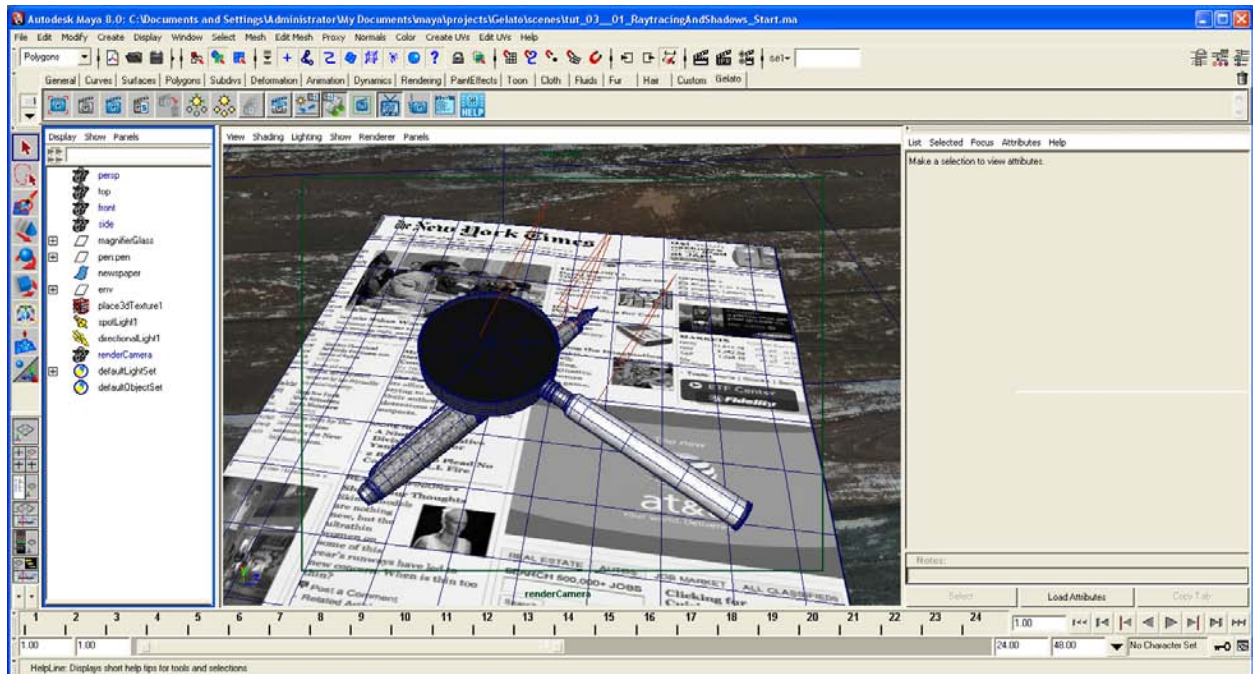


3.1 SHADOWS • RAY TRACING • ANTI-ALIASING



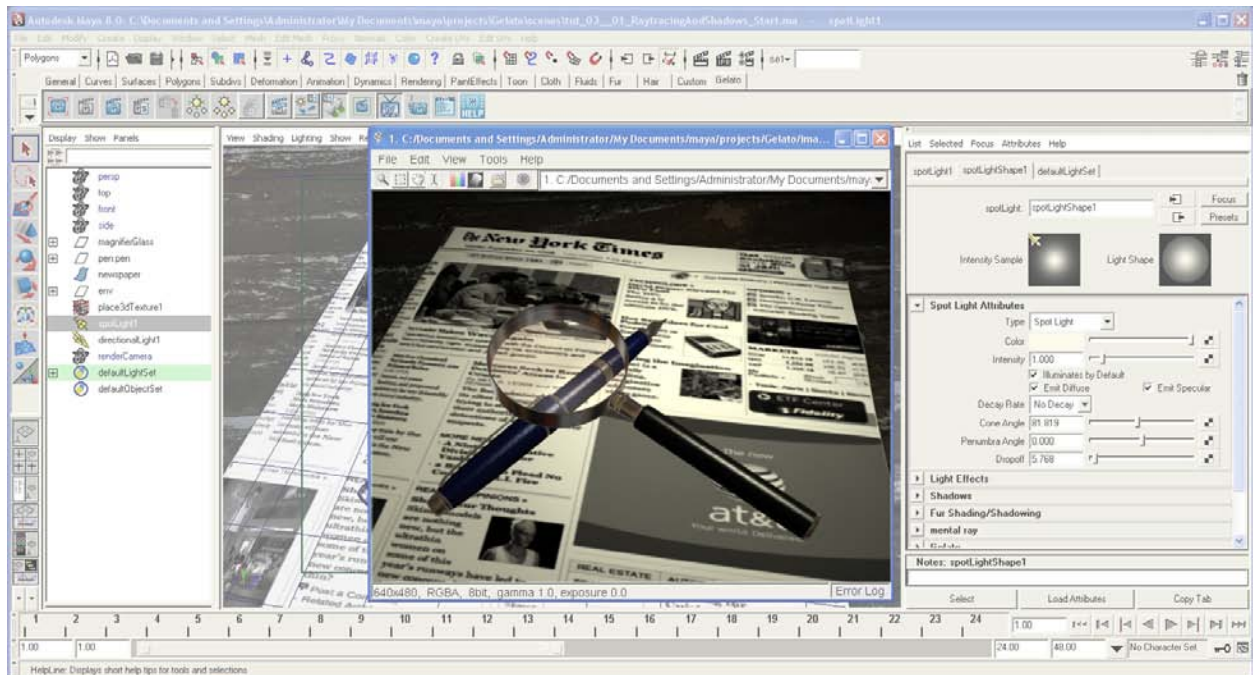
Welcome to the first in a series of 8 NVIDIA® Gelato® Advanced Tutorials.

In this tutorial, we will be looking at shadows, both ray-traced and depth map, and ray-traced reflections. When we look at depth map shadows, we'll see how Gelato can work a little magic on some artifacting that Maya can't handle on its own, at least not without incurring a render hit by increasing shadow map resolution. We'll see what we need to do to tweak ray tracing in Gelato and we'll take a look at how to improve both artifacting and aliasing issues that might be encountered along the way as we work through this project.



- Open scene tut_03_01.

A pen and magnifying glass are sitting on a newspaper; the scene has two lights, a directional light as the fill light and a spotlight as the key light.

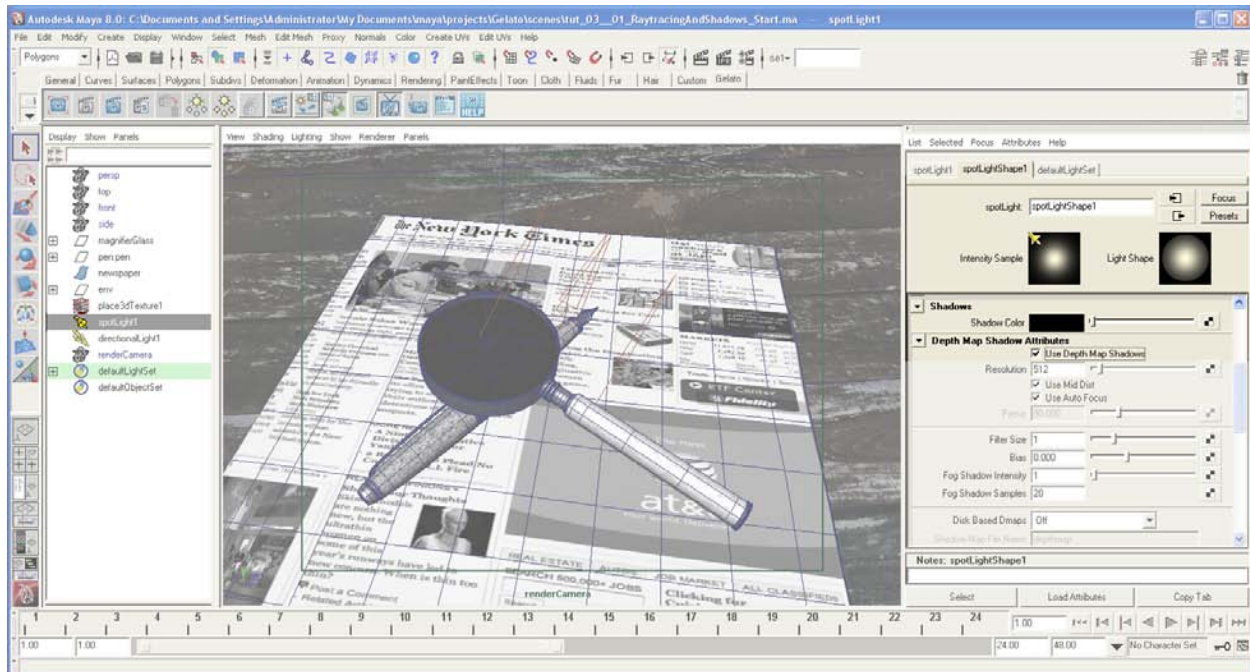


- Gelato Render.

* There are no shadows. Without shadows, we have no idea of the spatial relationship between the items. Is the magnifying glass resting on the newspaper or floating above it?

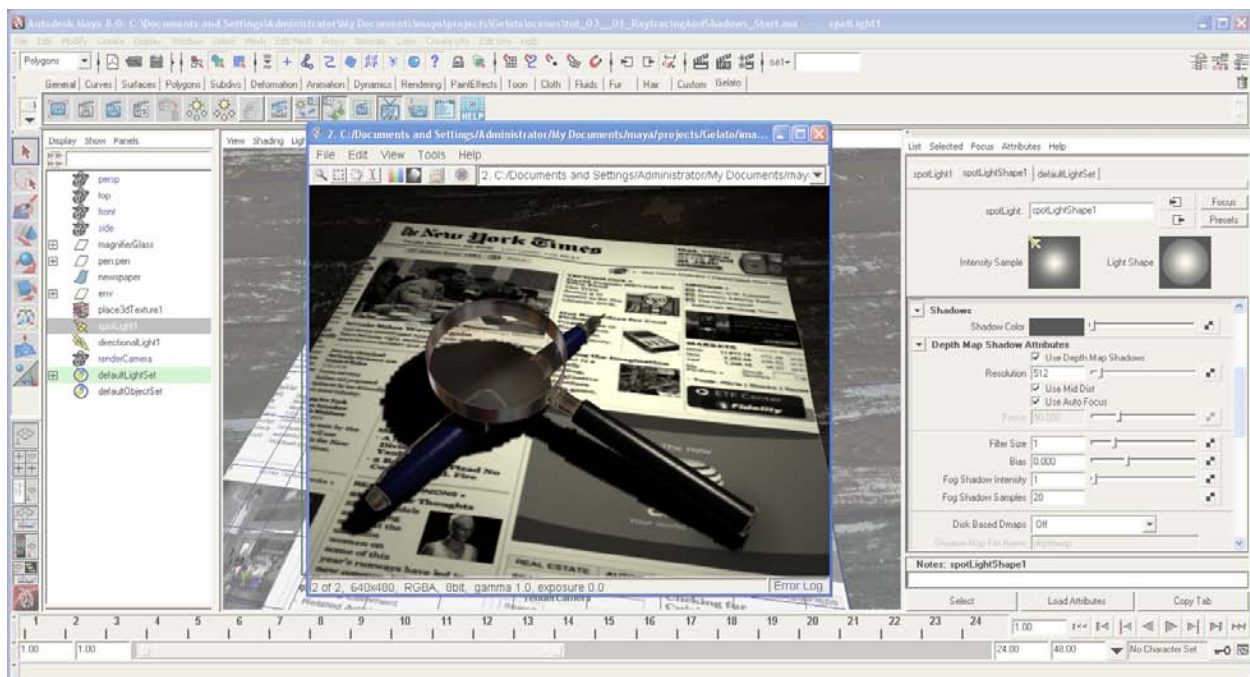
* Also, at the moment, the reflections on the pen and magnifying glass are coming from a reflection map. They are not being ray traced.

This is our starting point; let's begin.

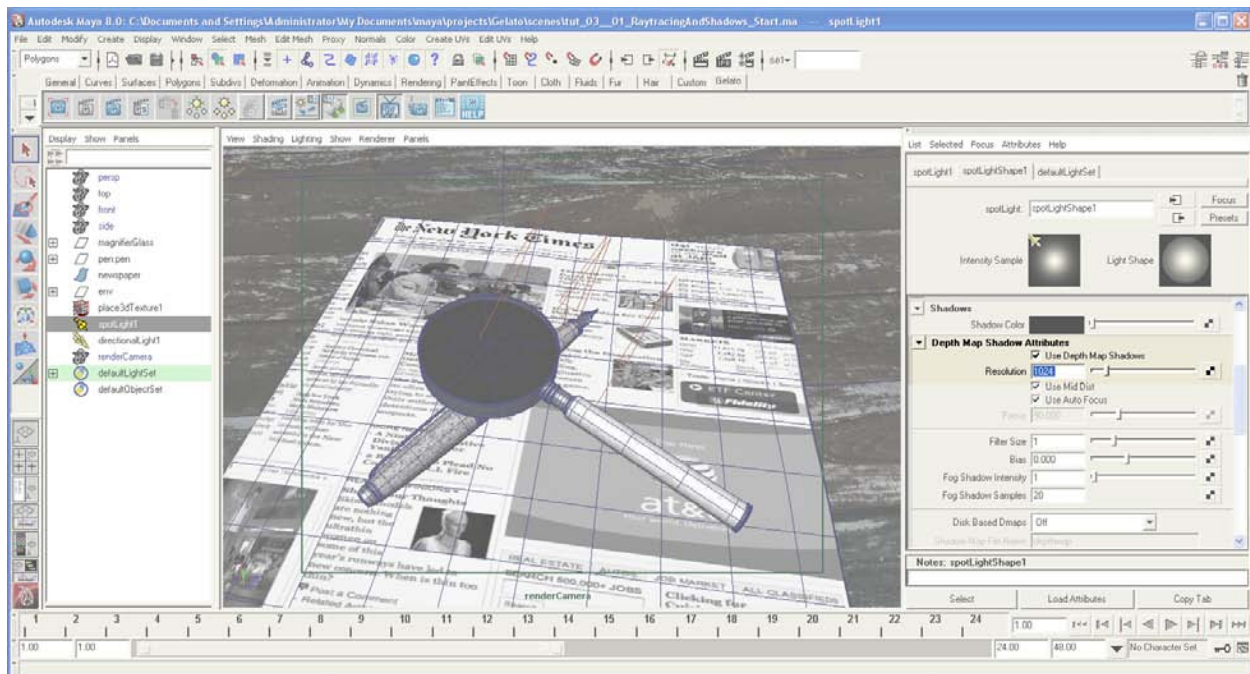


- Select “spotLightShape1” in the Outliner.
- Spotlight’s Attribute Editor > Shadows > Depth Map Shadow Attributes > enable Use Depth Map Shadows.

Depth Map Shadows are much faster to render than the ray-traced alternative and are commonly used because of this.

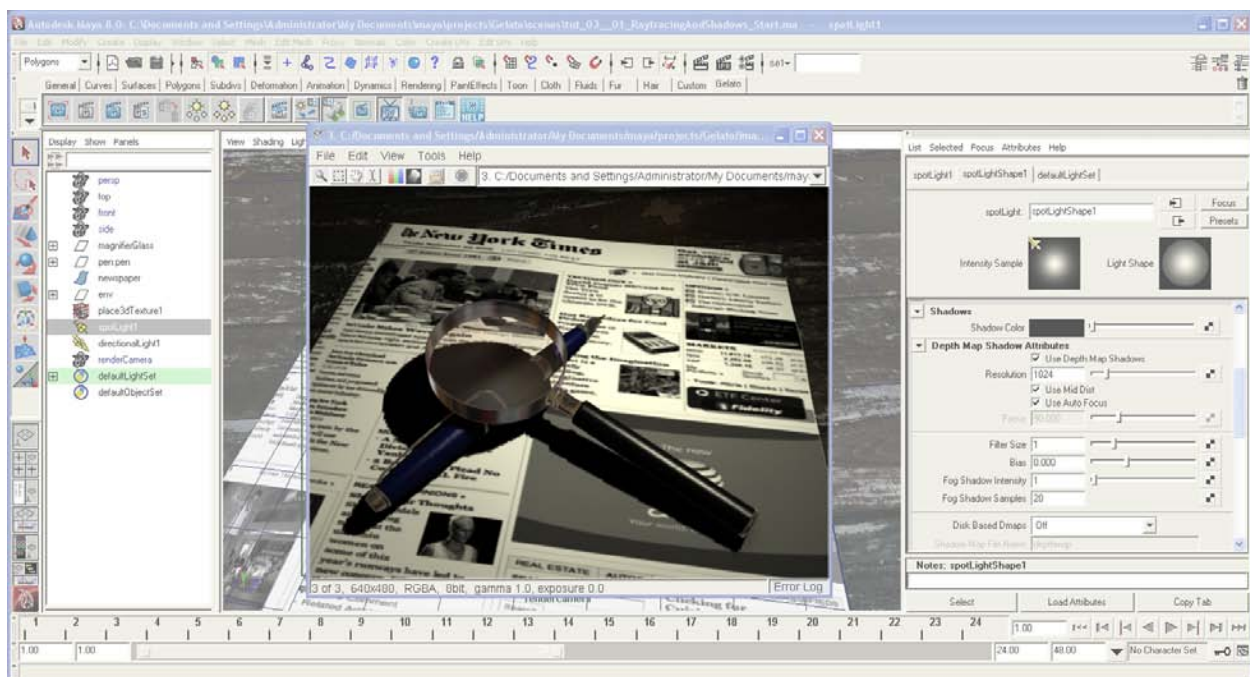


- Gelato Render.
- * We have a shadows – good.
- * Our shadows have ugly anti-aliasing artifacts along the edges – not so good.



