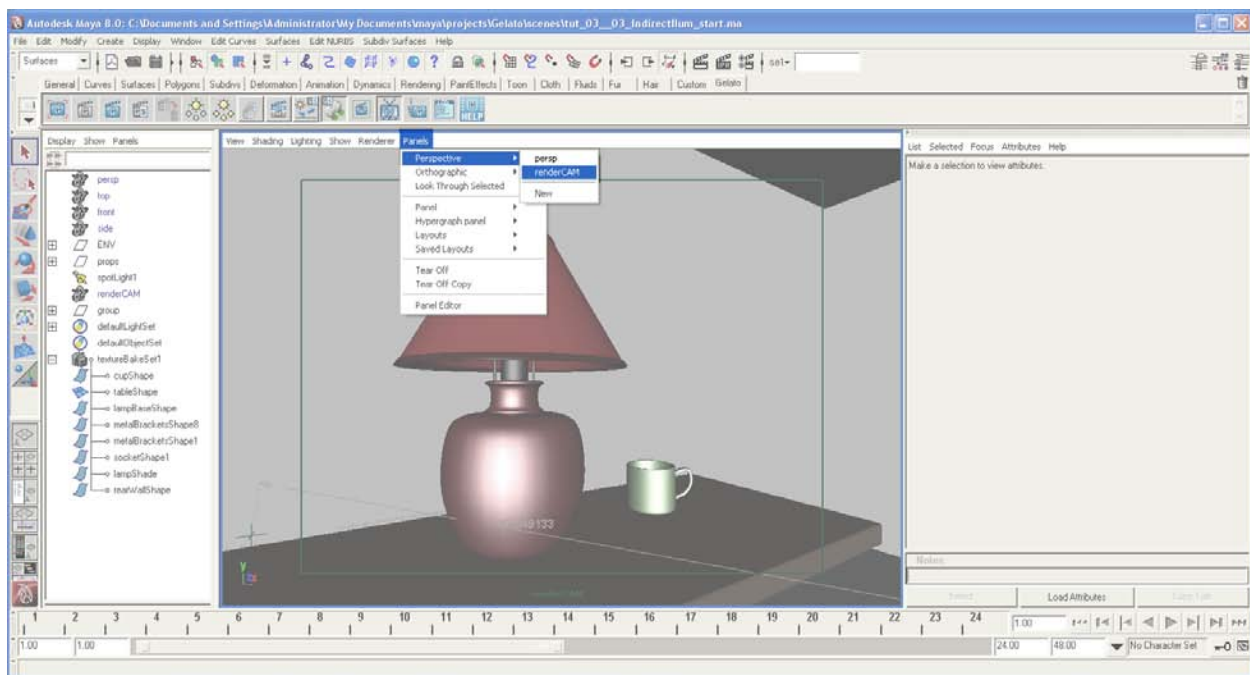
The normals, as shown in the above image, are now correctly aligned.



To flip the normals on a nurbs surface:

