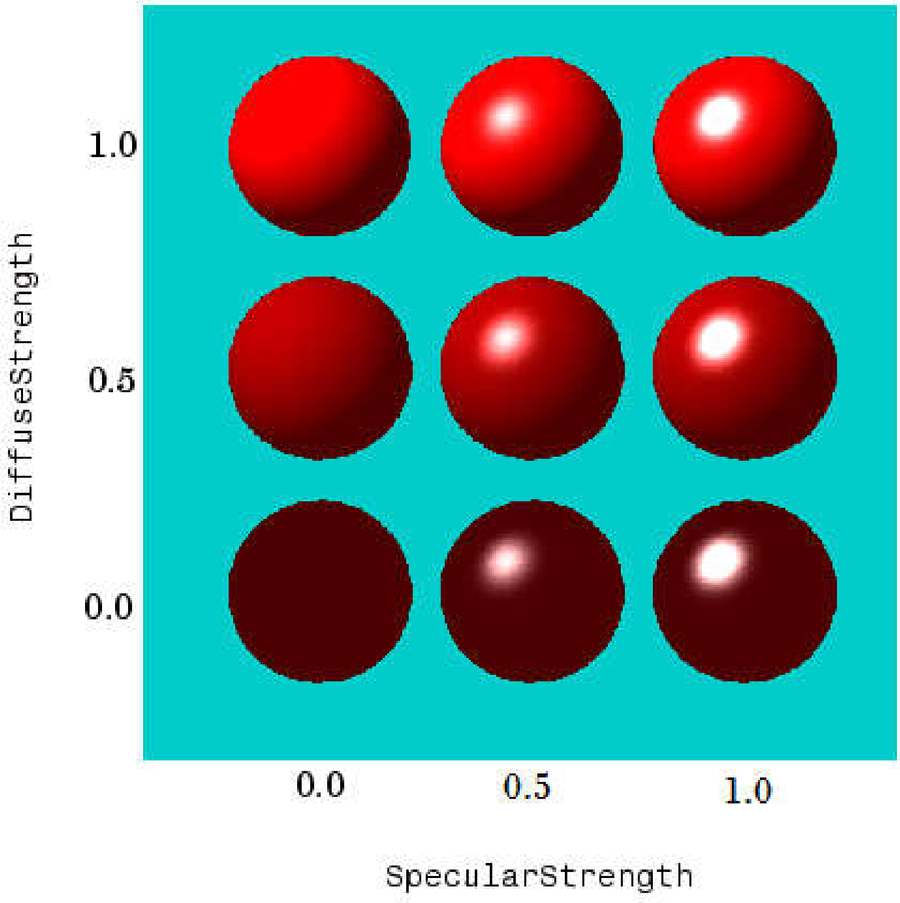
Reflectance Characteristics of Graphics Objects

Specular and Diffuse Reflection

You can specify the reflectance characteristics of patch and surface objects and thereby affect the way they look when lights are applied to the scene. It is likely you will adjust these characteristics in combination to produce particular results.

Also see the `material` command for a convenient way to produce certain lighting effects.

