
01 Reflection

Reflection as defined by Wikipedia is; “The change in direction of a [wavefront](#) at an [interface](#) between two different [media](#) so that the wavefront returns into the medium from which it originated. Common examples include the reflection of [light](#), [sound](#) and [water waves](#). The *law of reflection* says that for [specular reflection](#) the angle at which the wave is incident on the surface equals the angle at which it is reflected. [Mirrors](#) exhibit specular reflection. Reflection of light is either [specular](#) (mirror-like) or [diffuse](#) (retaining the [energy](#), but losing the image) depending on the nature of the interface.”

Unless you are a physicist the definition is probably a little confusing .

To visualise what is meant by Reflection in a simple practical sense the following diagram is offered.

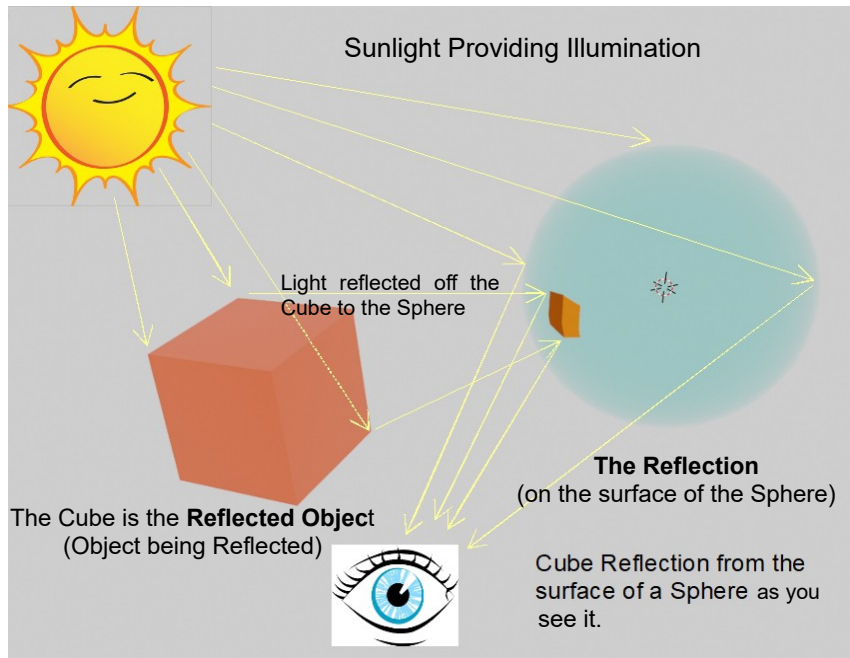


Figure 01.1

The basic concept to remember is; there are **Reflected Objects** and **Reflections**.

In Blender, Reflection can be specular or diffuse. Specular could be the reflection of Objects in the Scene on glossy or metallic or mirror surfaces (the reflection of the Cube on the surface of the Sphere). Diffuse reflections would be the subtle coloration of a matt surface caused by light bouncing off another Object.

In Blender, how Reflection is seen depends on the properties of the reflecting surface (the Sphere) and the **Viewport Shading Mode** being employed. To demonstrate reflection a smooth shiny **metallic** surface is best used.

Create a Scene as shown in Figure 01.2. Have the 3D View Editor in Right Orthographic View in **Solid Viewport Shading mode**. The Cube Object is the default Cube. The two UV Spheres are scaled up X2 and set to Smooth Shading.

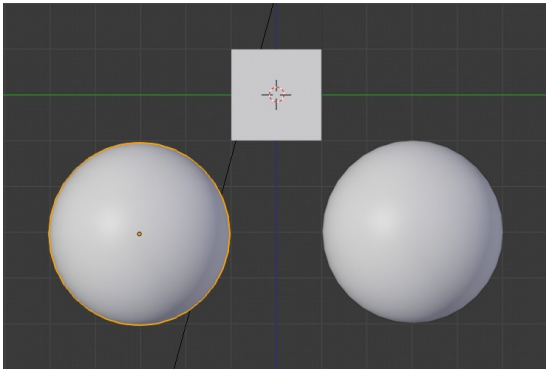


Figure 01.2

Set the Material for the Objects as follows:

Cube: Default settings except the Base Color is bright Red: R = 0.097, G = 0.010, B = 0.500.