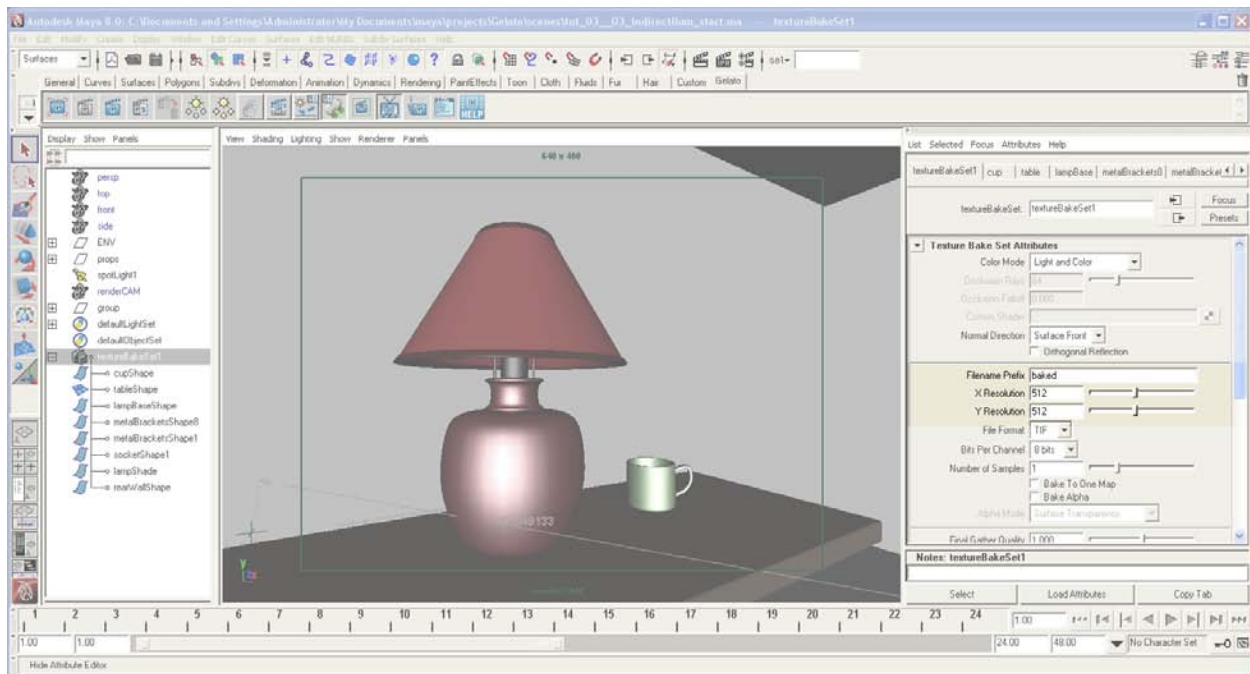
- Change the layout to Surfaces.
- Select the nurbs object.
- Main Menu > Edit Nurbs > Reverse Surface Direction.

So... knowing all this, take a moment to ensure that the normals of all objects in the texture bake set have their normals oriented correctly.



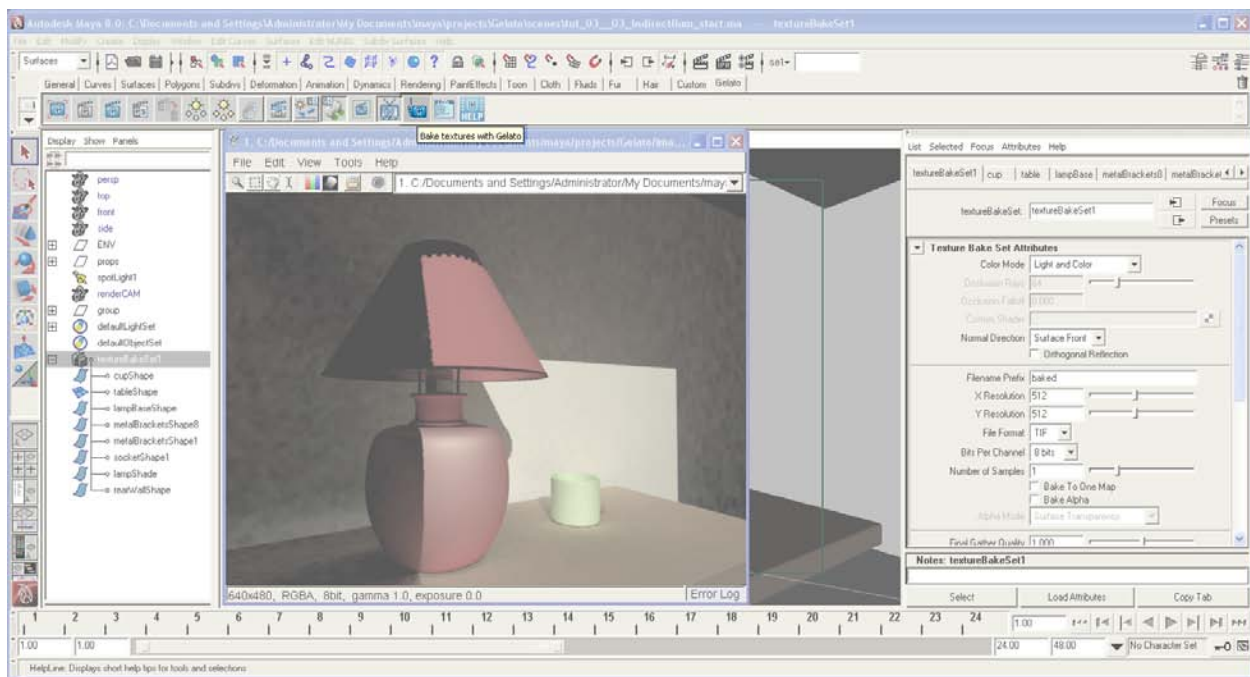
- Viewport window > Panels > Perspective > renderCAM..

