3D Lighting in Softimage

By Lucy Burton

This second installment in a series on lighting and rendering covers some of the specifics of working within the Autodesk* Softimage* package and how you can achieve various lighting effects. This time, we'll get familiar with the basic light options available, how to associate geometry with particular lights, adjusting ambience, and animating your lights as well as how you can add atmospheric effects to your scenes through the use of volumetrics. The article also covers how to master the use of caustics to achieve realistic reflection and refraction through a medium such as glass and discusses how light bounces within a scene.

Types of Lights

Sometimes a harsh, directional light is appropriate for a scene, and sometimes a more subtle approach is warranted. Therefore knowing which type of light to choose from within your arsenal, and how that particular light will function becomes critical, as different kinds of light change the softness of specular highlights and the directionality of shadows cast by objects. Autodesk* Softimage* uses several pre-designated light types and also offers various methods for creating two other types. Light options include:

This directional light mimics spotlights used in theater and film as well as various types of household lighting. It casts rays in a cone shape from a single point source.

This type of light casts light rays in all directions from a single point source, similar to a standard light bulb.

This type simulates soft directional lighting, such as that cast by a light box or bounce card typically used in professional photo shoots.

As the name suggests, these lights simulate neon tube or fluorescent lighting. Though it casts light in all directions similar to a Point Light, since the physical area the light emanates from is larger than a single point, the shadows it casts are softer.

This light simulates a directional light that is so far away the rays cast are perpendicular to each other by the time they reach the scene. The prime example of this light type is the sun or the reflected light from the moon.

Area Lights
Area light sources tend to generate more realistic lighting because of the soft shadows they create. In this instance, primitive geometry or specialized user-defined shapes create illumination across the entire surface of the object as opposed to just from one point, as is the case with a point light or spotlight. In terms of calculations, shadows are generated in much the same way as the computer creates the appearance of motion blur.

Environment Lighting
This type of lighting is generated via a sphere that has its normals inverted and is then placed over the entire scene. To this sphere geometry, either a high dynamic range (HDR) image or a Mental Ray shader preset is attached to generate light inward toward all other objects within the scene. The alternative is to add an environment shader to the entire pass and light the scene from there.

Setting Inclusive & Exclusive Light Parameters

To further optimize your scenes, it's helpful to designate specifically which lights will interact with which bits of geometry rather than simply letting all lights effect all geometry, which can increase calculation times. To do this, you must change the inclusive and exclusive parameters of particular lights, then associate those lights with particular geometric objects in the scene (see Figure 1).

Figure 1. Here, the top image shows the entire scene lit with no light associations. The image on the bottom left shows that the coffee cup has now been associated with the infinite light in the scene and an exclusive parameter applied, while the image on the bottom right shows the coffee cup with the inclusive parameter applied.

To control light selectivity within Softimage, simply select the light you wish to use within the viewport, then go to the **Render** toolbar on the left side of the interface and choose **Get >Light > Associate Light**. Next left-click on any scene objects you want to associate with that light either in the **Explorer** or in the viewport. Once you're done, simply right-click on an empty area anywhere within the viewport to end the selection mode. At that point, Softimage will create an **Associated Models Group** within that particular light's parameters, and simply by opening it's dialog box, you can change the light from the default **Inclusive** to **Exclusive** parameter or back again. To disassociate lights from objects, simply select the light, then again choose **Get >Light > Associate Light**, middle-click the objects you wish to remove from the **Associated Models Group**, then right-click on an empty area in the viewport when you're done.

Adjusting Ambient Lighting

Ambient lighting simulates indirect lighting within a scene. Ideally, this is something you want to lower to black so that the lighting you place in the scene behaves more realistically. Additionally, in complex scenes with numerous lights, reducing the default ambience helps the artist to determine better which light is creating a particular effect. This reduction is also particularly important in scenes where photon effects such as Global Illumination, Caustics, or Final Gathering are used.

To alter this setting, click **Ambience** in the **Render** toolbar on the left of the screen, and edit the ambient value using the color slider. To match the scene ambience with that of a background image, you can take that image into Adobe*

Photoshop* and look at its histogram. Doing so provides you with a lot of data on how to color match your scene with the photo.