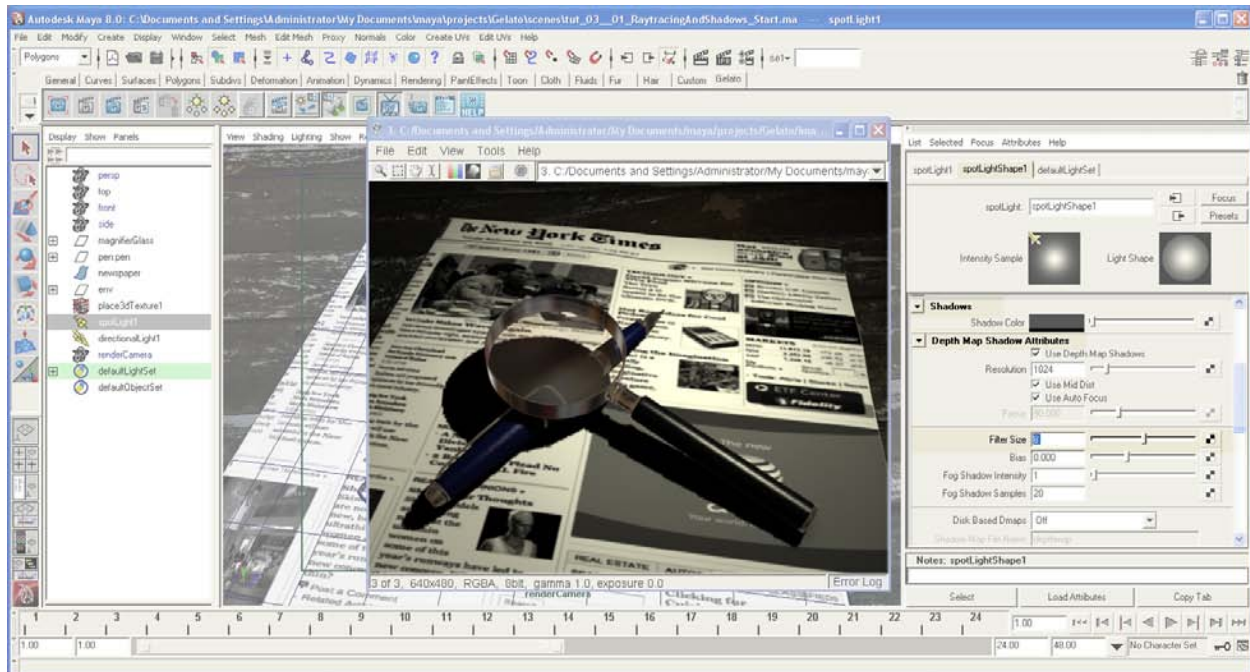
- Go back to the Depth Map Shadow Attributes.
- Notice that the Resolution is 512.
- Change the Resolution value to 1024.

The artifacts we are seeing result from our texture not having enough resolution, so our first strategy in removing them is to increase this value.



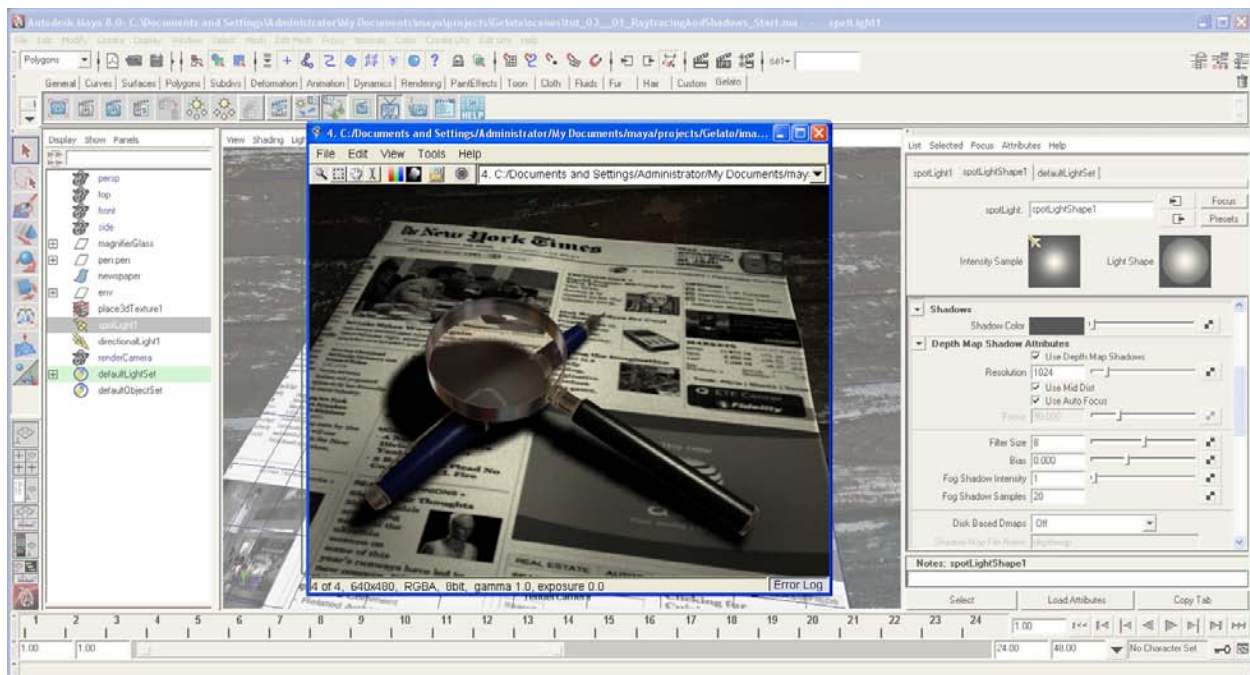
- Gelato Render.
- Compare this image to the last render by using the Wipe Tool.

The artifacts are beginning to improve.



We could increase the resolution again to get rid of the artifacts, but it's time to consider the entire scene. Having a really crisp shadow for the magnifying glass and pen won't work if you look closely at the newspaper. A solution is to take our reasonably sharp shadow with the bit of artifacting and blur it. This takes care of two problems (shadow too sharp + aliasing artifacts) in one shot.

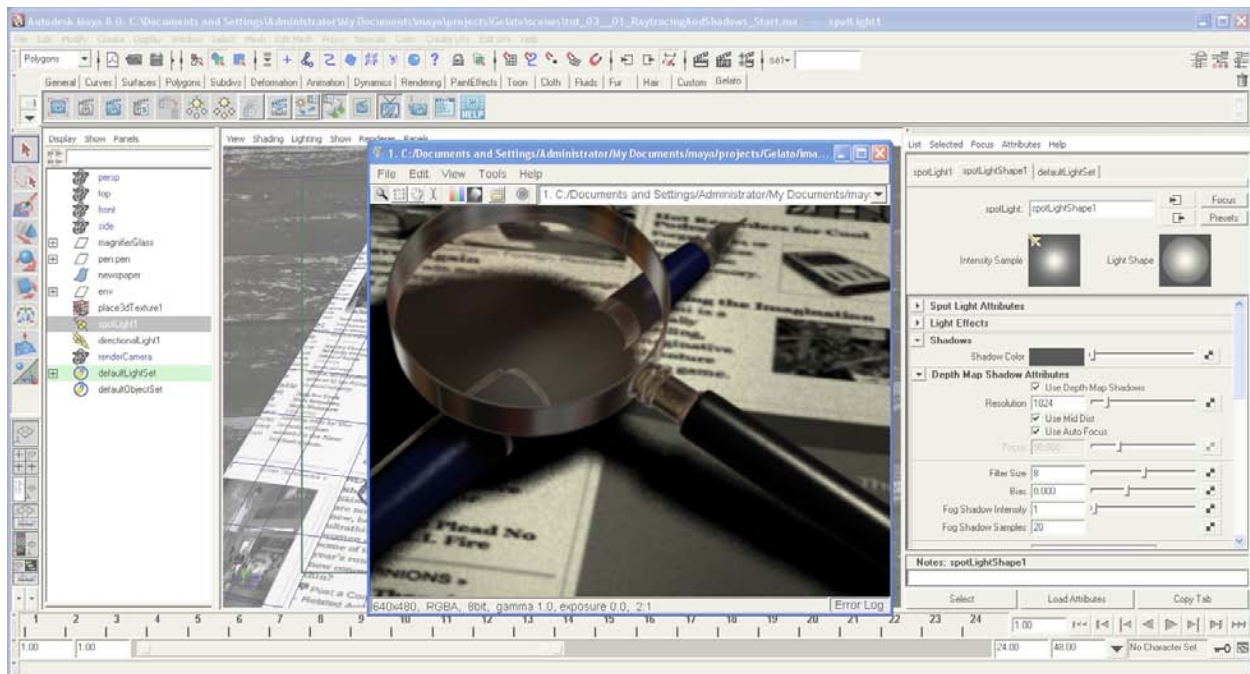
- Spotlight's Attribute Editor > Shadows > Depth Map Shadow Attributes > change Filter Size to 8.



- Gelato Render.

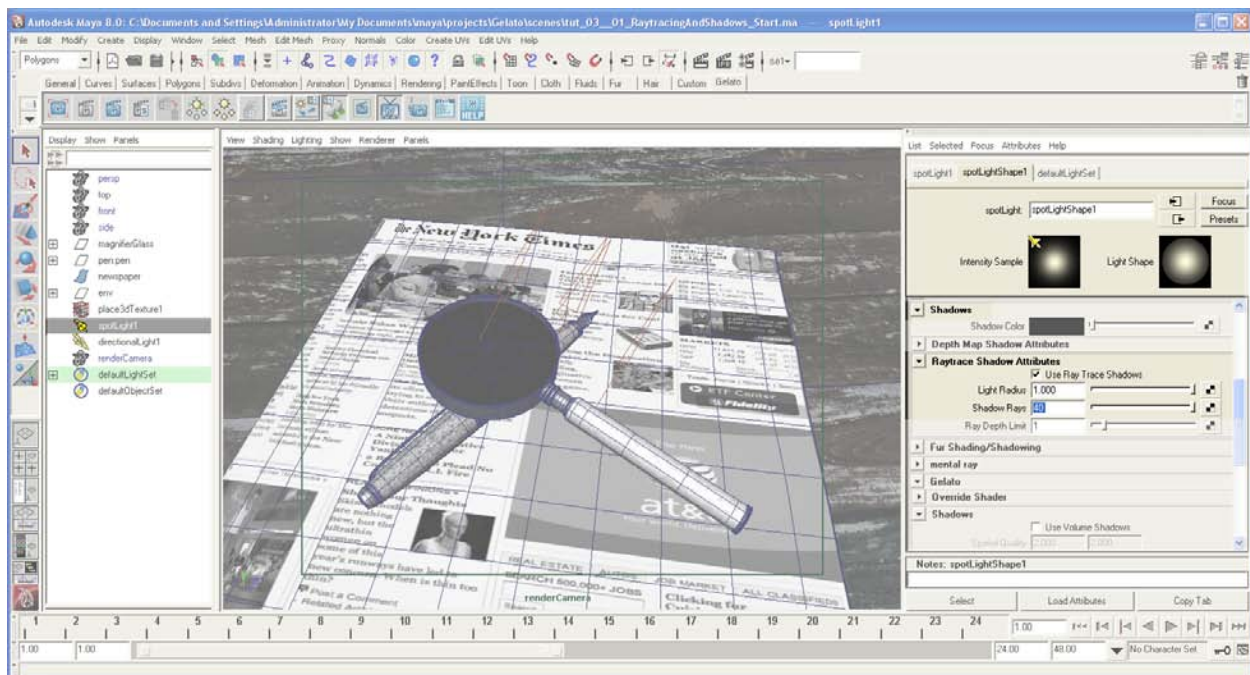
* The shadow looks much softer – good.

* This shadow softening has created more artifacts by way of noise – not so good.

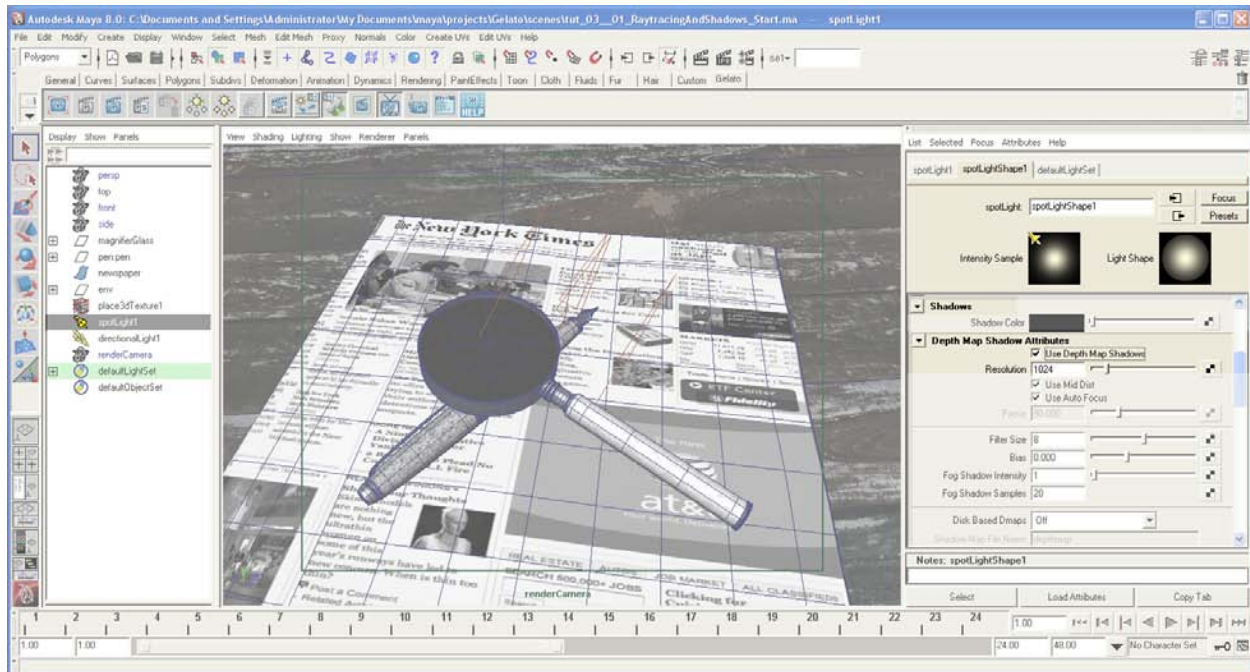


Zooming in, we can take a better look at this.

So now to address this... Maya itself doesn't have a separate way of dealing with these artifacts - it has no way to adjust the number of samples used when filtering out a Depth Map Shadow. To fix this problem, we would simply increase the resolution of the Depth Map. However, Gelato gives us another option...

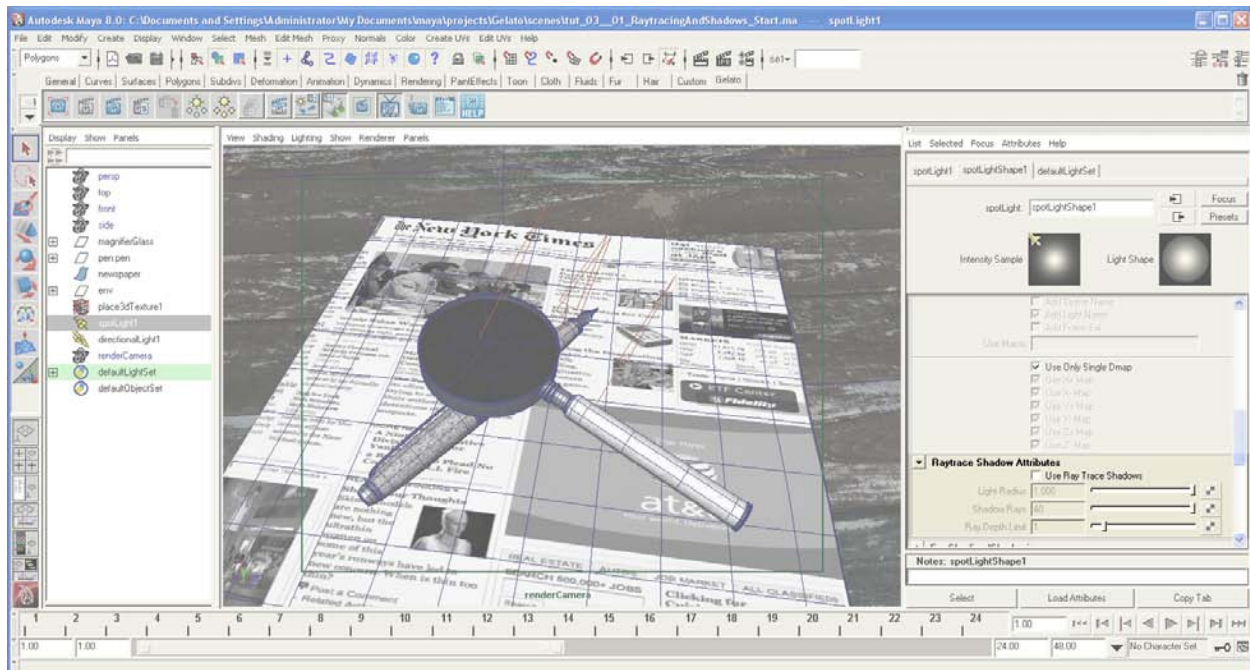


- Spotlight's Attribute Editor > Raytrace Shadow Attributes.
- Enable "Use Ray Trace Shadows."
- Change "Shadow Rays" to 40.