This will return our view to the original framing. *For the purposes of the baked set, however, it doesn't matter which camera is used.*

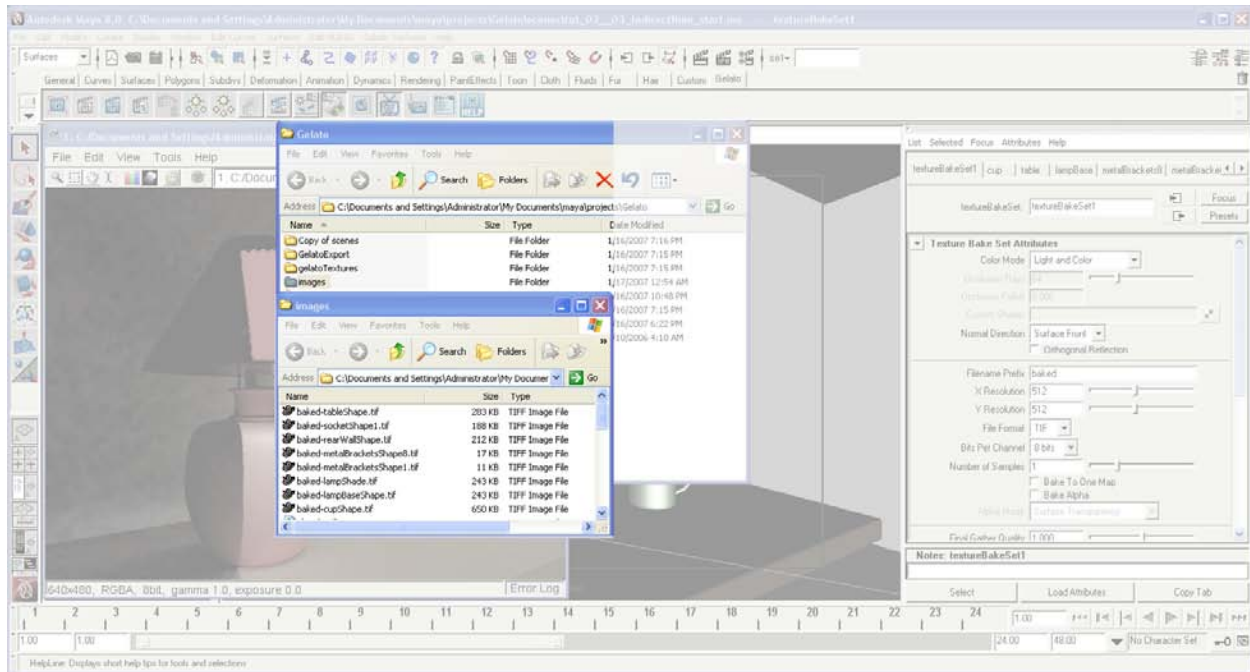


Back in the Texture Bake Set Attributes...

The X and Y Resolutions are set to 512; the File Format is set to TIF. We'll leave both these setting at their defaults.