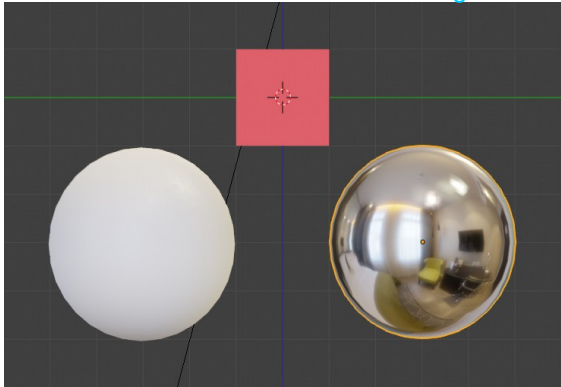
Note: The red color does not display in Solid Viewport Shading mode.

Left UV Sphere: Default Gray, RGB = 0.800
Metallic: 0.000, Roughness: 0.500

Right UV Sphere: Default Gray, RGB = 0.800
Metallic: 1.000 (Max), Roughness: 0.091 (Smooth)

It must be emphasised that Reflection occurs from any surface but is more evident on very smooth metallic or mirror-like surfaces. The above settings have the left hand UV Sphere with a non metallic (Metallic: 0.000) semi rough (Roughness: 0.500) surface. The right hand UV Sphere has a metallic (Metallic: 1.000) smooth (Roughness: 0.091) surface. Both spheres and the cube display as default gray since the **3D View Editor is in Solid Viewport Display mode**. To see how the Material settings affect the display, change the 3D View Editor to **LookDev Viewport Shading mode** (Figure 01.3).

Figure 01.3



In **LookDev** mode, Materials display on the Objects. The Cube displays red and the left hand UV Sphere is gray.

The right hand UV Sphere shows reflection but of what? **LookDev Viewport Display** is designed to preview the Scene without the expense of a rendered view. The reflection on the right hand sphere gives an indication of how the sphere will display when Objects and lighting are finalised.

The reflection is taken from a **Matcap** (Material Capture) located in the **LookDev Shading Options** (Figure 01.4) in the 3D View Editor Header (upper RHS).

Click Shading – Click the Matcap Image to select an option.

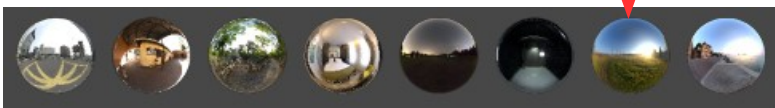
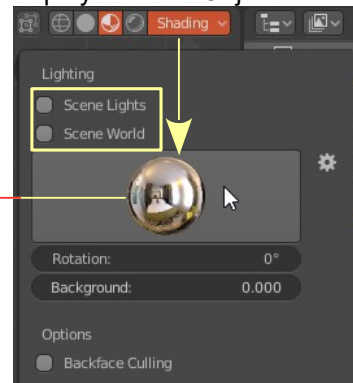


Figure 01.4



Also, in the LookDev Shading Options, see **Scene Lights** and **Scene World**.

Checking **Scene Lights** causes the light emitted from Lamps in the Scene to be reflected.

Figure 01.5

Checking **Scene World** introduces light from the **World Background**. With Scene World active the Matcap Reflection is cancelled and you have, in effect, a Rendered View (Figure 01.5).

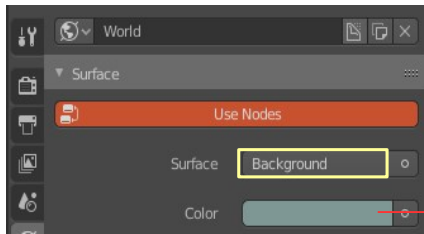
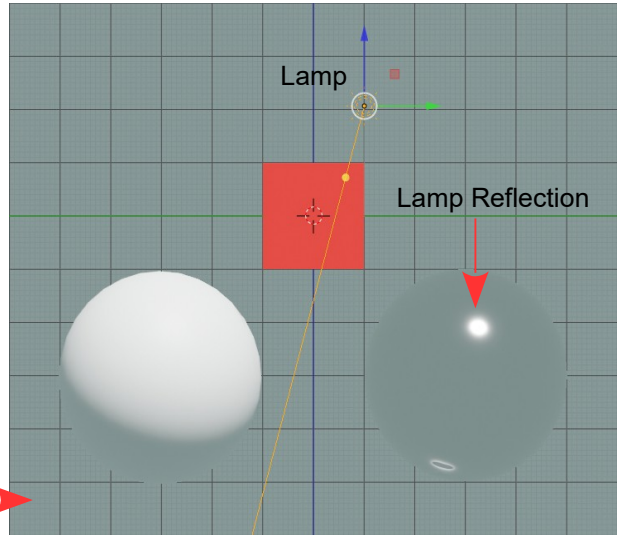


Figure 01.6



At this point you have probably noticed that although the Lamp is reflected on the surface of the right hand Sphere (Metallic Smooth) there is no reflection from the red Cube or the left hand Sphere.