Volumetric & Glow Effects

Volumetrics simulate atmospheric effects like fog, smoke, dust, or haze within a scene (see Figure 2). You can use glow effects to simulate things like neon lights, sunlit windows, or a glowing moon at night. Because Autodesk* Softimage* is an extremely versatile application, you can create volume effects through a number of methods, such as adding a Volumic Property to a light via the Render Toolbar, assigning the volume effect to a geometric bounding box that surrounds particular lights in your scene, or using a highly specialized preset such as the **Volumic_Cigarette_Smoke** shader. However, for purposes of this tutorial, I will discuss how to create the appearance of light shafts through a combination of light projections and pass shaders.

First, select the light you want to use to generate the atmospheric rays of light in your scene, and then open the Render Tree either from one of the viewport drop-down lists, or by pressing the 7 hot key on your keyboard. By default, your light will have a **Soft Light** node attached to your Light shader. From the **Light** menu in the left hand node list, click **Fast_Light_Effects** and drag it into the Render Tree staging viewport. Plug the node into your Light by clicking the red **Output** dot and dragging the connection to the red **Input** dot that designates the Light Shader within the **Light** node. All connections within the Render Tree are made using this nodal method.

Notice that a standard UV grid **nolcon_pic** node is plugged into the **Projector_Pic** and **Flare_Preset** ports on the **Fast_Light_Effects** node. You will need to replace this grid either by selecting an already-prepared picture from your **Clips** list or by clicking **Nodes > Texture > Image** and choosing a new image file to use. If you do the latter, once you've loaded the new image from the **Image Node (new from file)** option, simply disconnect the particular **Image Clip** node by clicking on the connector line (which will change to white at the point of disconnect) and pulling it away from the **Image Input** node. Then, click the blue **Output** dot on the **Image Clip** node and drag your connector to plug into both the **Projector_Pic** and **Flare_Preset Input** ports. Click **nolcon_pic**, and press **Delete** to clean up your workspace. You can also delete the hanging Image node, as its main purpose is to evaluate image texture orientation coordinates on geometry — not needed in the case of Image clips applied to lights.

Figure 2. In the scene above, the warm-colored rays of an early morning sunrise are simulated passing between ancient Roman columns into a dark temple interior, and the haze created by morning fog.

The next step is to enable the pass you are rendering to allow Volumetric Effects to be applied to your scene from the **Render** menu (or press 3 on your keyboard). Select the pass you want to use from the **Pass** drop-down menu on the left toolbar. Unless you've already created a lot of specialized passes like Shadow or Reflection, typically you'll just select your **Default_Pass**. Then, in the **Render** section, click **Render > Pass Options**. In the Volume section of the window, click **Add**, and then select **Fast_Volume_Effects** from the list in your DS Presets folder. You've now enabled this option in your scene.

Next, click the light you've assigned volumic effects to, and open the Render Tree. Double-click the **Fast_Light_Effects** node for the light; in the window that appears, click the **Volumic Properties** tab, and then select the **Force Volumic Shadows** check box. Doing so causes the volumic light to be occluded by the objects it interacts with and creates shadows within the shaft of light. As you can see, the **Fast_Light_Effects** node alone offers a myriad of possibilities for creating not only light shafts but star effects, glows, and shards within these effects, and of course all of these parameters can be individually animated, as well. Beyond realistic light effects within your scenes, this process also helps you create motion graphics effects for use in things like title sequences for broadcast, film, or product promotion natively within your 3D application before ever taking your scenes into a 2D compositing application for refinement or additional effects. Believe me when I say this offers hours of fun time just playing with the options.

The biggest problem with achieving realism with 3D is that, unless modified, the computer tends to create images that look too perfect — edges that are too sharp, objects that have no dirt or dust, etc. The truth is, life is fuzzy and random, subtle and dirty.

Actual light bulbs are not simply smooth, uniform glass. In addition to the light bulbs themselves often having finishes like frosting that diffuses light, the lamp casing containing the light bulb also distorts, mutes, and directs the light. Still other lights have silver reflectors that bounce light in particular ways, which you can mimic in 3D. Autodesk* Softimage* users can create translucent throw patterns by attaching textures to the light within the Render Tree. You can also use this projection technique to create shadow patterns (like those cast by Venetian blinds or leaves), as was mentioned in "Simulating Real-world Film Lighting Techniques in 3D."