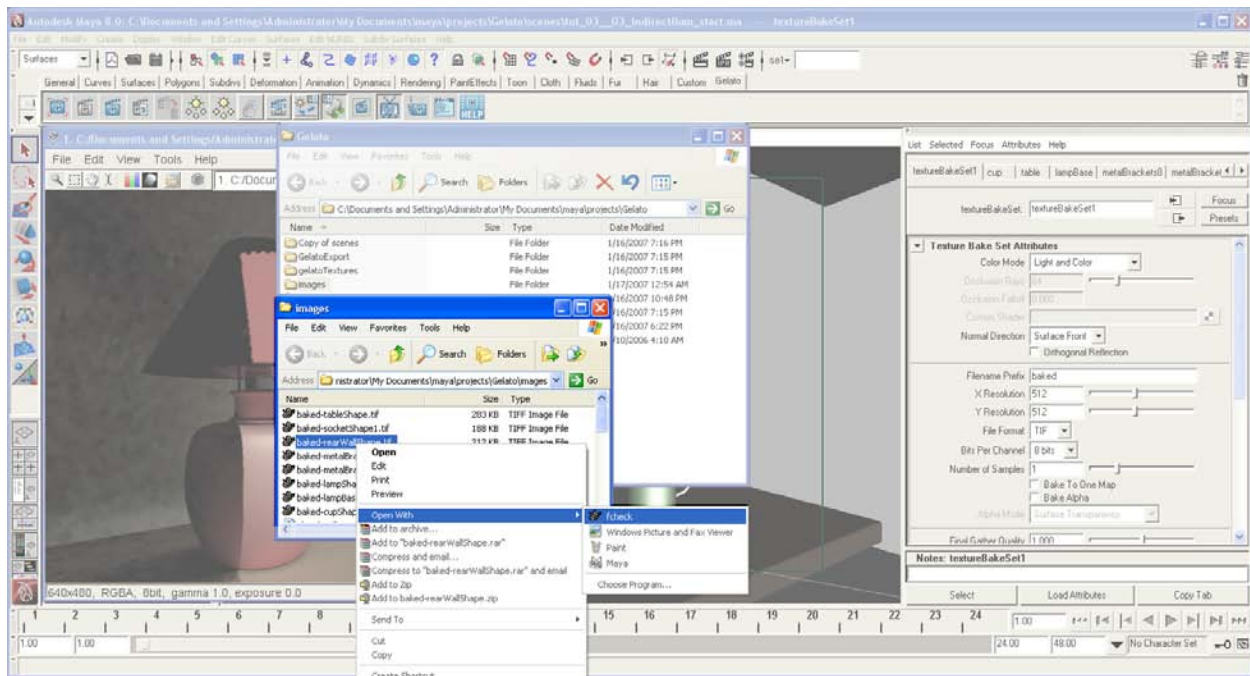


- Bake textures with Gelato (this is a new one for us – you can find it 3rd from the right in the Gelato Shelf).

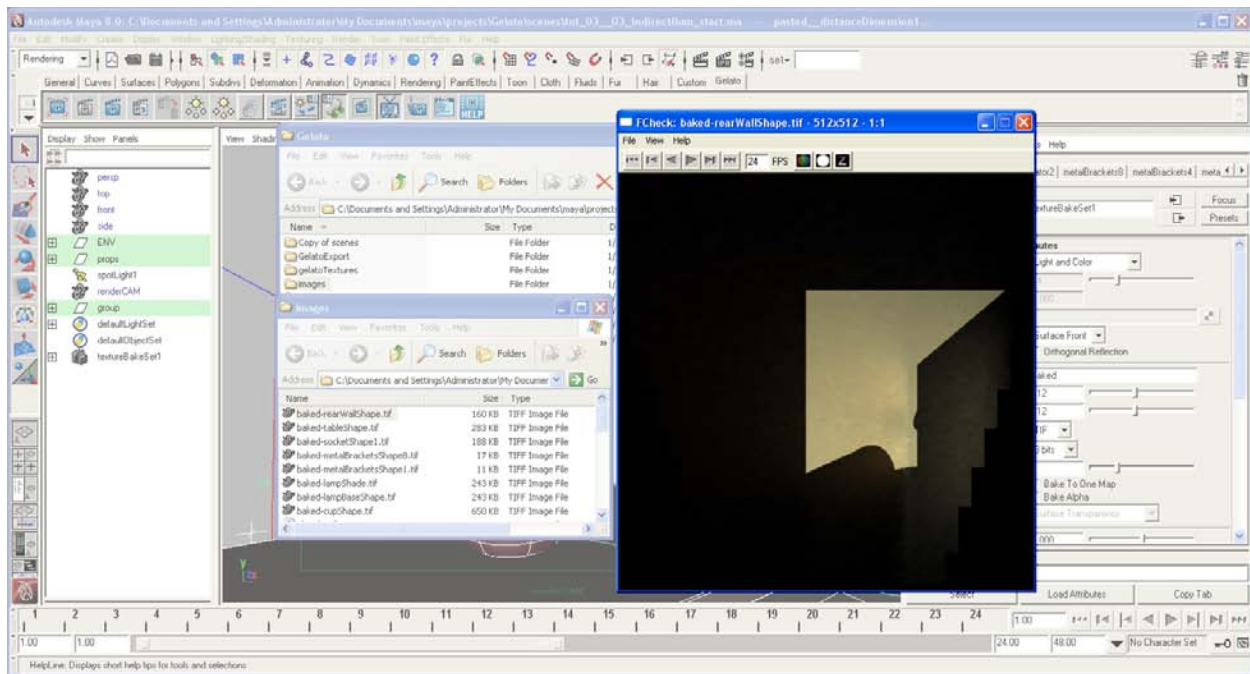


- Navigate to the Maya folder > Projects > Gelato > Images.