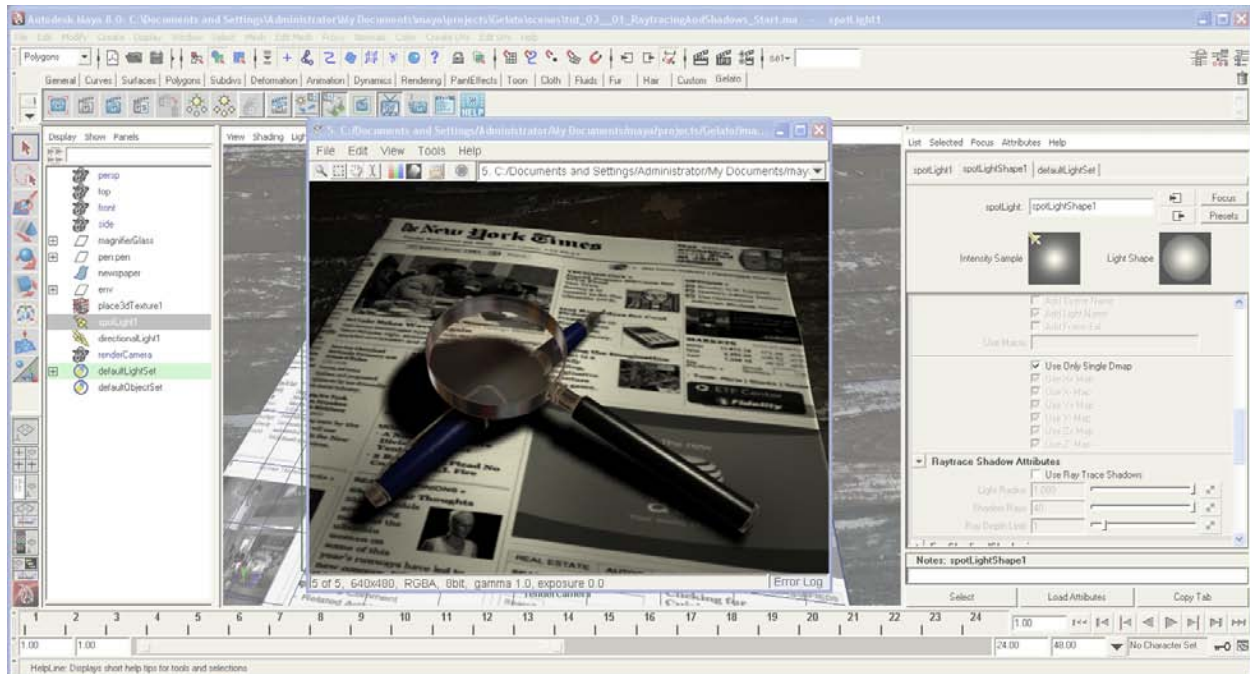
When we turned on the Raytrace Shadows, the Depth Map Shadow Attributes turned off. We need this on.

- Shadows > Depth Map Shadow Attributes.
- Enable “Use Depth Map Shadows.”



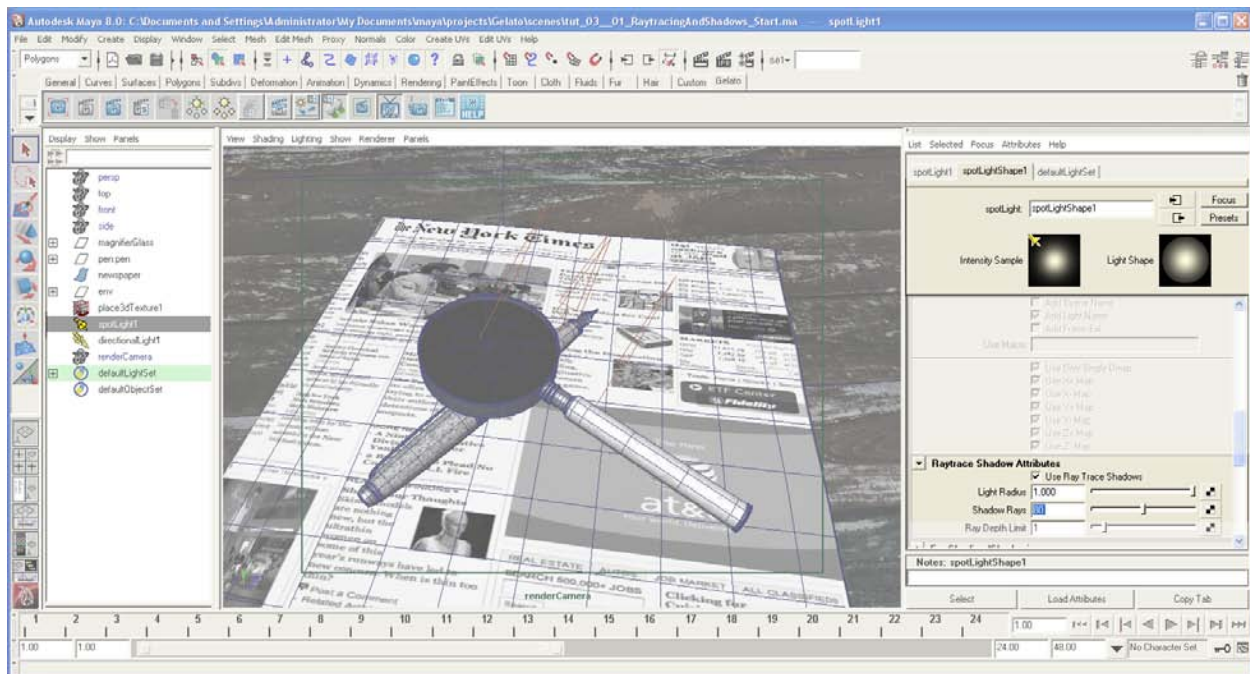
The Raytrace Shadow Attributes settings will grey out when this is done, but that’s okay – Gelato will still read the value we inputted.

Gelato won't be ray tracing when we perform this step – it will merely look at the Shadow Rays value in the Raytrace settings.

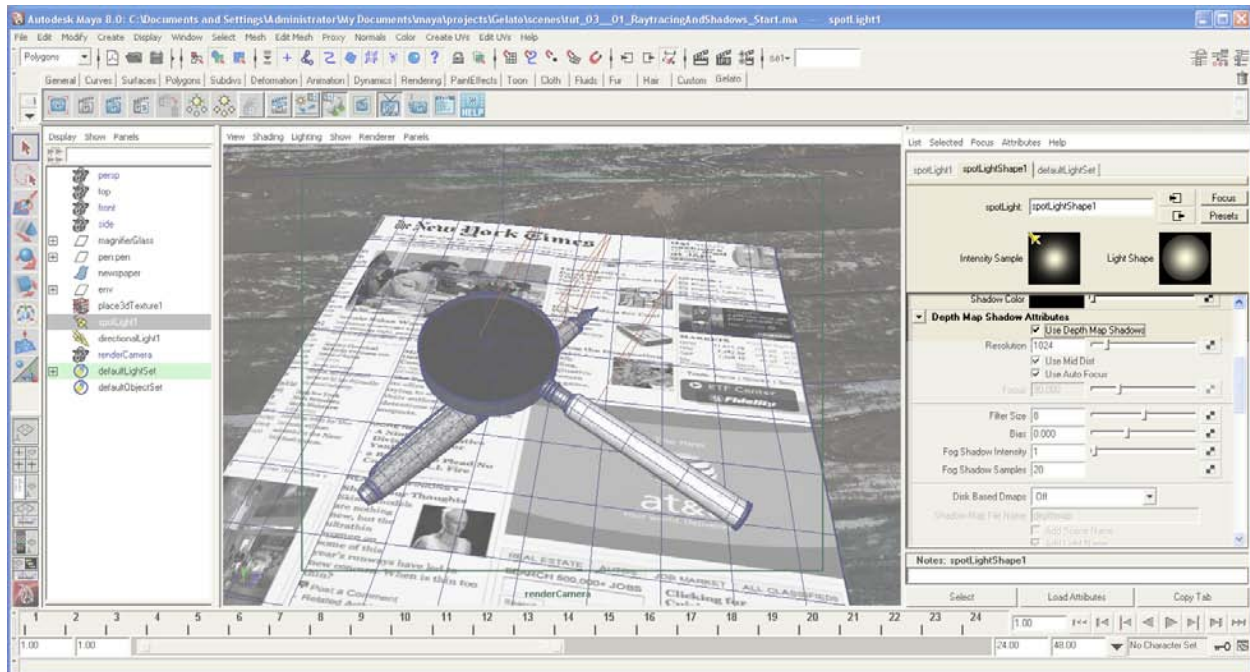


- Gelato Render.

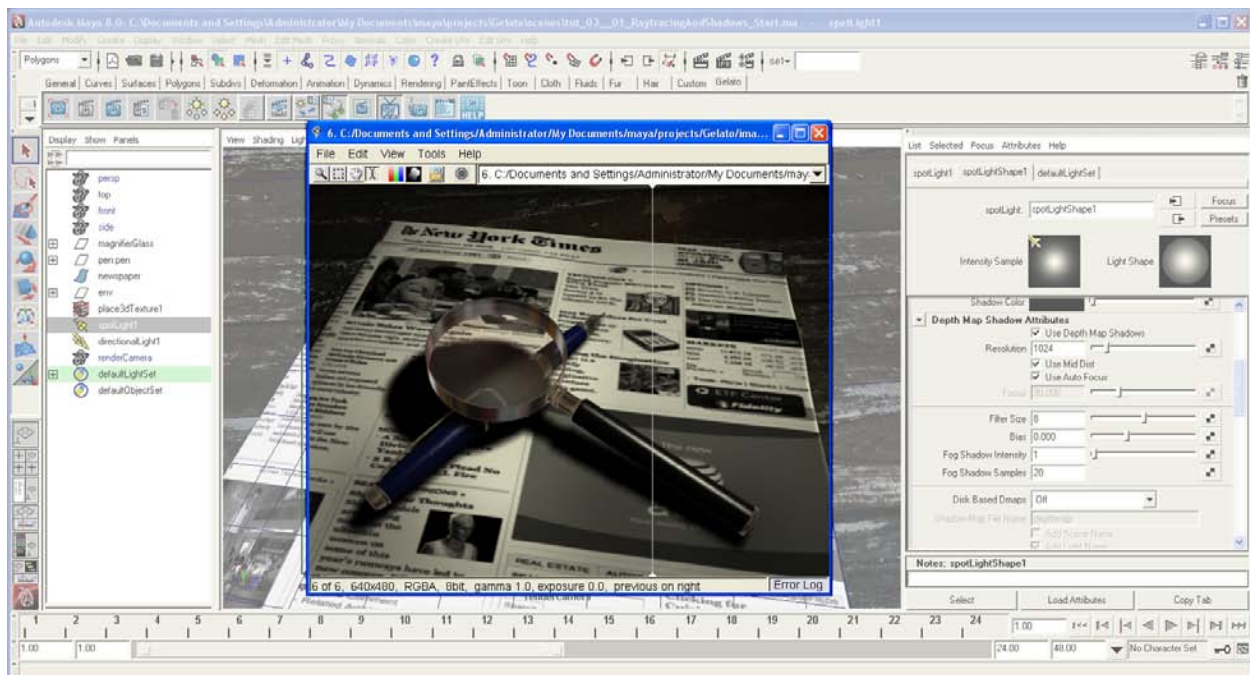
There are still some artifacts visible, but if we compare this image to the last, we can see that they are beginning to be filtered out.



- Spotlight's Attribute Editor > Raytrace Shadow Attributes.
- Enable "Use Ray Trace Shadows."
- Change "Shadow Rays" to 80.

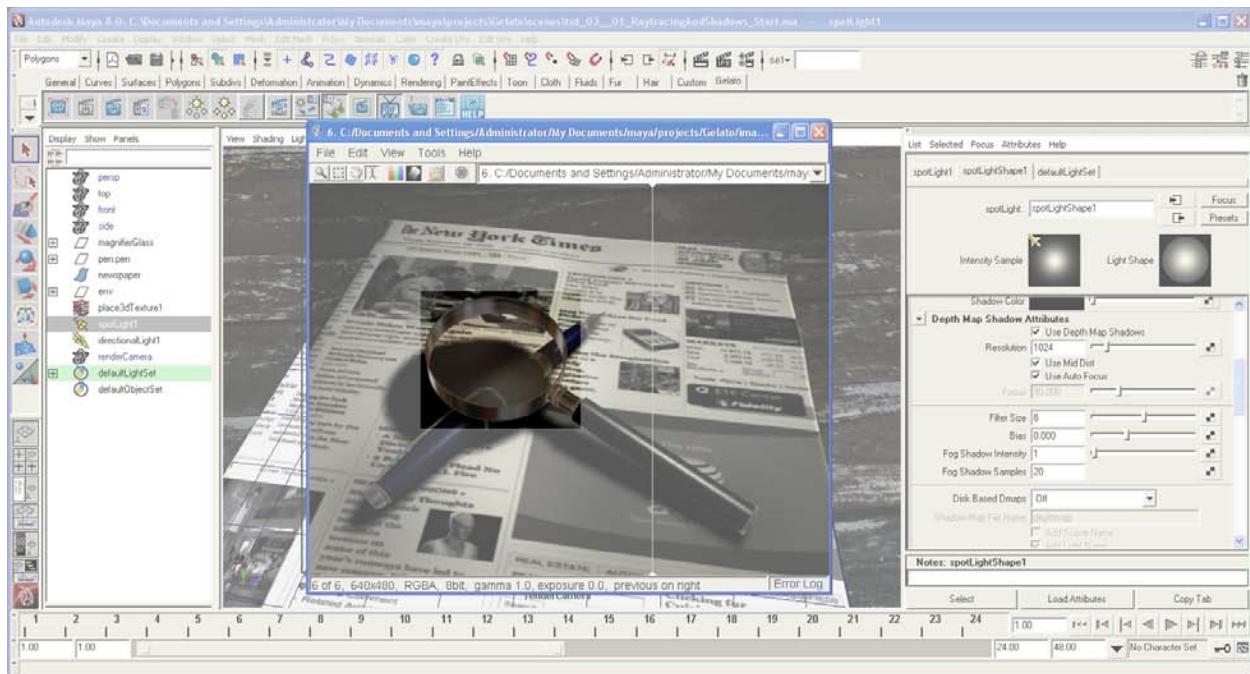


- Spotlight's Attribute Editor > Shadows > Depth Map Shadows > enable Use Depth Map Shadows.



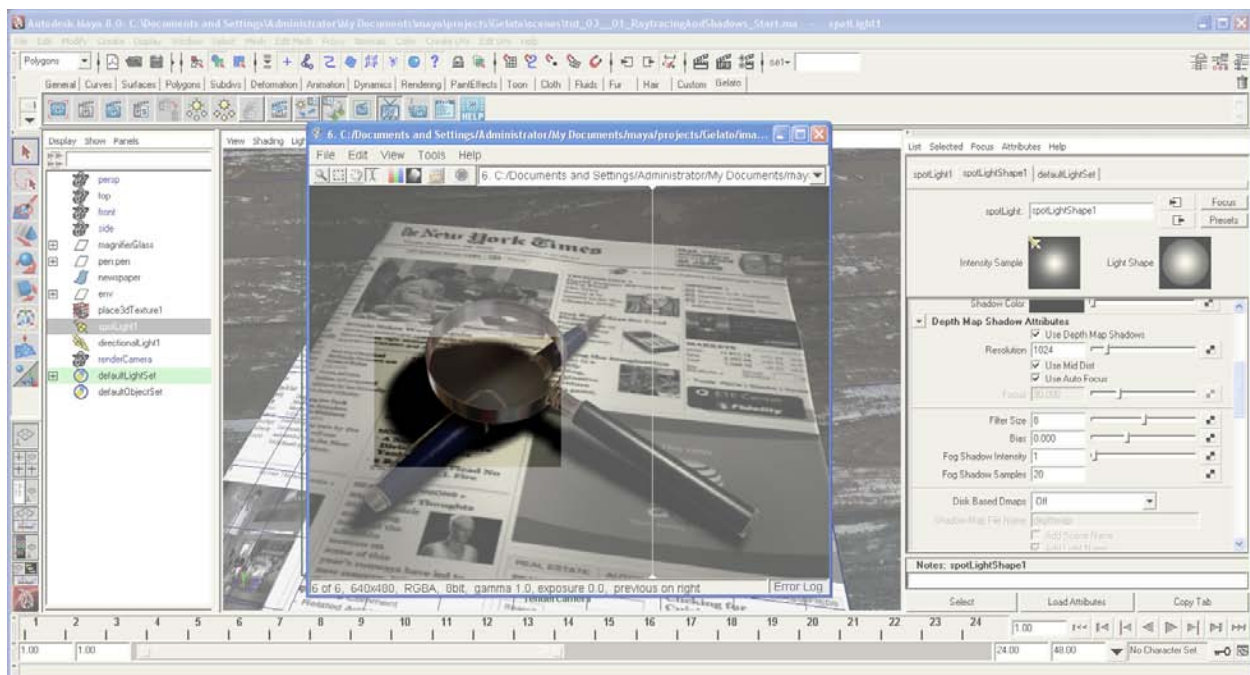
- Gelato Render.
- * If we compare this image to the last, we can see that things are looking pretty good.
- * As well, the render took much less time than if we had increased the depth map shadow resolution.

Completely removing artifacts might not be necessary for an image – each project's needs are different; if you do need very clean shadows, continue to tweak until you're satisfied.