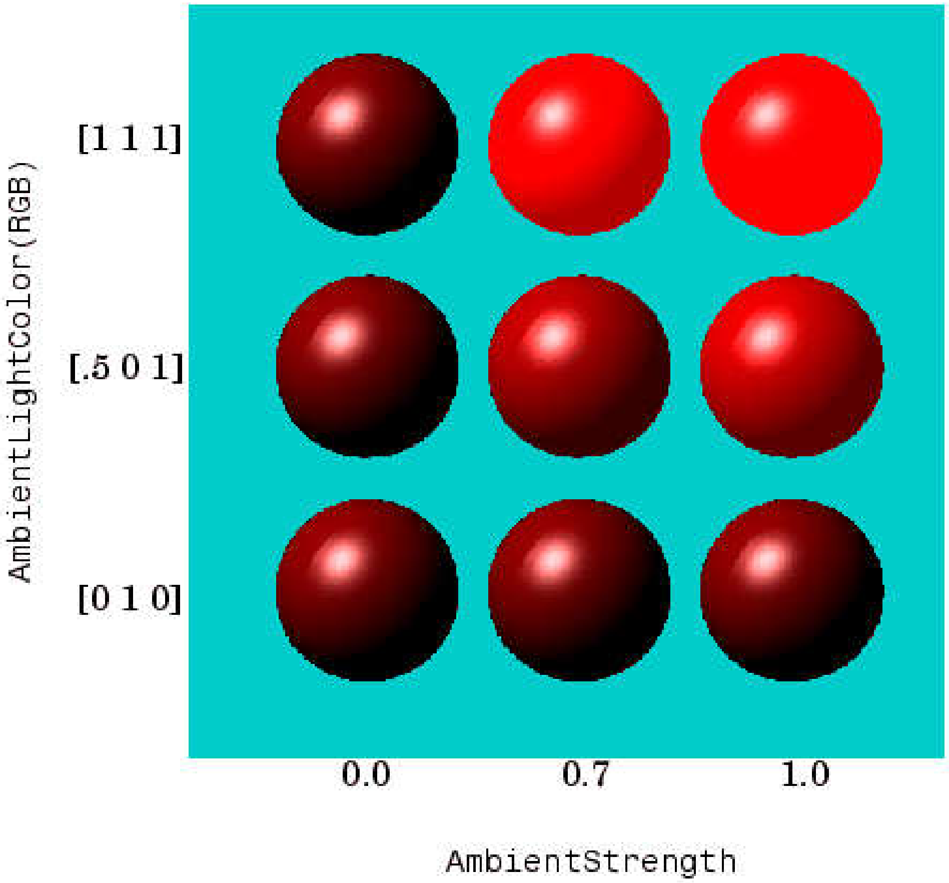
You can control the amount of specular and diffuse reflection from the surface of an object by setting the `SpecularStrength` and `DiffuseStrength` properties. This picture illustrates various settings.



Ambient Light

Ambient light is a directionless light that shines uniformly on all objects in the scene. Ambient light is visible only when there are light objects in the axes. There are two properties that control ambient light — `AmbientLightColor` is an axes property that sets the color, and `AmbientStrength` is a property of patch and surface objects that determines the intensity of the ambient light on the particular object.

This illustration shows three different ambient light colors at various intensities. The sphere is red and there is a white light object present.

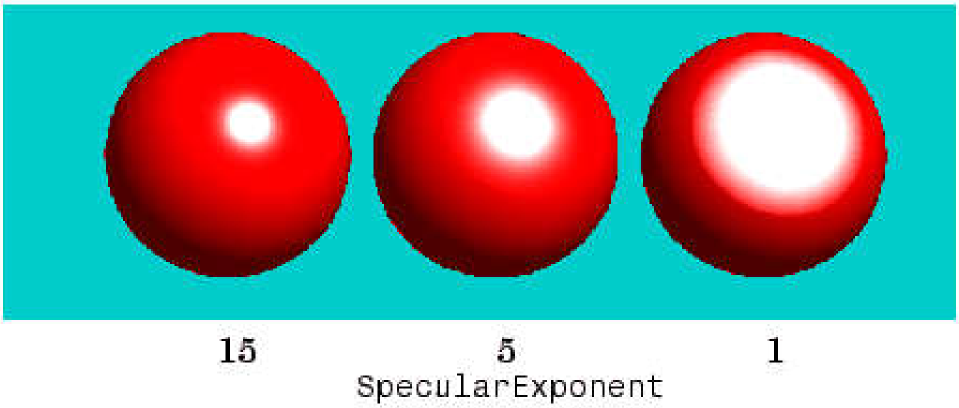


The green [0 1 0] ambient light does not affect the scene because there is no red component in green light. However, the color defined by the RGB values [.5 0 1] does have a red component, so it contributes to the light on the sphere (but less than the white [1 1 1] ambient light).