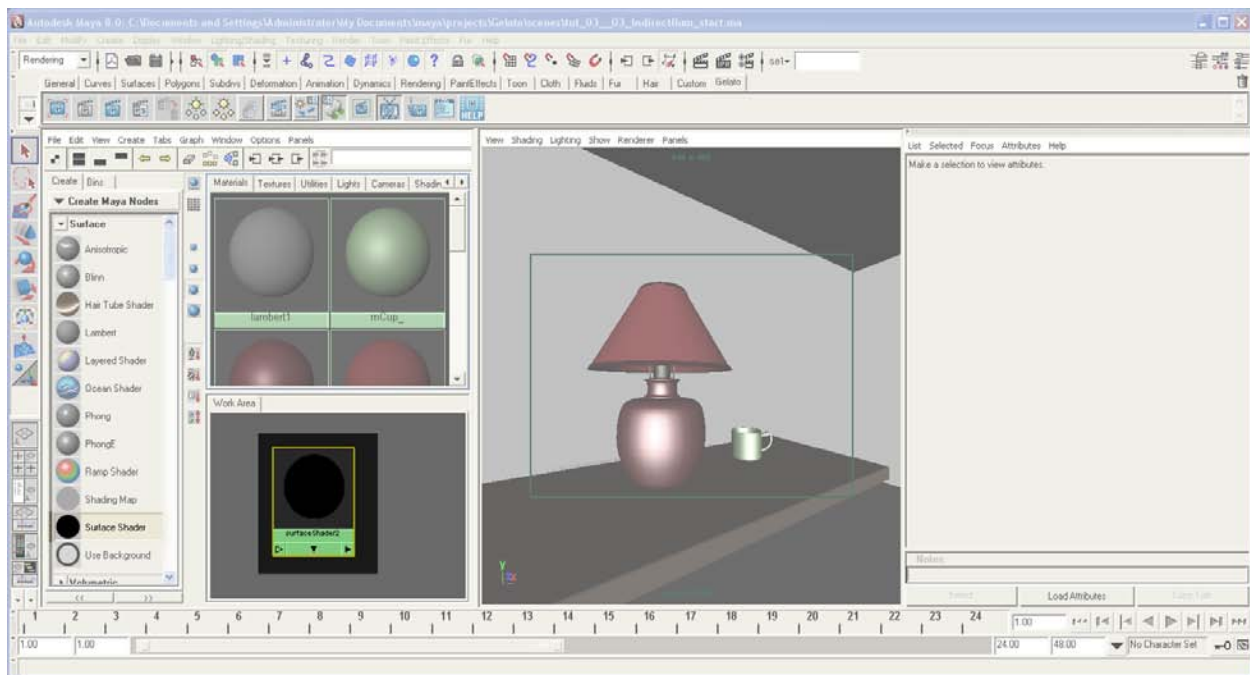
Here we can find the results of the render.