There are a few more observations to make:

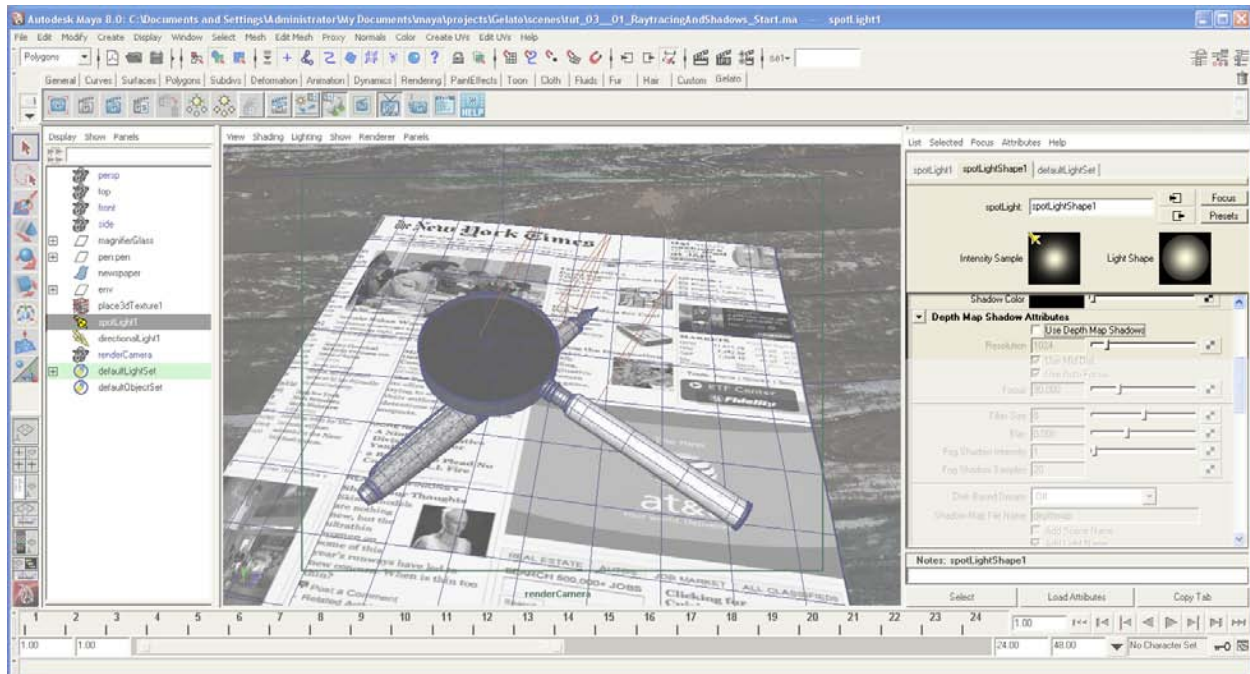
- The reflections we are getting right now are solely from an environment reflection map – there is no contribution from the surrounding objects.



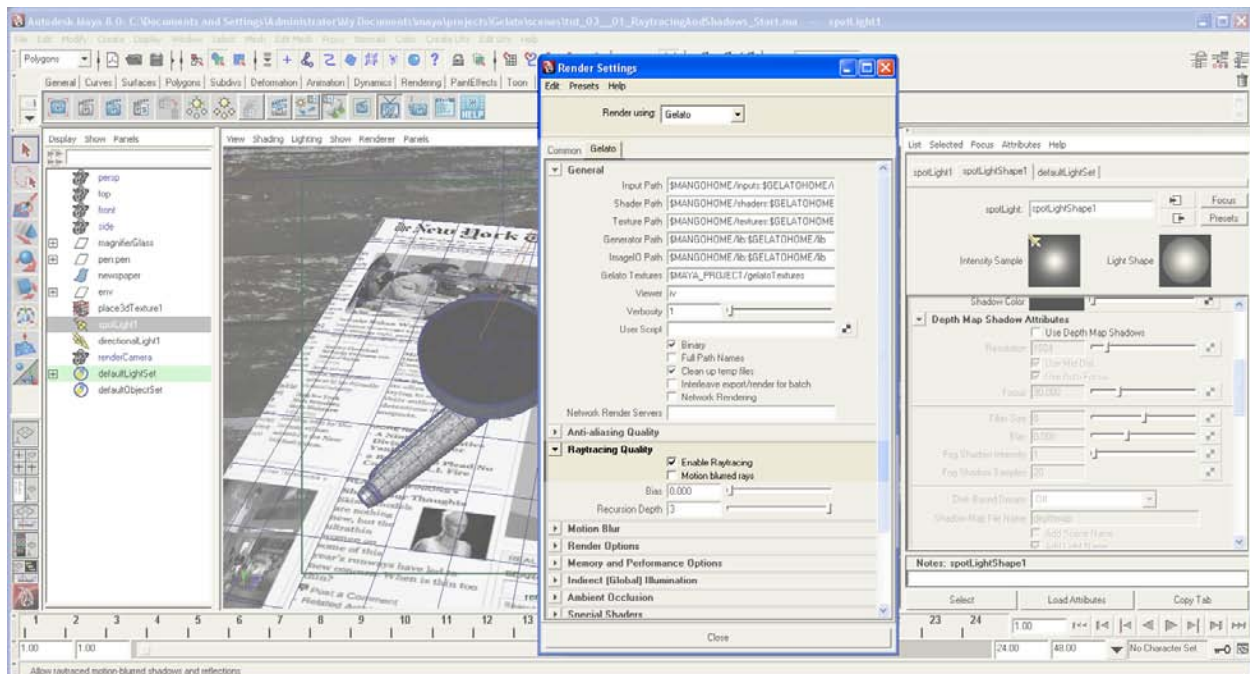
- The shadow from the magnifying glass shows the magnifying glass as a solid object – it isn't recognizing the transparent glass.

Depth Map Shadows don't recognize transparency. The shadow is created based solely on the occlusion of the geometry, not the properties of the object.

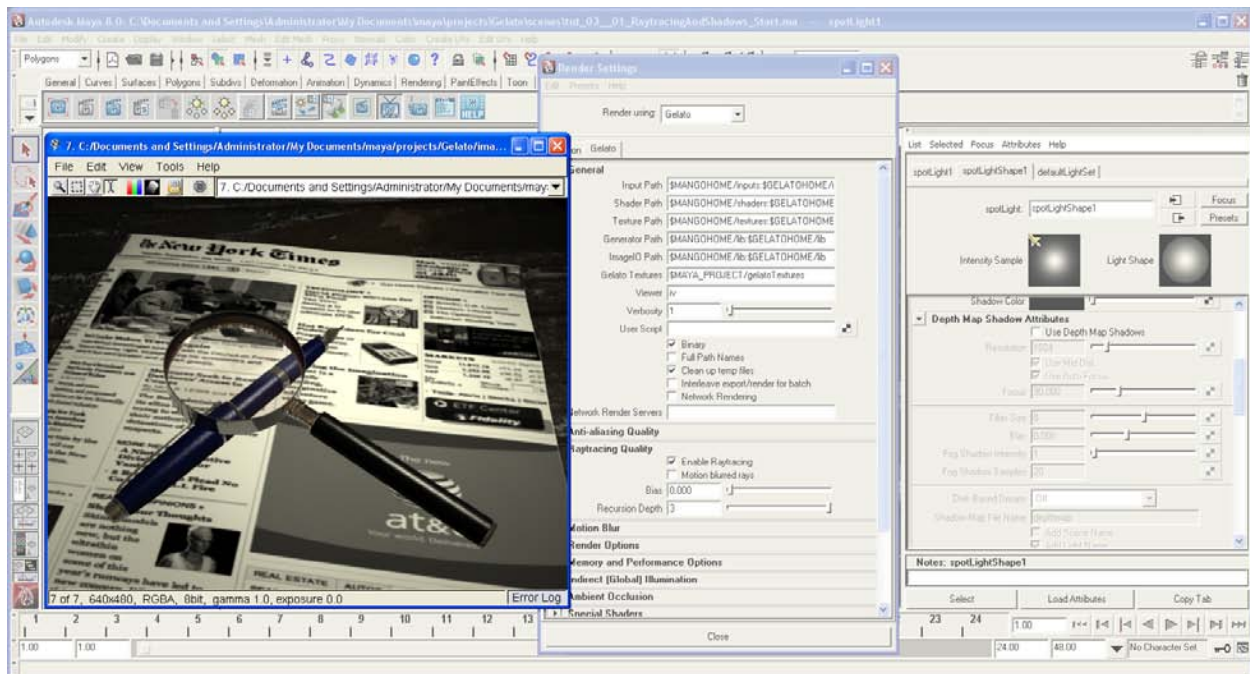
Both this and the reflection issue can be addressed with ray tracing.



- Select the spotlight once more and open its Attribute Editor.
- Shadow > Depth Map Shadow Attributes > disable Use Depth Map Shadows.

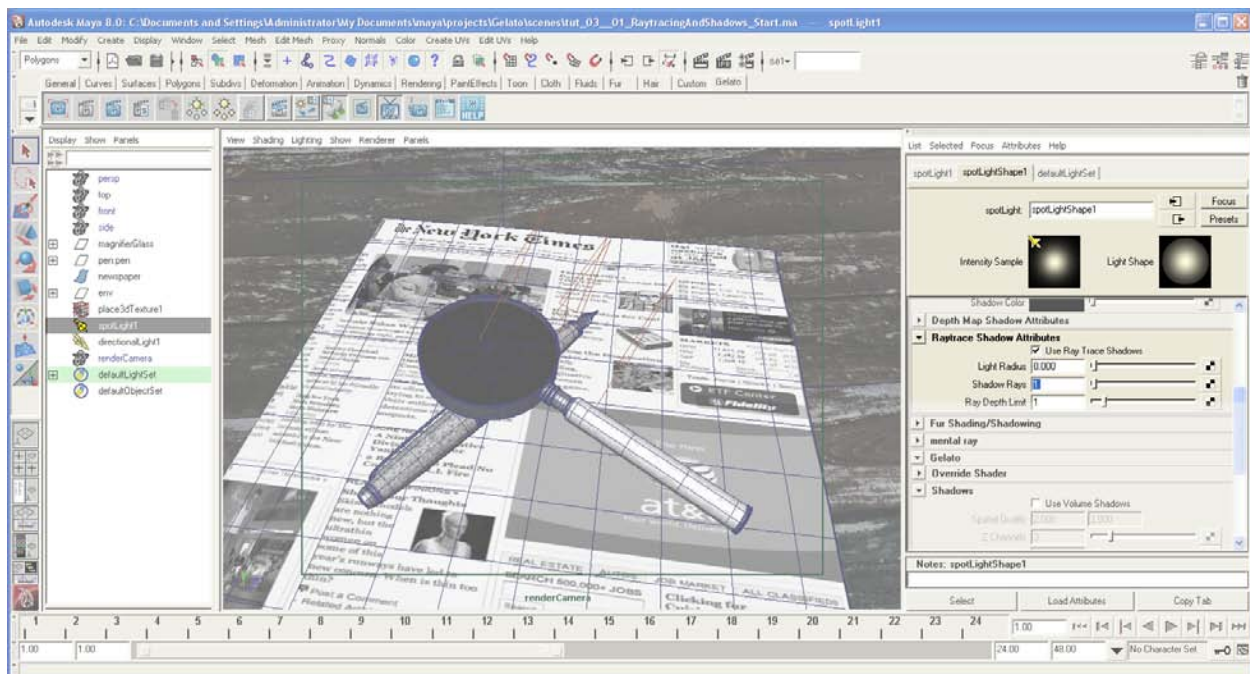


- Open the Render Settings dialog.
- Gelato tab > Raytracing Quality > enable Raytracing.

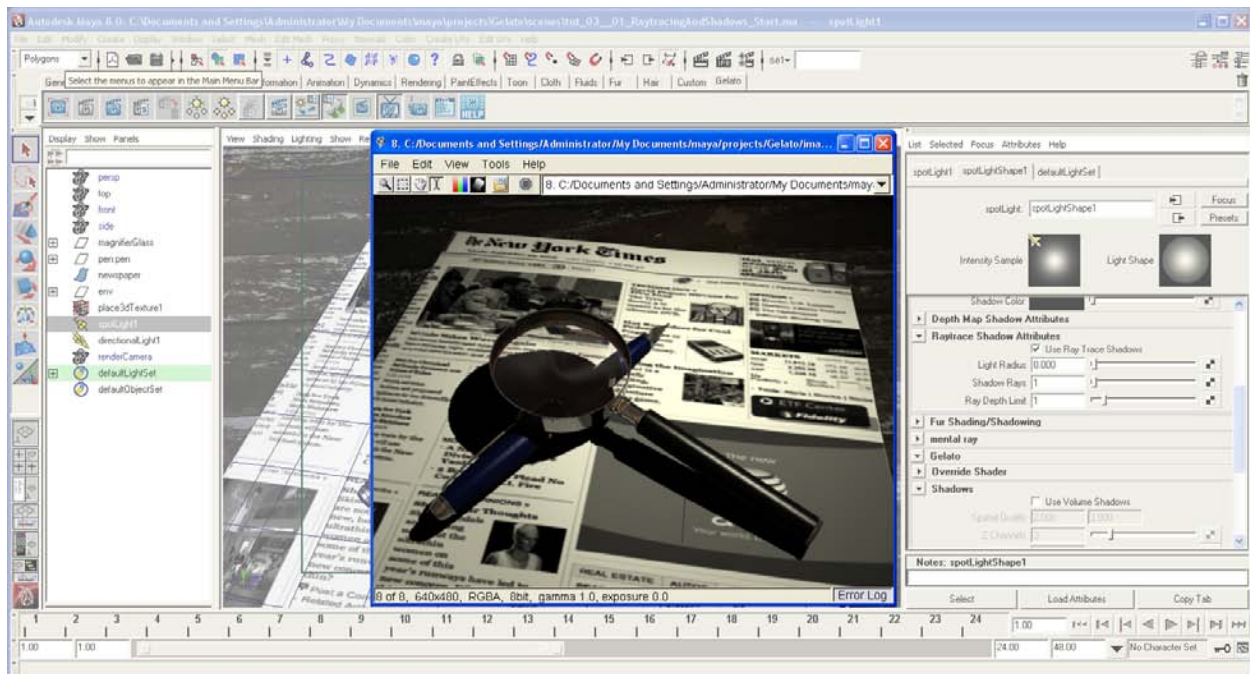


- Gelato Render.

The environment is now being reflected in the reflective objects.

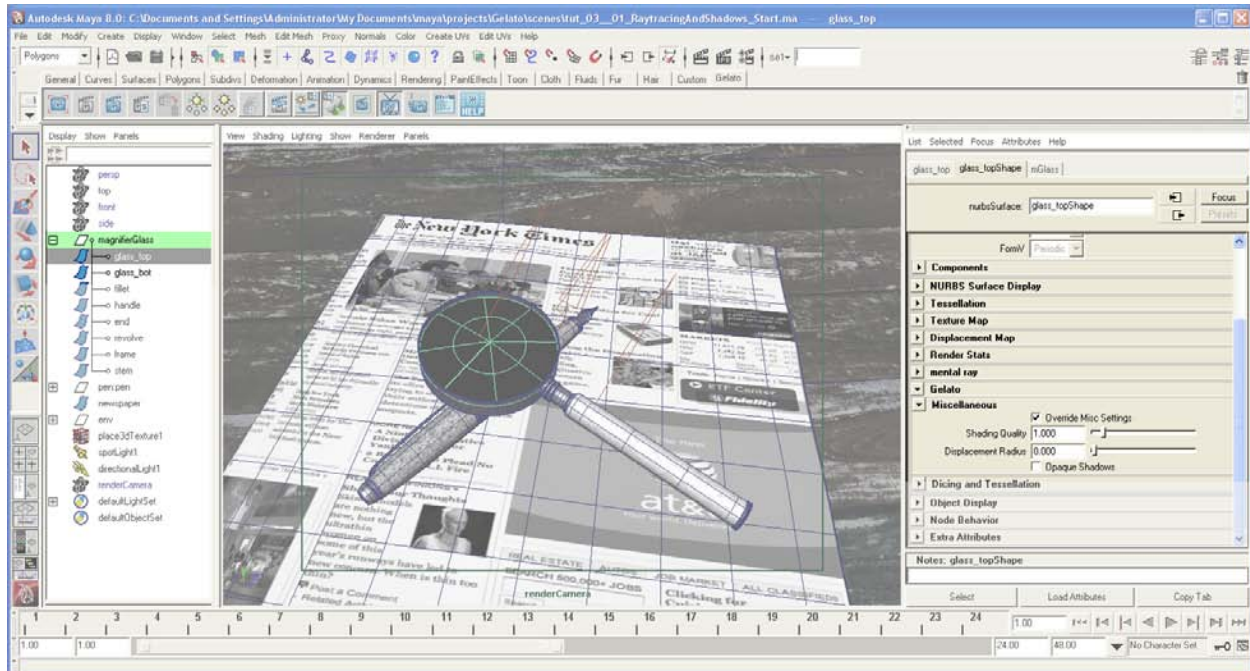


- Select the spotlight and open its Attribute Editor.
- Raytrace Shadows Attributes > enable Use Ray Trace Shadows.
- Change: Light Radius to 0.000.
Shadow Rays to 1.