If you want to apply this effect to a window in Softimage, you can use the image you plug into the light as a Projector Pic to actually create specific patterns of light that correspond to the patterns on the window itself, such as how light is diffused through a frosted finish, gradient pattern, or colored stained glass, as seen in Figure 3.

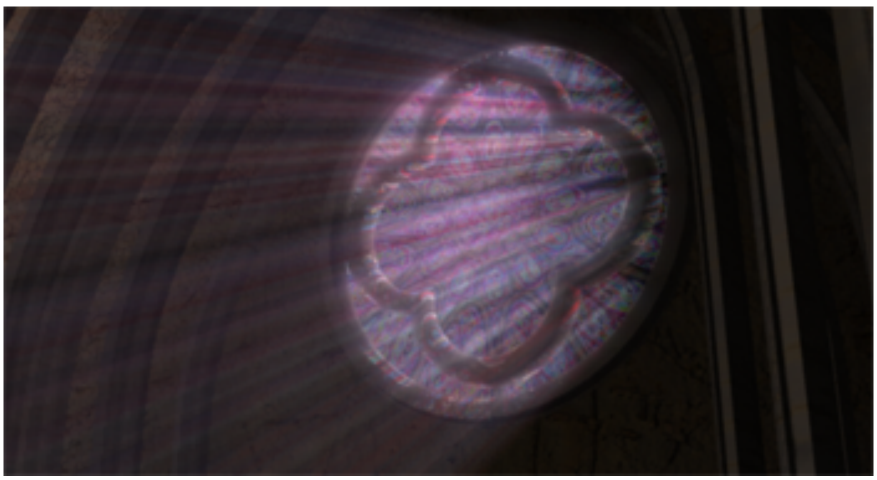

Figure 3. The image above has the pattern of a real stained glass window from a cathedral in Belgium applied to it. Notice that not only do you get the haze effect from the incense smoke and dusty air within the church, but that each light ray projects the color of the glass section it interacts with. Because the glass has caustics applied, it also throws highlights onto the diffuse rose window frame. And thanks to a glow effect applied to the window, it appears brighter, as if interacting with the sunlight outside and glowing relative to the dark interior of the building.

On the glass object you're projecting the pattern through, once you've applied the texture to the geometry, be sure to turn off Secondary Visibility from the **Explorer** menu by double-clicking the **Visibility** parameter. Doing so allows the light rays to pass through the geometry. You can also activate the object as a caustics generator from here. The texture you use will also need to have an inverted alpha channel that only allows light to pass through the colored areas.

The glow effect is a post-process, so your entire scene will render, and then the glow effect will be added at the end of the procedure. As a result, it's vital that you fine-tune your glow in the Render Region tool in your **Camera** window by pressing the Q key and dragging a box around the item you want to test view.

Caustics: Emitters & Receivers, Photon Reflection & Refraction, Min/Max Depths

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Caustics are light patterns created when specular reflections from a light source illuminate a diffuse surface such as wood, cloth, or stone. The most familiar example of this would be the light patterns that water generates onto surrounding walls when a light source such as the sun bounces off the top surface of the water or that are cast when lights at the bottom of a pool display patterns in the surrounding environment at night. You can also see this effect when light passes through a glass placed on a table, generating hot spots of luminance on the surface.

Mental Ray uses a photon map to generate these effects. This map is calculated in Autodesk* Softimage* through something called *photon tracing*, which is basically the computer mathematically generating the digital equivalent of photons (particles of light) emerging from a designated light source, and then tracing them through the three-dimensional scene. These photons move throughout the scene until they either hit a diffuse surface that absorbs the particle, are reflected or refracted through surfaces such as glass, or are reflected off of surfaces like metal. You determine how many times a photon will be allowed to bounce or bend by setting the **Photon Trace Depth** in the **Light Parameters** dialog box.