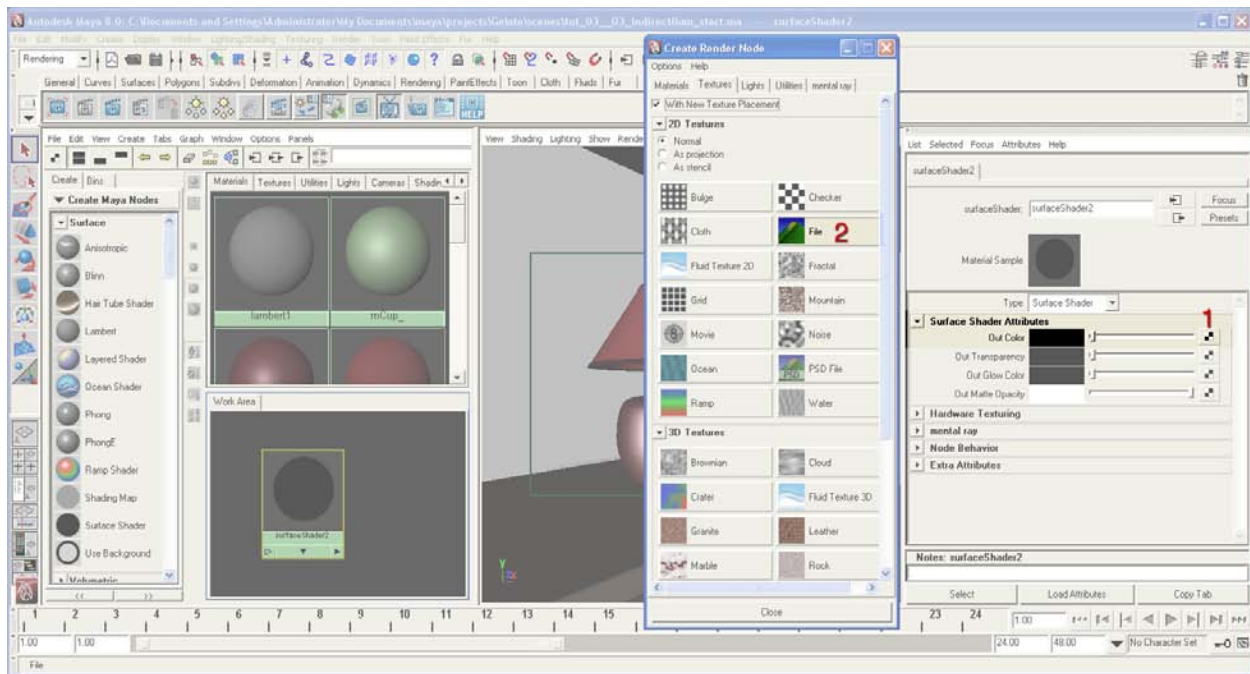
- Select “baked-rearWallShape.tif”
- **[R+CLK]** on its name, then, in the resulting pop-up menu, choose Open With > fcheck.



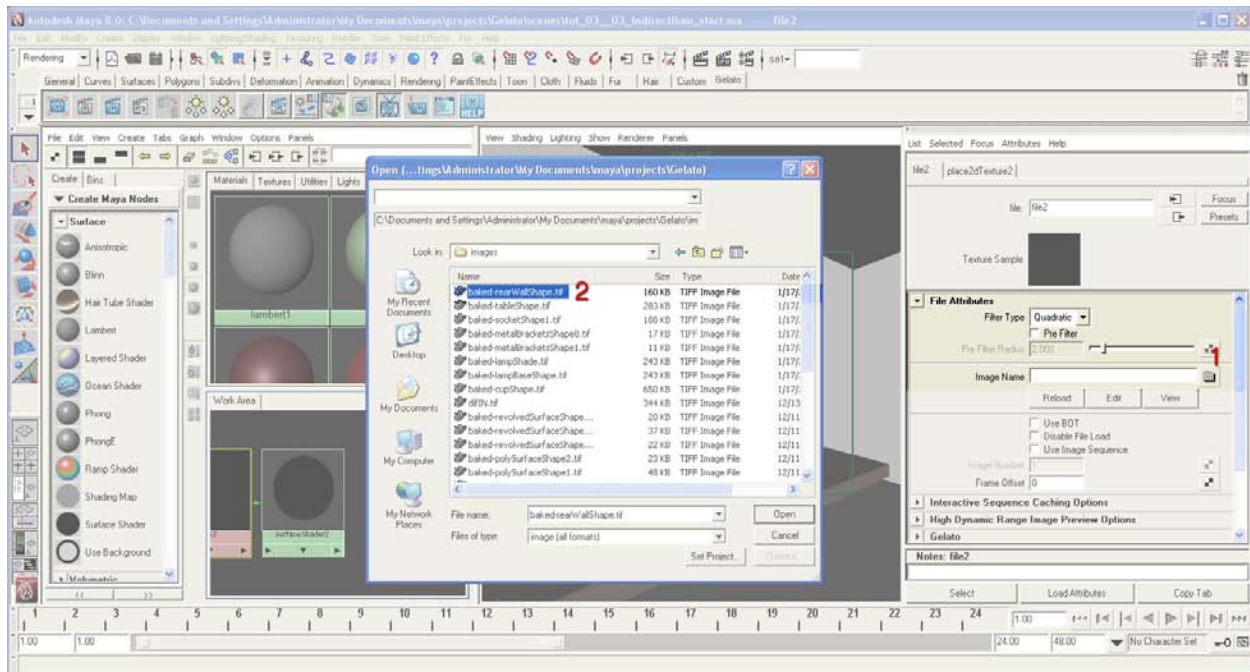
We can see the information - it is the length of the wall in a square UV space and it can now be applied as a texture map.