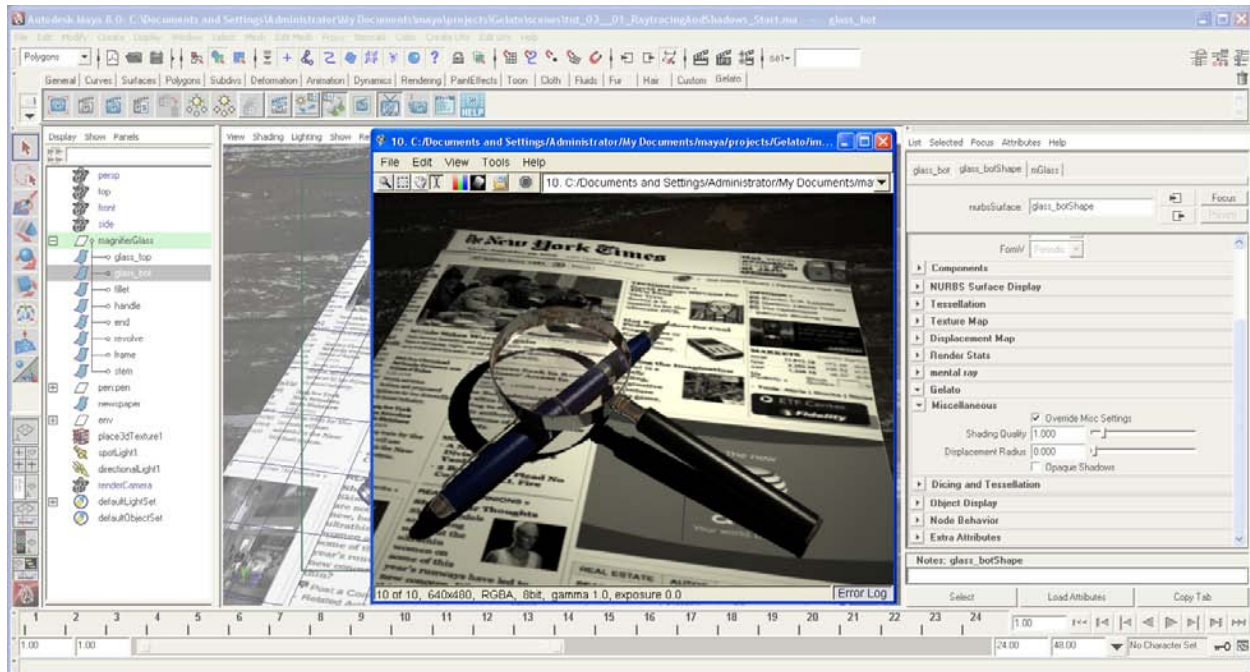


- Gelato Render.

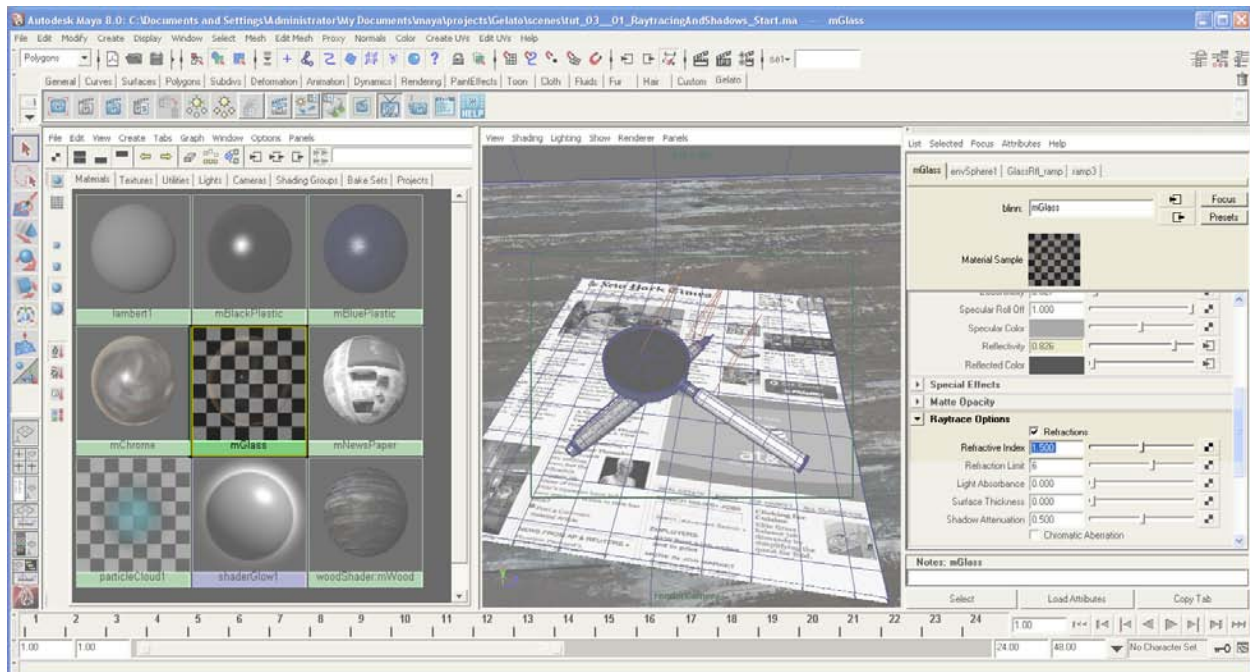
The ray-traced shadows don't look very different from the Depth Map Shadows – there is still no acknowledgement of the transparency. This is something specific to Gelato. To get the transparency, we need to go to the shape node of the glass geometry...



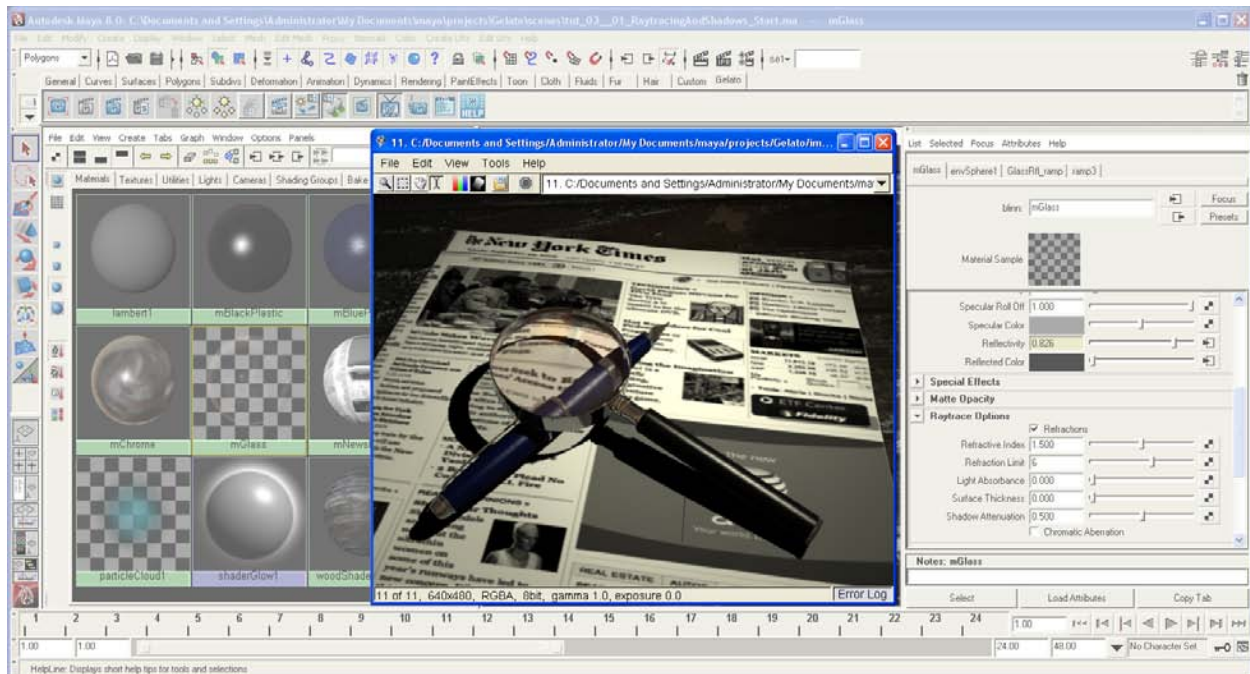
- Open up the Outliner and select “glass_top.”
- Open its Attribute Editor and scroll to Gelato > Miscellaneous.
- Enable “Override Misc Settings.”
- Turn off “Opaque Shadows.”
- Repeat these steps for “glass_bottom.”



- Gelato Render.
- * There is now transparency where the glass is – good
- * Glass should show refraction, but doesn't – not so good.

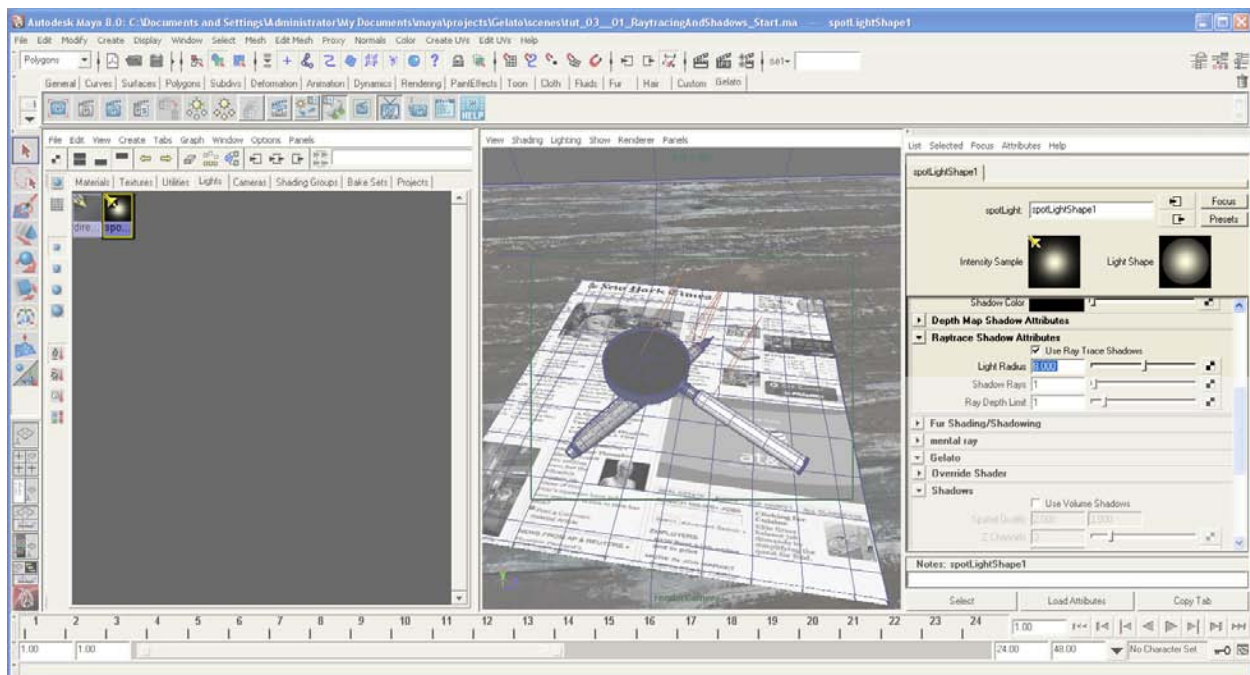


- Open the Materials tab.
- Select “mGlass” > Attribute Editor > Raytrace Options > enable Refractions.
- Change the Refractive Index to 1.500.
- Gelato Render.



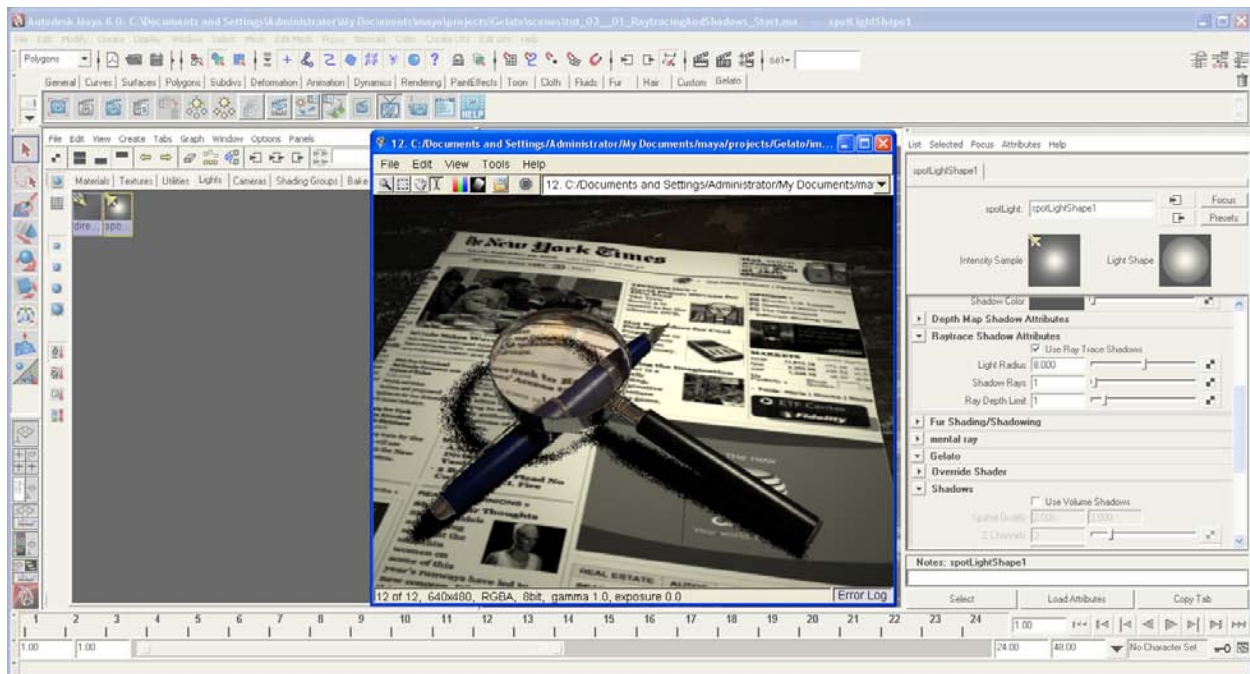
We can now see that the newspaper writing seen through the glass is distorted, so the refraction has kicked in.

Now, as we had adjusted the softness of the depth map shadow, we need to adjust the softness of this ray-traced shadow.



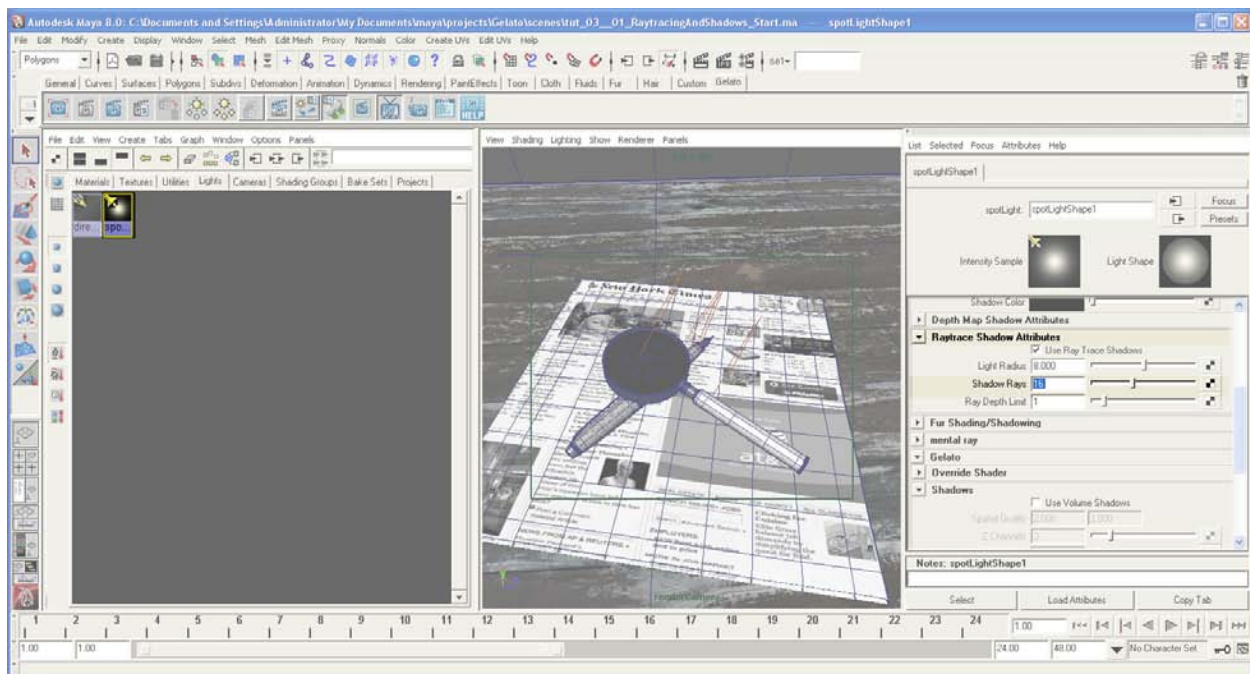
- Select the spotlight.
- Spotlight's Attribute Editor > Shadows > Raytrace Shadow Attributes.
- Change the Light Radius to 8

The light was coming from a single infinitely small point. When we changed the light radius to 8, we increased it to 8 units, giving it surface area. The shadows are now being generated from this area.



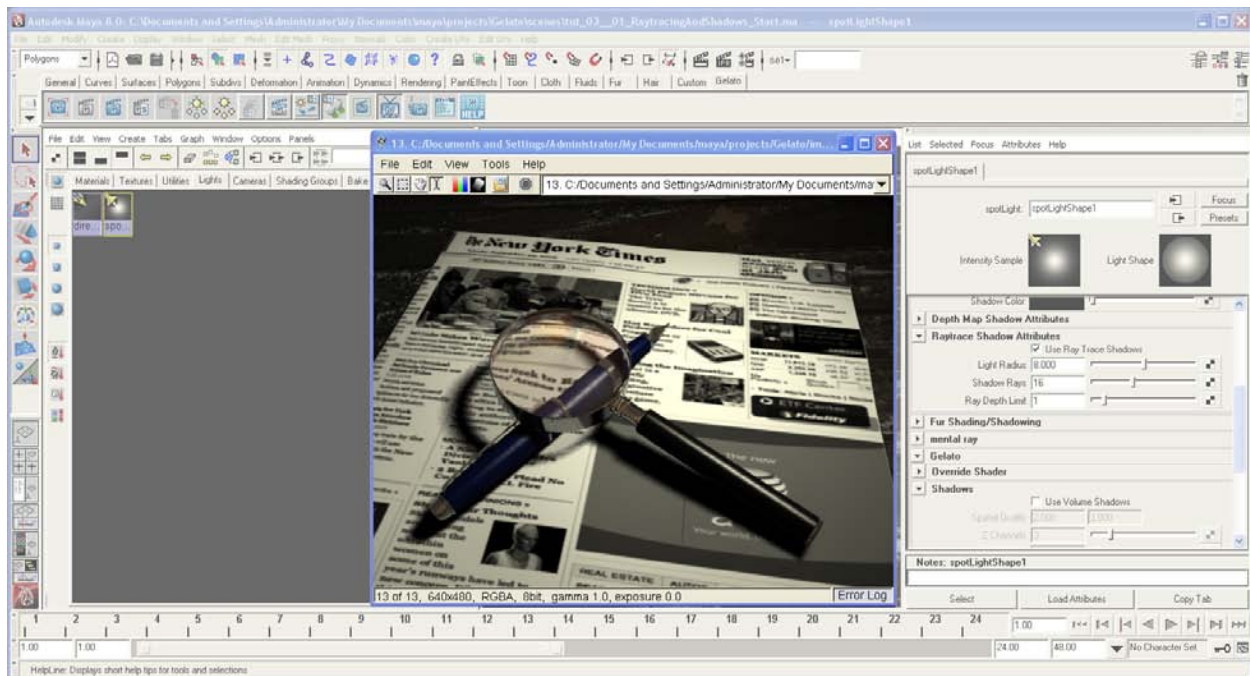
- Gelato Render.