The refractive index determines how far a light ray is bent when it travels through a transparent or translucent medium as compared to how it travels through pure vacuum. So for instance, water at 68 degrees Fahrenheit (20° Celsius) has a refractive index of 1.333; therefore, light passes through water at 1/1.333 (0.75) the speed of light, as it does going through the vacuum of space. The light is also bent (refracted) as it passes through that medium. The refractive index of an item also describes how light bounces off of reflective surfaces such as metallics. Figure 4 provides an example of these effects.

Figure 4. In the image on top, you see a scene with a standard spotlight applied and no other effects. Notice how dark the glass appears. Meanwhile, the image on the bottom shows what it looks like when 300,000 caustic photons are applied in conjunction with global illumination (GI), producing secondary light bounce effects on the wood inlay table. Additionally, the darkness of the glass is reduced as the photons are allowed to reflect and refract a total of 24 combined times through the photon trace depth. This is what helps give the glass a more luminous, crystalline appearance. The nature of the materials you assign within the Render Tree is also significant: Notice that the ice is more translucent and has a different refractive value (1.309) as compared to the glass (1.65). Even the glass of the light bulb differs from that of the drinking glass, as it has a subtle frosting texture applied to it in the lower image.

To generate caustics, you must activate caustic generation from within the **Light Parameters** dialog box of that particular light source, then determine the amount of energy it emits. Autodesk* Softimage* generates 10,000 photons by default, but they are of very low quality, used mainly to get a general idea that the effect is functioning within the scene. For standard-quality caustic effects in your final render, generally speaking a minimum of 100,000 photons are required; really high-end renderings can go as high as a million. Such a high value is not recommended for individual users in most cases, though, as memory usage increases in direct proportion to how many photons the computer has to calculate within the scene. This process can rapidly devolve into render times that slow production to such a degree as no to be feasible, so it’s best to work up gradually within a scene until you achieve a sensible balance point.

To control how photons behave as they hit objects within a 3D scene, you must define the value by attaching photon material shaders to the particular objects — in other words, telling the computer that a particular object will either absorb photons (as wood does) or absorb and reflect photons (as a wood table with a high gloss finish does) or how light photons will be refracted as they pass through a glass. You set this value through the visibility options within each object's photon material shader, by choosing to make the object either receive or generate photons, or both.

To control caustic brightness, you must adjust both the caustic intensity of the light itself and the caustic **Accuracy** parameter within your **Render** settings. The **Accuracy** parameter determines how many photons the computer will calculate during rendering. The default is 100, and the higher the number, the smoother the effect. The **Radius** setting controls the maximum distance (in Softimage Units) from the light Mental Ray will calculate photon behavior.

Hard and fast rules here are difficult to come by. There is a lot of nuance involved that depends entirely upon the complexity of the particular scene, the computing power you possess, and how much time is allotted for the project. So, this is very much art and instinct as much as science.

Summary

As with any of the rules discussed in this series of articles, if the artist is attempting to achieve realism, then he or she has to operate within certain boundaries in order to achieve commonly accepted results that an audience expects. However, the fun part about 3D is that once the artist grasps the rules, intentionally breaking them can actually produce some really fantastic results that have not one thing to do with realism but are visually exciting nonetheless. And it is often this experimentation and creativity that lead to further advances within the field.

Upcoming articles will go into further detail with the complex nodal Render Tree functions in Autodesk* Softimage* as well as how to apply Final Gather and GI in combination with HDR imagery (HDRI) lighting to produce realistic reflections.

About the Author

Lucy Burton was raised in Europe and returned to the United States for college, graduating with honors from Seattle University with a degree in Drama/Political Science and obtaining Film Certification at New York University. She interned in Technical Direction at Intiman Theatre. Having worked professionally both in theater and in production on several films, she then moved into the postproduction/visual effects realm, first working on Softimage 3D Extreme at Mesmer FX. Lucy has been working with the XSI platform since its inception nearly a decade ago. After founding her own digital design studio in 2001, she went on to produce documentary videos on the humanitarian crisis in Indonesia following the tsunami and helped a nongovernmental organization that assists victims in Darfur, Afghanistan, and Uganda, among other crisis areas. She now is freelancing in and around Hollywood, California.