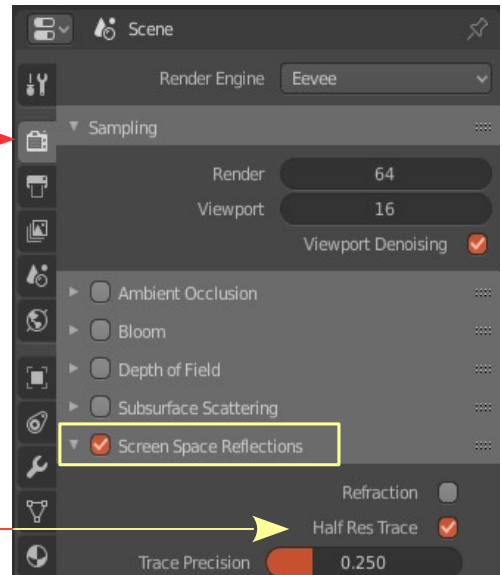
In the Properties Editor, Render buttons, check **Screen Space Reflections**.

Figure 01.7

With Screen Space reflections checked, Reflections display as seen in Figure 01.8 (over page).

By selecting the left hand UV Sphere and in the Properties Editor, Material buttons, increase the Metallic value to 1.000 and decrease the Roughness value. Reflection will display on both UV Spheres.

Note: The edges of the Reflections appear undefined. This can be improved by un-checking **Half Res Trace**.



Note: Reflection may be further improved by using **Reflective Cubemaps** and **Irradiance Volume, Light Probes** (supplements 03 and 04).

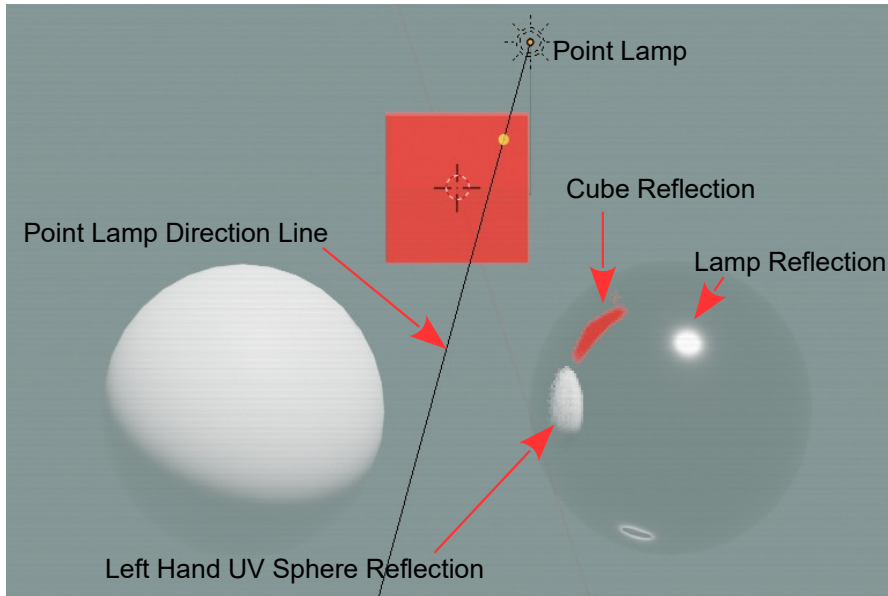


Figure 01.8

Figure 01.8 shows light bouncing off the red Cube and the left hand UV Sphere reflected on the surface of the right hand UV Sphere.

Note: The line indicating the direction of the Point Lamp does not point towards the Lamp Reflection on the surface of the right hand Sphere. By rotating the Point Lamp you will see all the reflections in the Sphere change position, as will the shadow on the lower side of the left hand Sphere (Figure 01.9).

Figure 01.9