The shadows are being spread out, but currently are not looking very attractive. Not enough samples were being taken, so the shadow is looking very noisy.

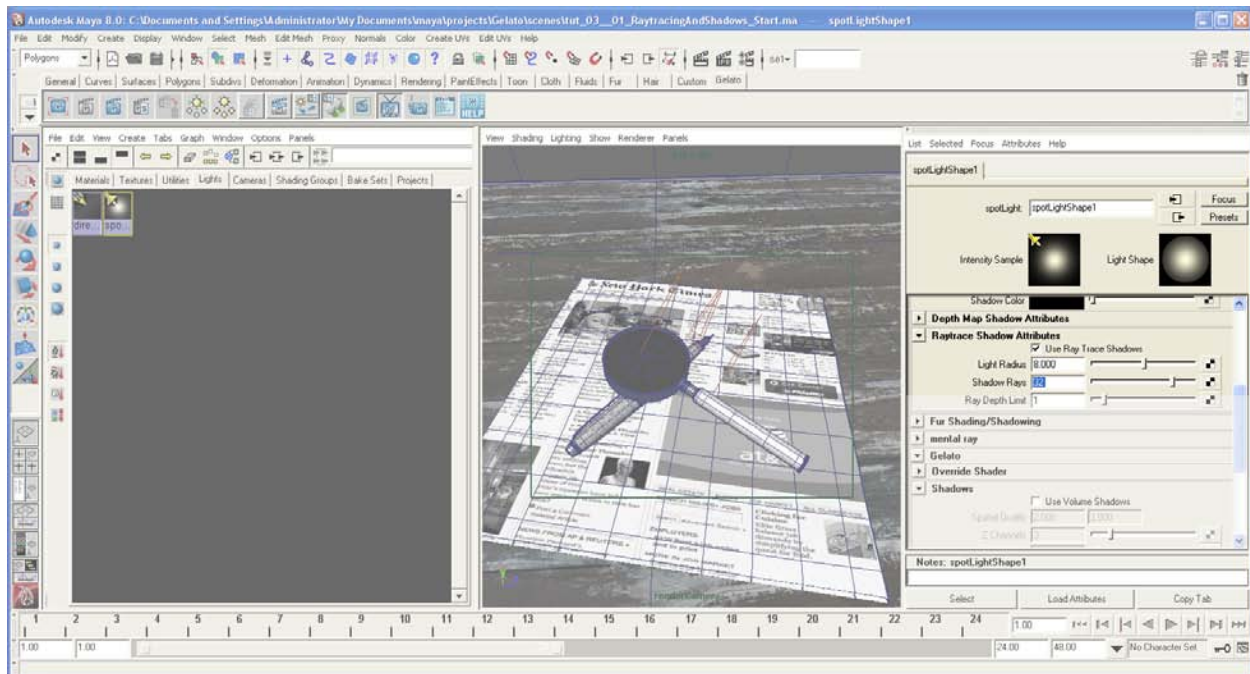


To improve this situation, we need to increase the Shadow Rays...

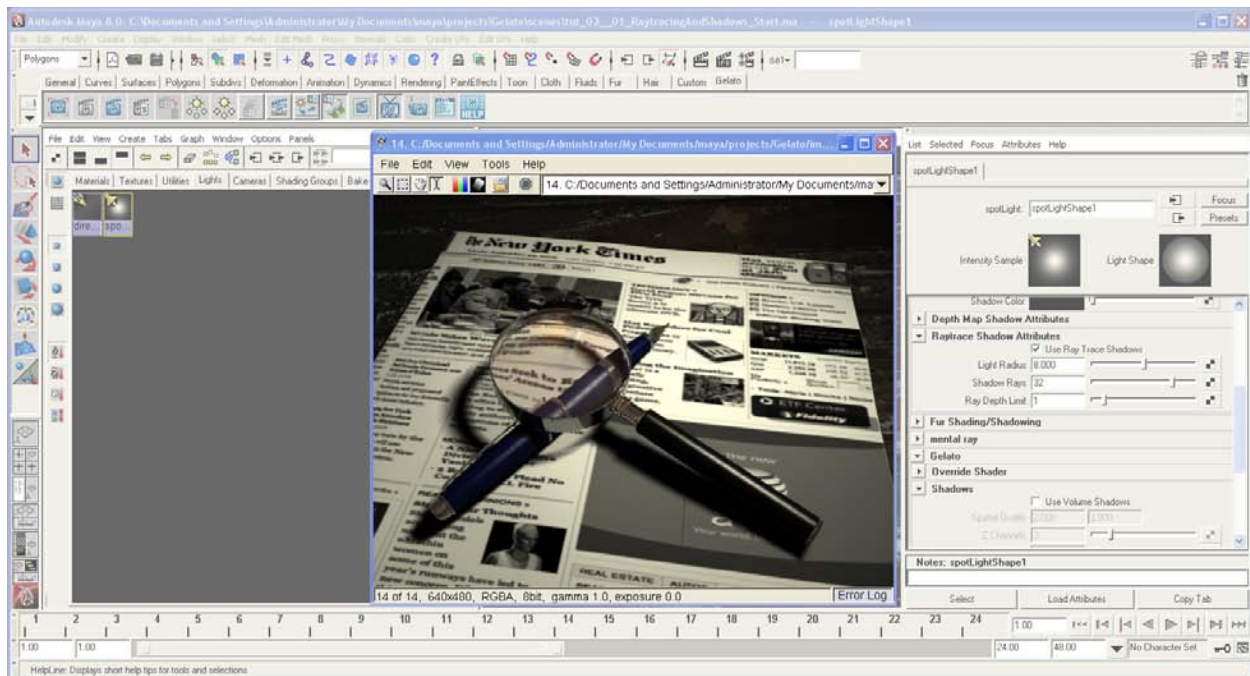
- Change "Shadow Rays" to 16.
- Gelato Render.



The shadow is now softer and the noise has been greatly reduced.

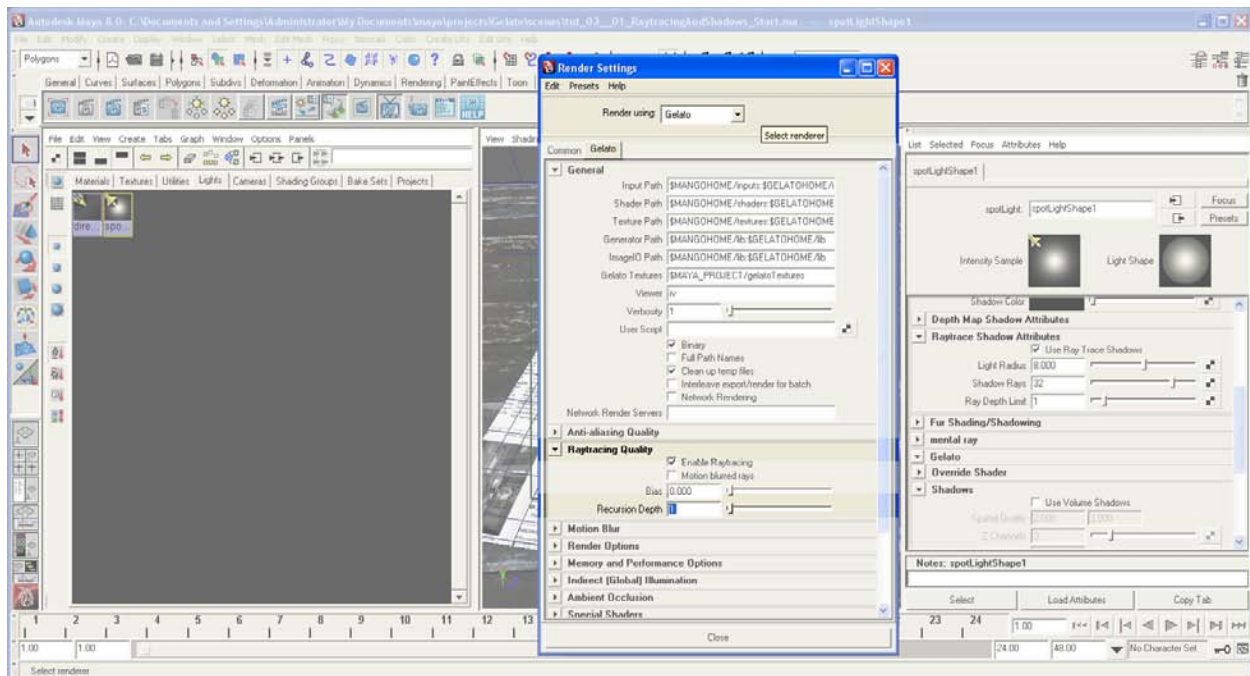


- Change the Shadow Rays to 32.
- Gelato Render.



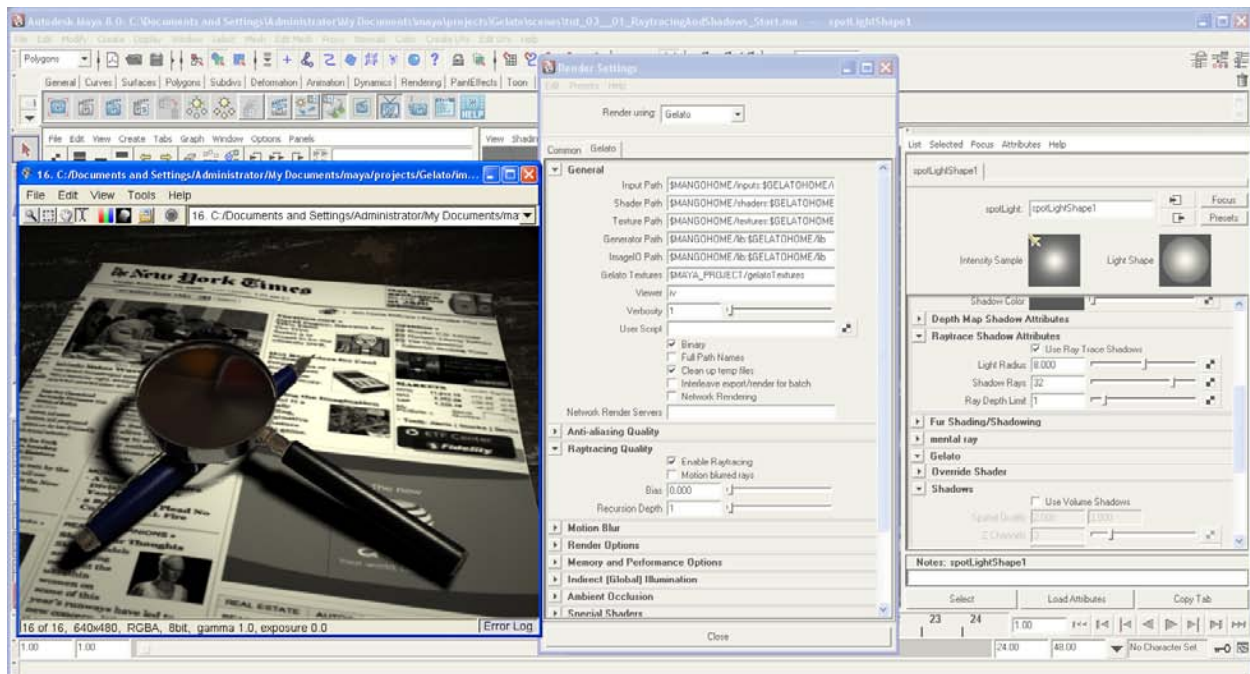
The image looks even better.

We could continue to increase the Shadow Rays setting, but this will cost us in render time. We could increase the Light Radius, but when we do this, we will also have to increase the Shadow Rays to remove sampling artifacts, which, again, will increase render time. For the purposes of this tutorial, we will leave any further tweaking to you.

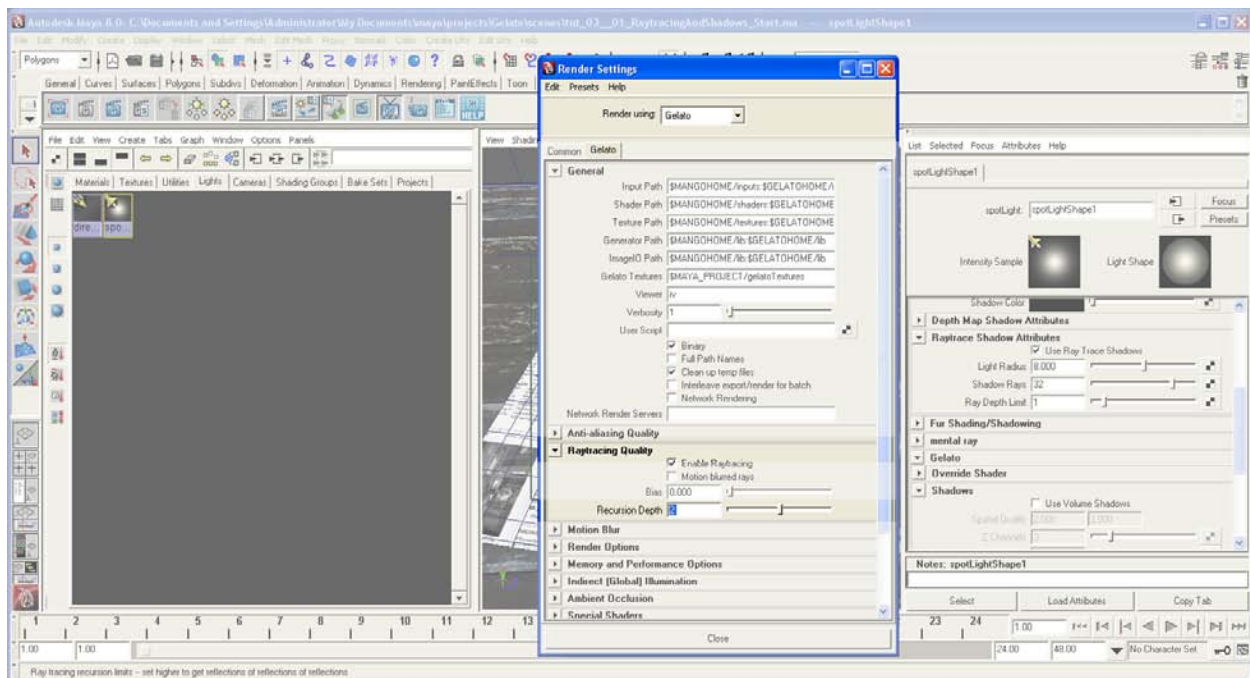


Let's now take a look at recursion depth...

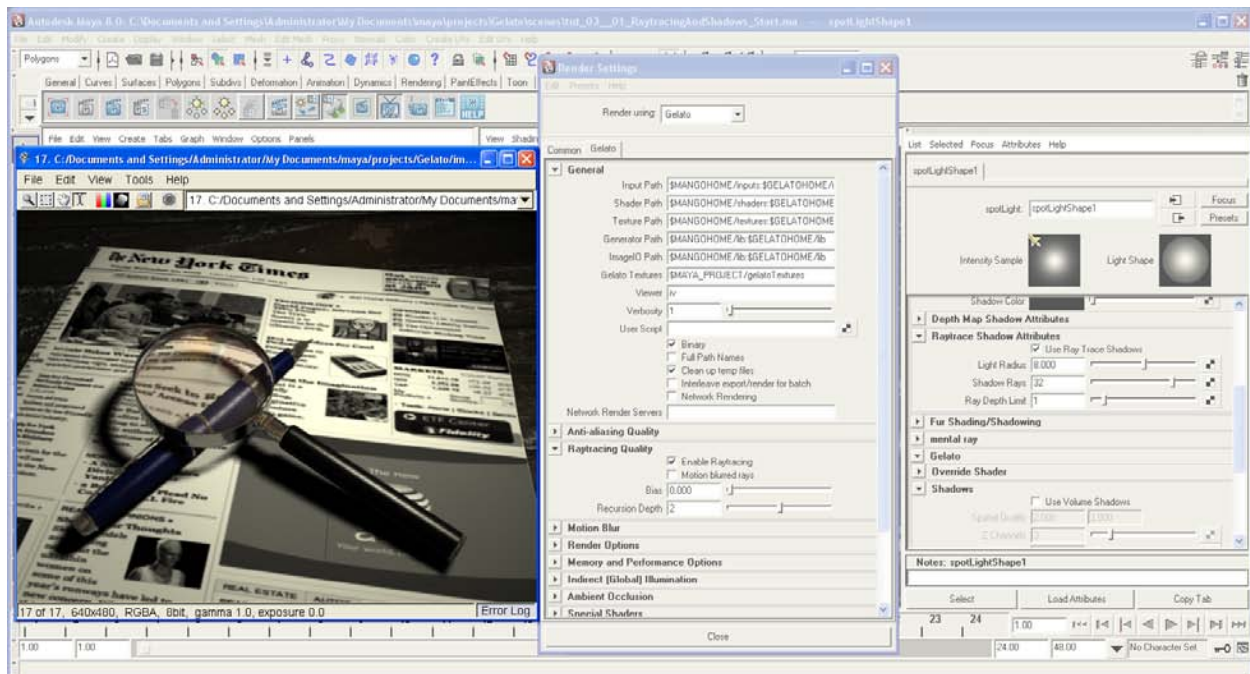
- Open the Render Settings.
- In the Ray tracing Quality section, change the Recursion Depth to 1.
- Gelato Render.



