

## Tutorial 9 – Basic Lighting and Shading

**SHADING MATERIALS** - A material type (also referred to as a shading model) defines how a particular shading material on a surface simulates a natural reaction to light. Blinn, Phong, and Lambert are a few examples of material types available in Maya. Each of these material types provides distinct shading characteristics based on the mathematical algorithms that define them.

A specular highlight is the bright spot of light that appears on shiny objects when illuminated (for example, see image at right). Specular highlights are important in 3D computer graphics, as they provide a strong visual cue for the shape of an object and its location with respect to light sources in the scene.



### **ANISOTROPIC**

Is a material (shader) that represents surfaces with grooves, such as a CD, feathers, or fabrics like velvet or satin. The appearance of specular highlights on an Anisotropic material depends on the properties of these grooves and their orientation. The Specular shading attributes (shiny highlights) determine the direction of the grooves as well as their properties.

In contrast an isotropic material (such as Phong or Blinn) reflects specular light identically in all directions. If you spin an isotropic sphere, its specular highlight remains still.

An anisotropic material reflects specular light differently in different directions. If you spin an anisotropic sphere, its specular highlight changes, depending on the direction of the grooves.



### **PHONG**

Is a material (shader) that represents glassy or glossy surfaces (such as car moldings, telephones, bathroom fittings) with a hard specular highlight.



### **PHONG E**

Is a material (shader) that is a simpler version of the Phong material. The specular highlights on Phong E surfaces are softer than those on Phong surfaces, and Phong E surfaces render faster.



### **LAMBERT**

Creates a matte surface without specular highlights. Lambert is the default shading material.



### **BLINN**

Creates a shiny surface with specular highlights, often used to simulate metallic surfaces. It offers high-quality specular highlights useful for simulating glass and metals.

## TEXTURES

A **procedural texture** is a 2D or 3D texture calculated based on an algorithm or mathematical formula. It can be useful for creating random patterning.

A **ramp texture** is a 2D texture or color gradient in which the color or grayscale value changes across the image.

## RENDERERS

### Maya's Software Renderer

A general purpose renderer with broad capabilities. You can produce high-quality images with complex shading networks, including procedural textures and ramps. Software rendering is computed through your machine's processor.

### Maya's Hardware Renderer

A general purpose renderer that uses your machine's graphics card for computation. You can produce broadcast resolution images in less time than with software rendering, and in some cases, the quality may be good enough for final delivery.

## LIGHTING

Maya has many types of lights that simulate natural and artificial lighting.

A directional light uses parallel rays of light, as if illuminating from a very far distance, to illuminate the scene. A directional light is often used to simulate sunlight.

A spotlight emits light from a single point within a limited cone angle. You can aim a spot light in the direction you want the light to illuminate.



### Ambient Light

A pervasive background light source with no particular source location or direction.

Ambient light appears to come from everywhere at the same time, like sunlight on a hazy day. Ambient light is typically used to control the overall brightness and color of a scene. Use an ambient light to simulate a combination of direct light (for example, the sun or a lamp) and indirect light (sunlight diffused by the atmosphere, or lamp light reflected off the walls of a room).



### Spot Light

A light that shines evenly within a narrow range of directions (defined by a cone) from the light's location.

Spot lights create a beam of light that gradually becomes wider (for example, a flashlight or car headlight).



### Directional Light

In rendering, a light that shines evenly in one direction only. Its light rays are parallel to each other, as if emitted perpendicular to an infinitely large plane. Use a directional light to simulate a very distant point light source (for example, the sun).



### **Point Light**

A light that illuminates in all directions, radiating from a point in space. For example, a point light can simulate an incandescent light bulb.



### **Area Light**

A type of light source that emits light from a two-dimensional area. A larger area light has a stronger intensity.



### **Volume Light**

A major advantage of using a volume light is that you have a visual representation of the extent of the light (the space within which it is bound).

## **RAYTRACING**

In computer graphics, ray tracing is a technique for generating an image by tracing the path of light through pixels in an image plane. The technique is capable of producing a very high degree of photorealism; usually higher than that of typical scanline rendering methods, but at a greater computational cost.

## **CAUSTICS**

Caustics are the light effects and specular patterns that are cast on surfaces as a result of focused light reflecting off highly reflective surfaces or refracting through translucent surfaces. The light patterns that occur on the bottom of a swimming pool on a sunny day, or the bright areas that occur in the shadow of a glass object as light shines through it are examples of caustics.

The Caustic feature in the mental ray® for Maya® renderer simulates caustic effects in your Maya scenes. Caustics are similar to Global Illumination in that they are an indirect illumination effect.

## **GLOBAL ILLUMINATION**

Global illumination is the technique used to capture indirect illumination, the natural phenomenon where light bounces off anything in its path until it is completely absorbed.

## **PENUMBRA**

A partial shadow, as in an eclipse, between regions of complete shadow and complete illumination