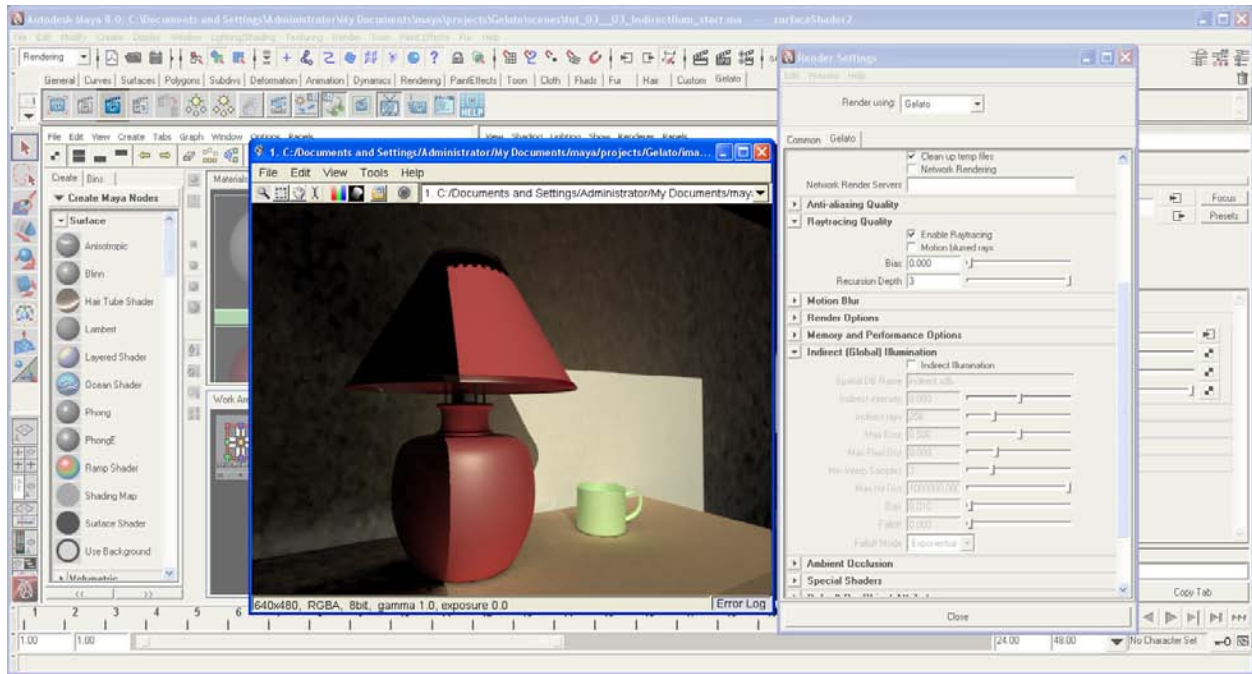
- Close the FCheck window.
- Open the Hypershade/Persp layout.
- Create a Surface Shader.



- Surface Shader Attributes > Out Color > **[CLK]** the checked button to the far right of Out Color.
- In the ensuing Create Render Nodes dialog, **[CLK]** the File texture.



- In the File Attributes, **[CLK]** the folder to the far right of Image Name.
- In the resulting Open dialog, choose “baked-rearWallShape.tif”



- Gelato Render.

This renders out much more quickly than when the Indirect Illumination was enabled in the Render Settings.

The cameras can still be animated – as long as the objects don't move – making this technique very valuable when we wish to have the look of indirect lighting without the render hit one would incur with an animated scene.