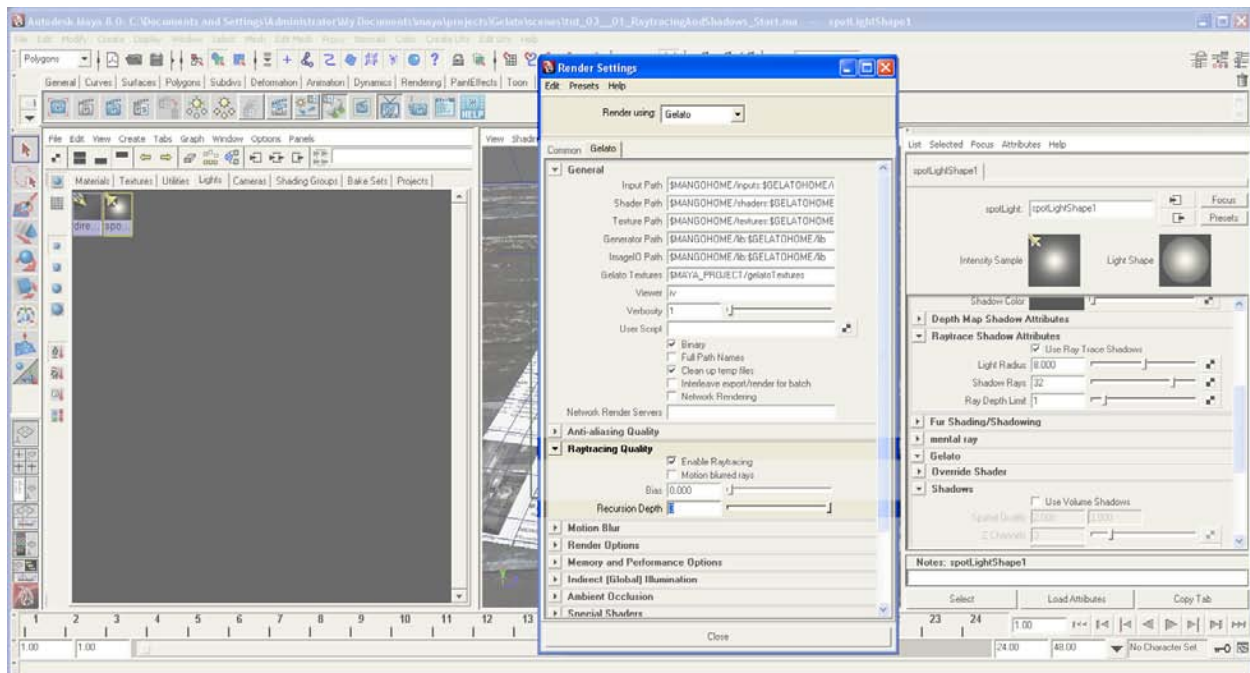
We can no longer see through the glass – we're seeing ray tracing, but we see no transparent refractions.



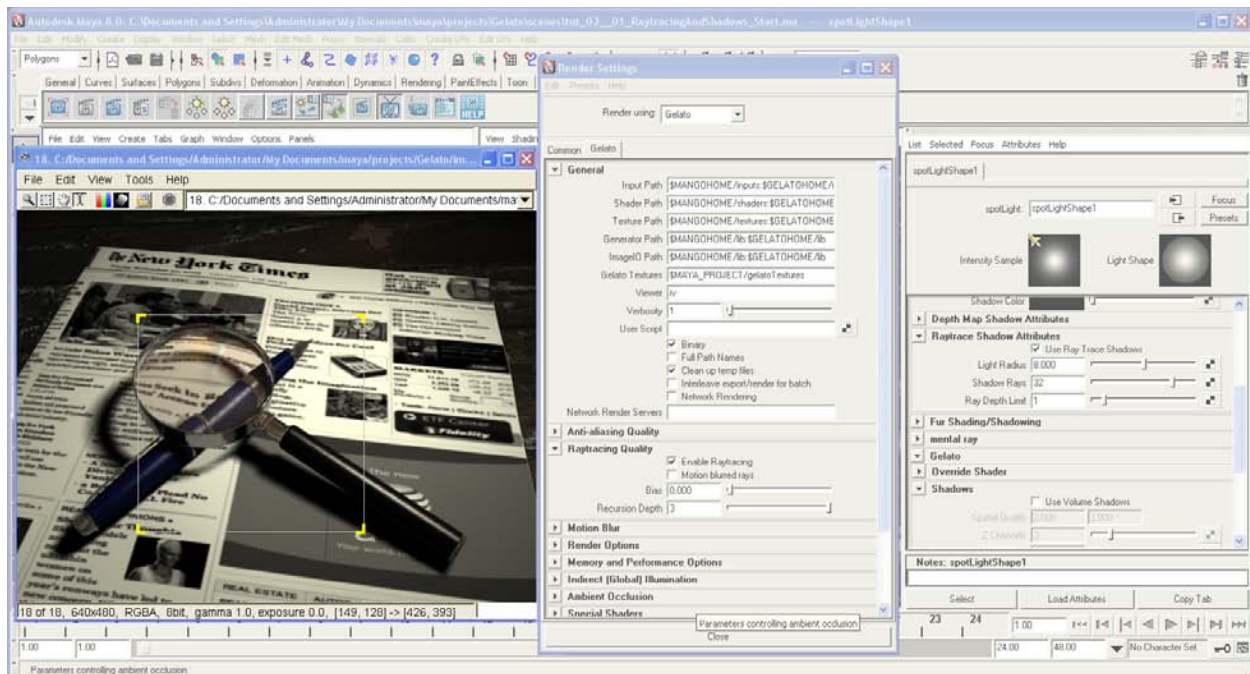
- Change the Recursion Depth to 2.
- Gelato Render.



- * There is ray tracing and we can see through the glass.
- * There are reflections.
- * There is refraction.



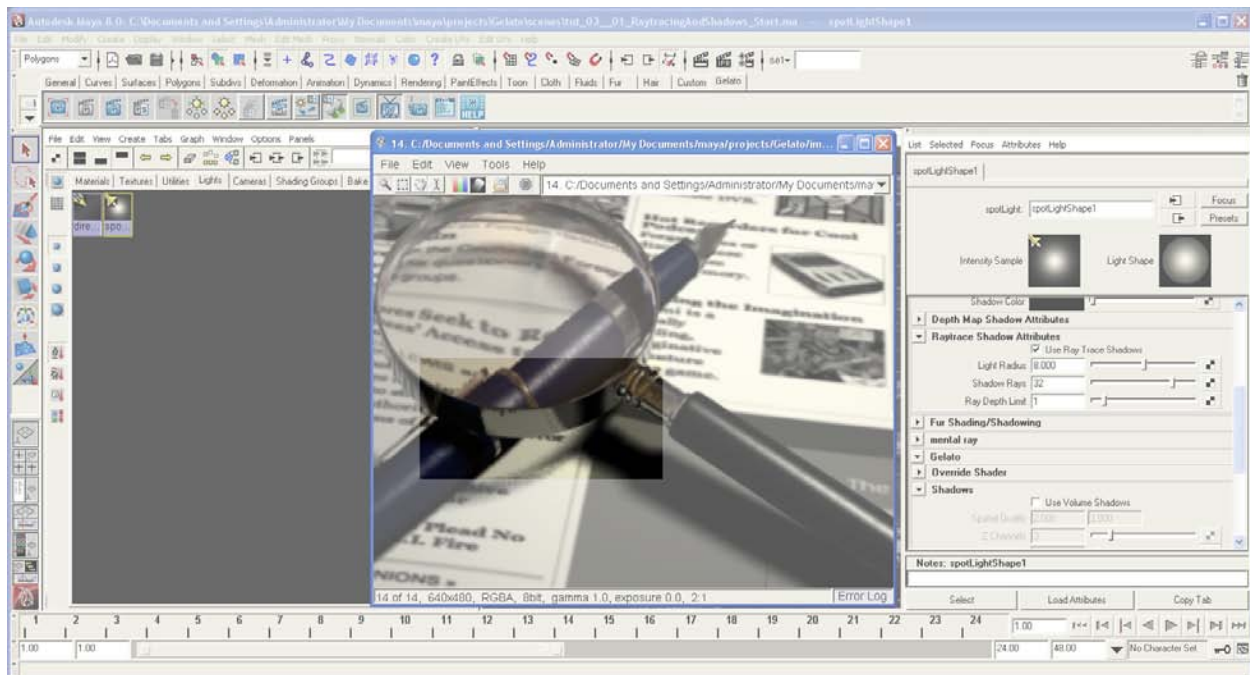
- Change the Recursion Depth to 3.
- Gelato Render.



We now have the whole kit and kaboodle - ray tracing, reflections, refractions, and shadows in the reflections.

Take a moment to use the Wipe Tool to compare the difference between the settings of 2 and 3. Take a careful look particularly along the top edge of the magnifying glass.

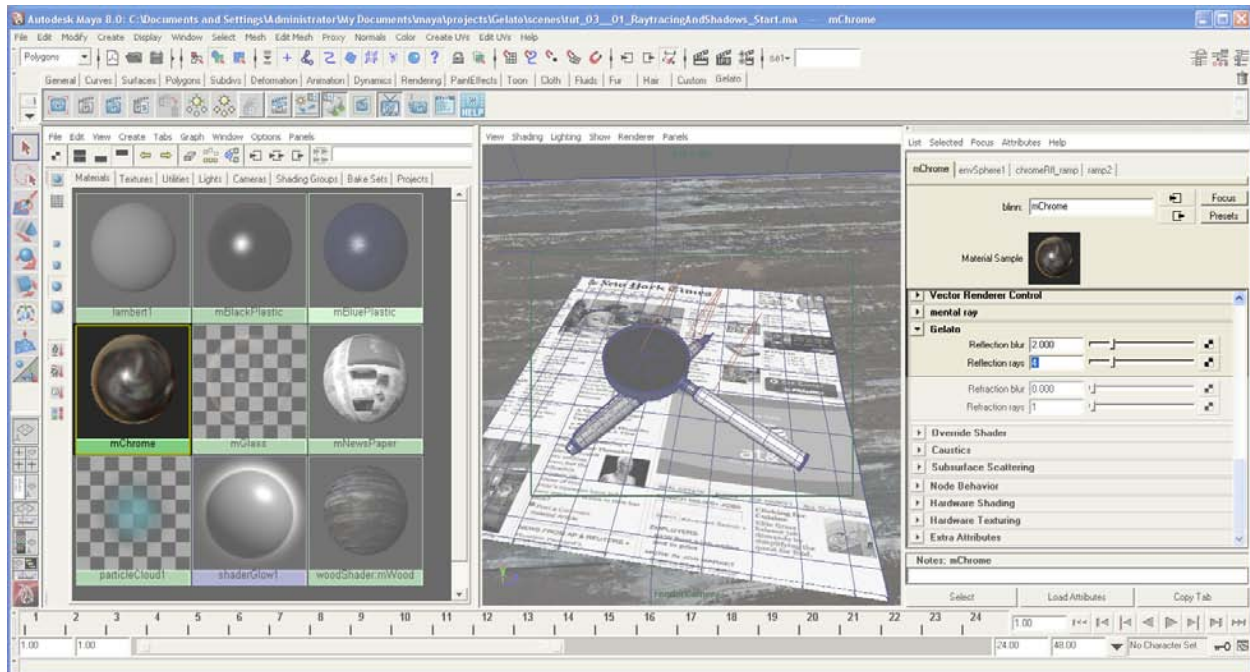
As the recursion value increases, so does the render time; for this tutorial, we don't need anything more than a value of 3.



- Zoom in on the area indicated in the above image.

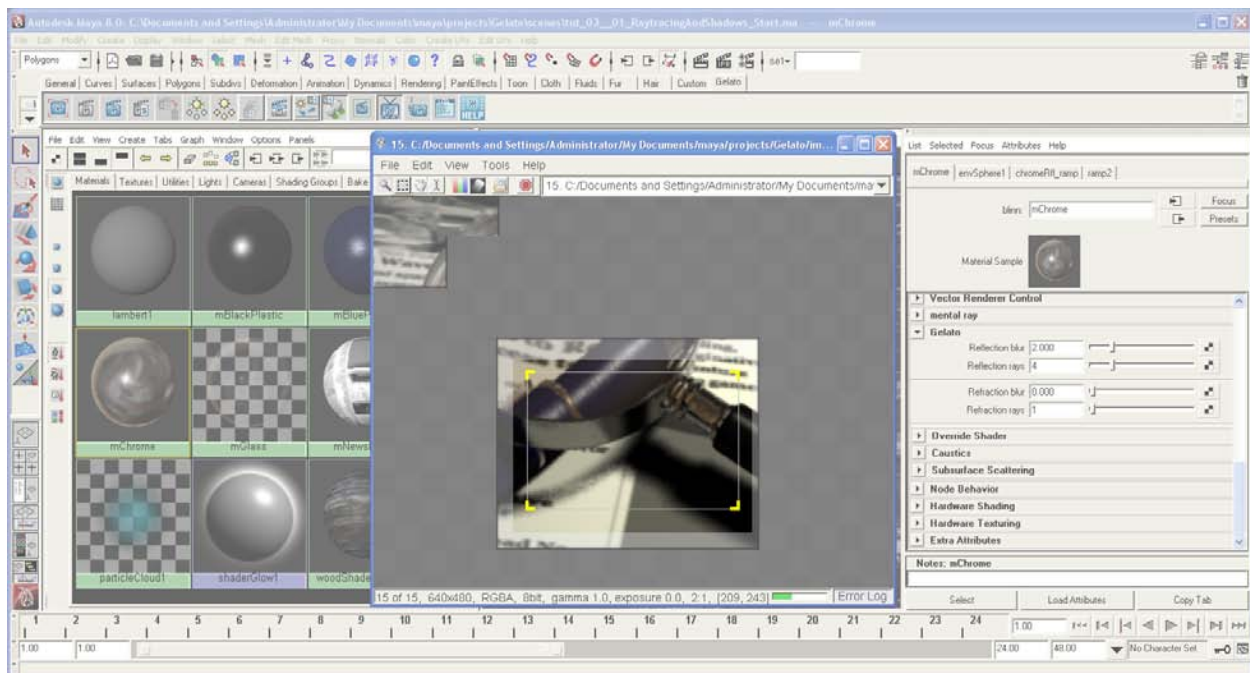
The reflections are showing jagged edges. The ray tracing is reflecting the shadow, but is not blurring it. It's calculating the reflection before it's filtering the shadow itself.

Gelato enables us to blur ray-traced reflections. Maya doesn't give us full control over this, though Mental Ray does, so you may be familiar with this type of adjustment.

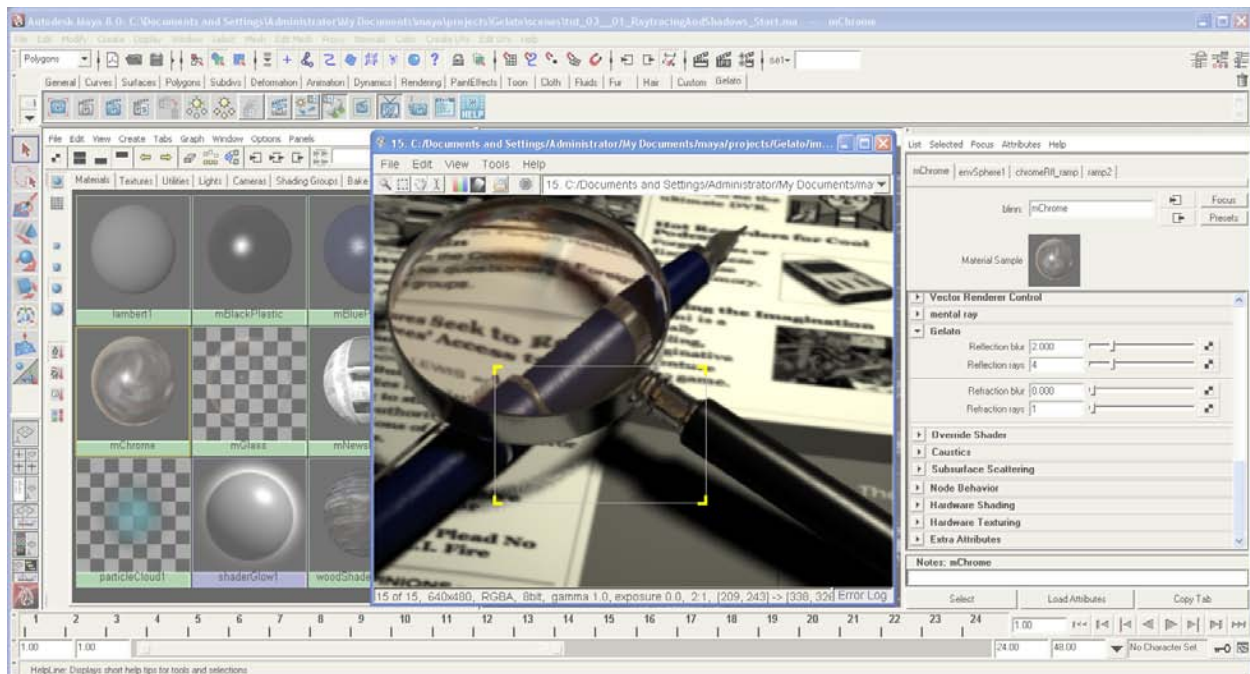


- Select the mChrome material.
- Material's Attribute Editor > Gelato > change: Reflection Blur to 2
Reflection Rays to 4

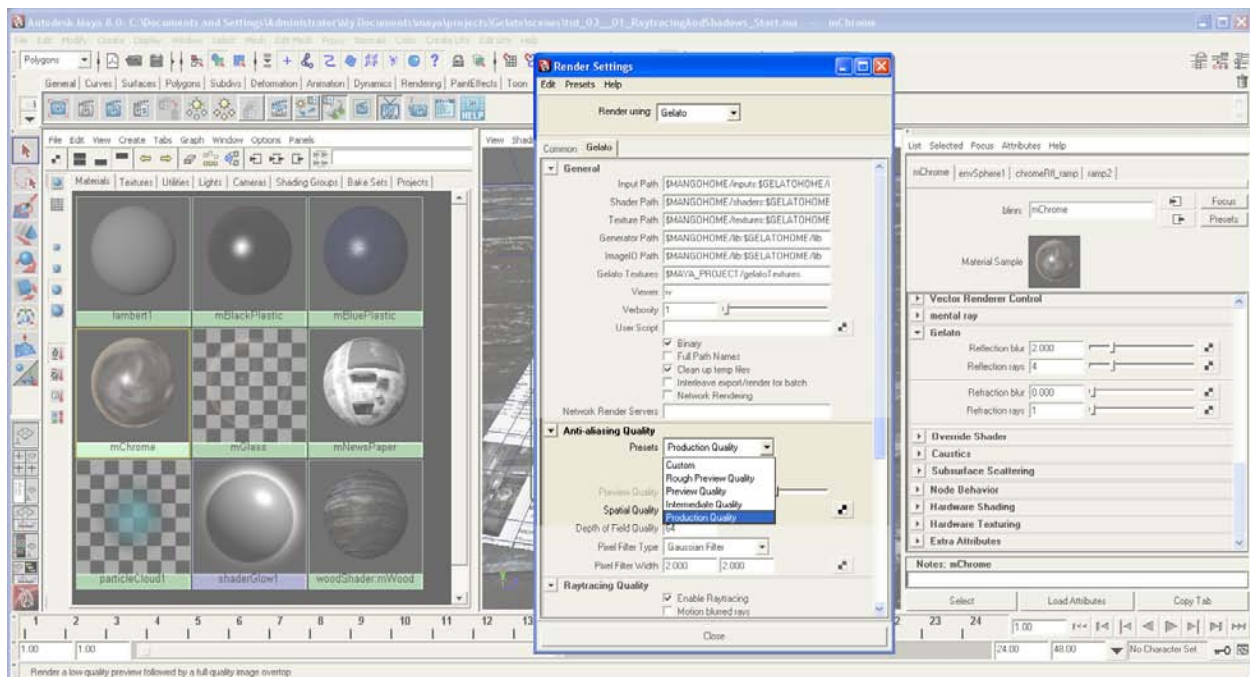
Since this is a very reflective material, we don't want to blur the reflection out too much; the Reflection Rays will help us deal with any artifacts.



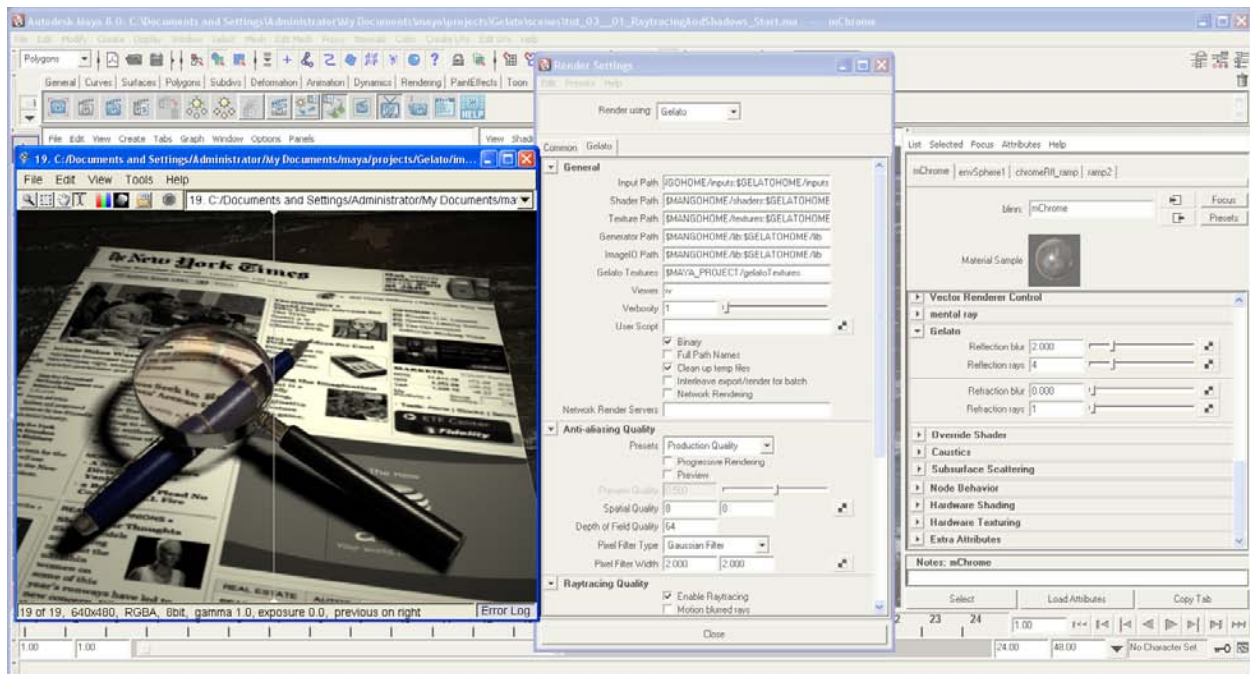
- Gelato Render.
- Because of the increased render time, drag across part of the image with the Selected Render Tool.



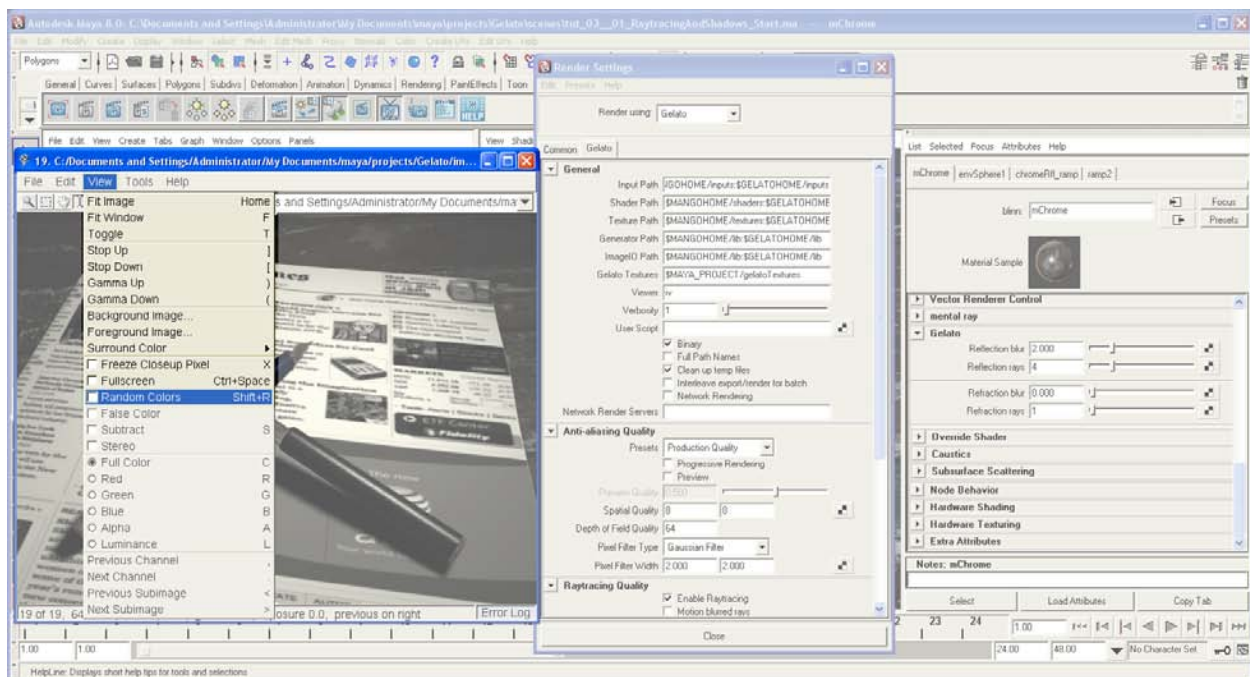
- Use the Wipe Tool to compare this image to the last.
We can see that the jagged edge is now being softened.



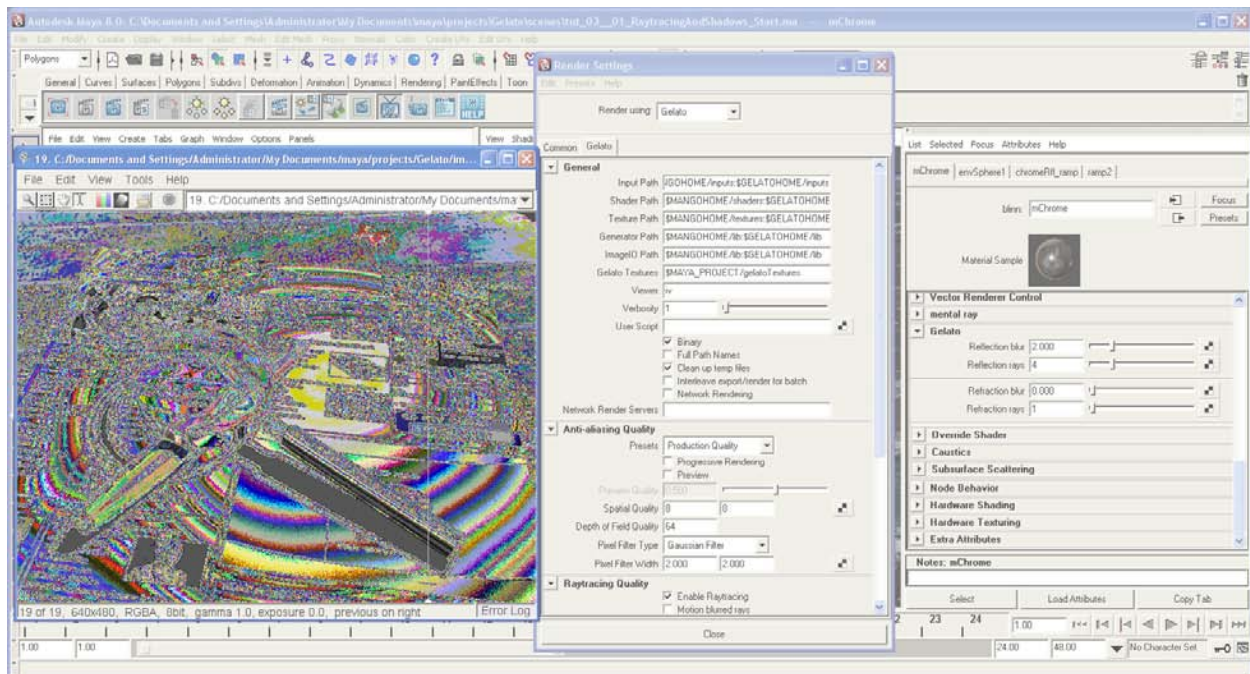
- Render Settings > Gelato > Anti-aliasing > Production Quality.
This will deal with some minor anti-aliasing artifacts still seen.



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

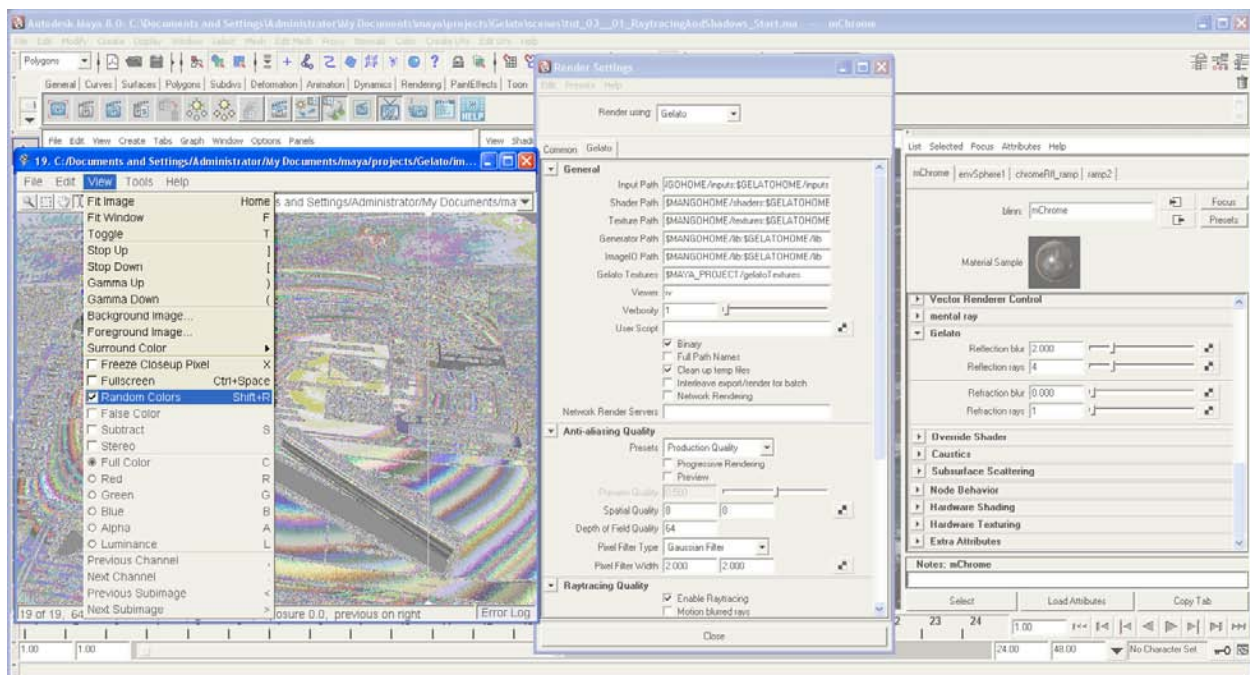


- Image Viewer > View > Random Colors.

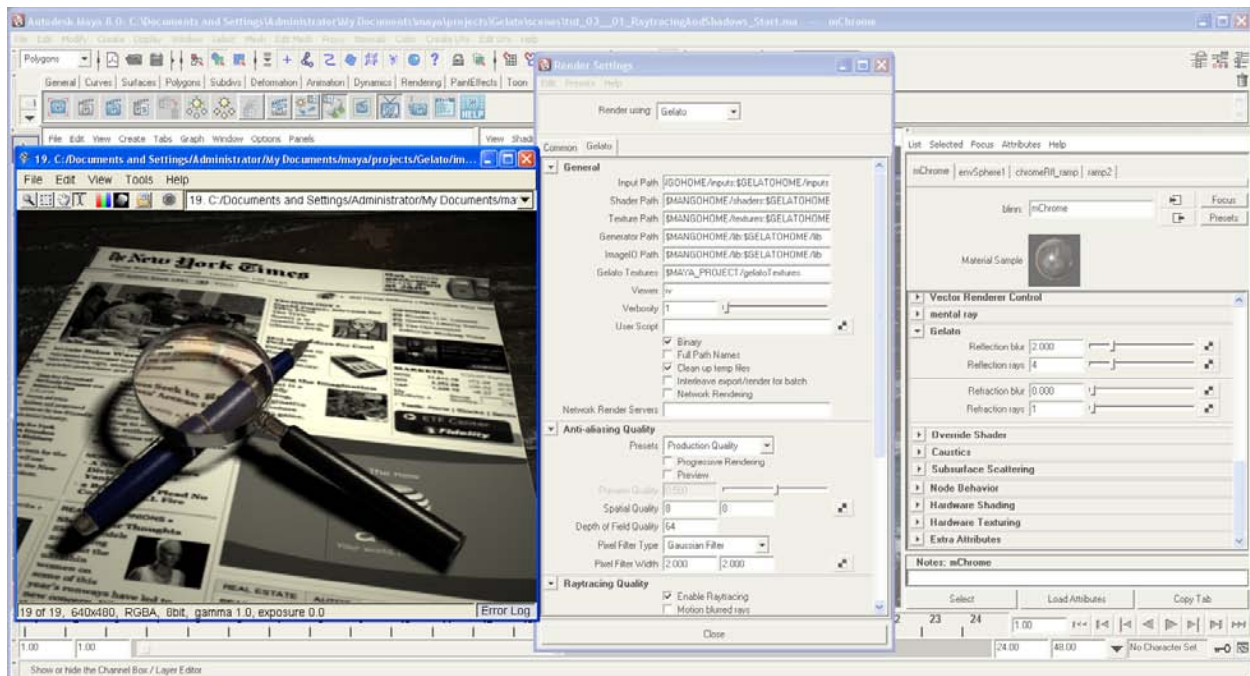


- Use the Wipe Tool to compare this image to the last.

We can see that things have been improved. Look especially along the edges of the newspaper and in the reflective areas of the magnifying glass.



- Image Viewer > View > Random Colors to turn this off.



So we have transparent shadows, reflections and refractions. We have seen how things work with both depth map shadows and ray-traced shadows.

In the next tutorial we'll take a look at ambient occlusion.