Specular Exponent

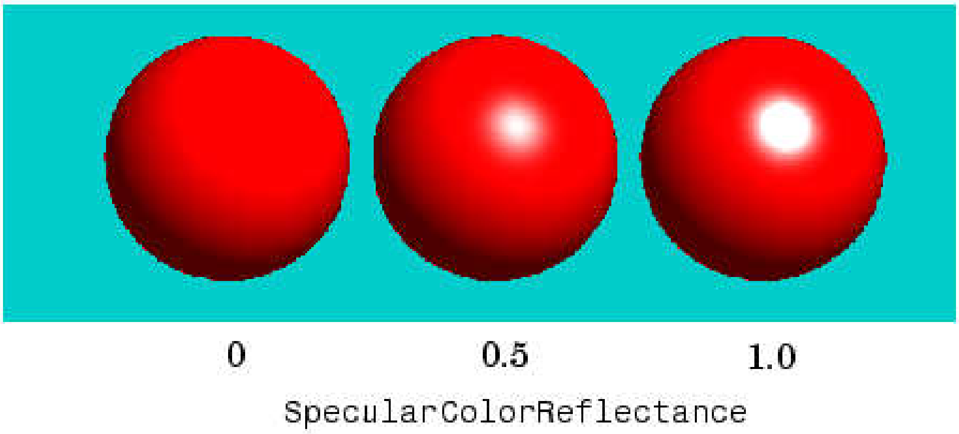
The size of the specular highlight spot depends on the value of the patch and surface object's `SpecularExponent` property. Typical values for this property range from 1 to 500, with normal objects having values in the range 5 to 20.

This illustration shows a red sphere illuminated by a white light with three different values for the `SpecularExponent` property.



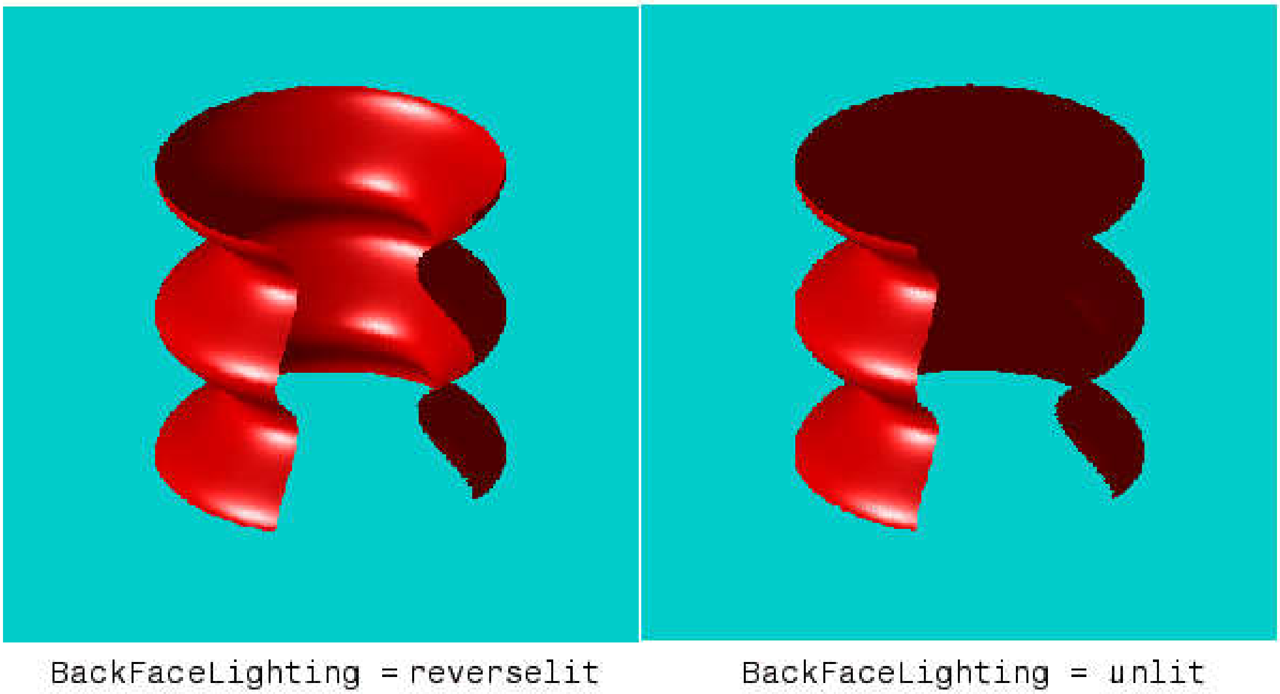
Specular Color Reflectance

The color of the specularly reflected light can range from a combination of the color of the object and the color of the light source to the color of the light source only. The patch and surface `SpecularColorReflectance` property controls this color. This illustration shows a red sphere illuminated by a white light. The values of the `SpecularColorReflectance` property range from 0 (object and light color) to 1 (light color).



Back Face Lighting

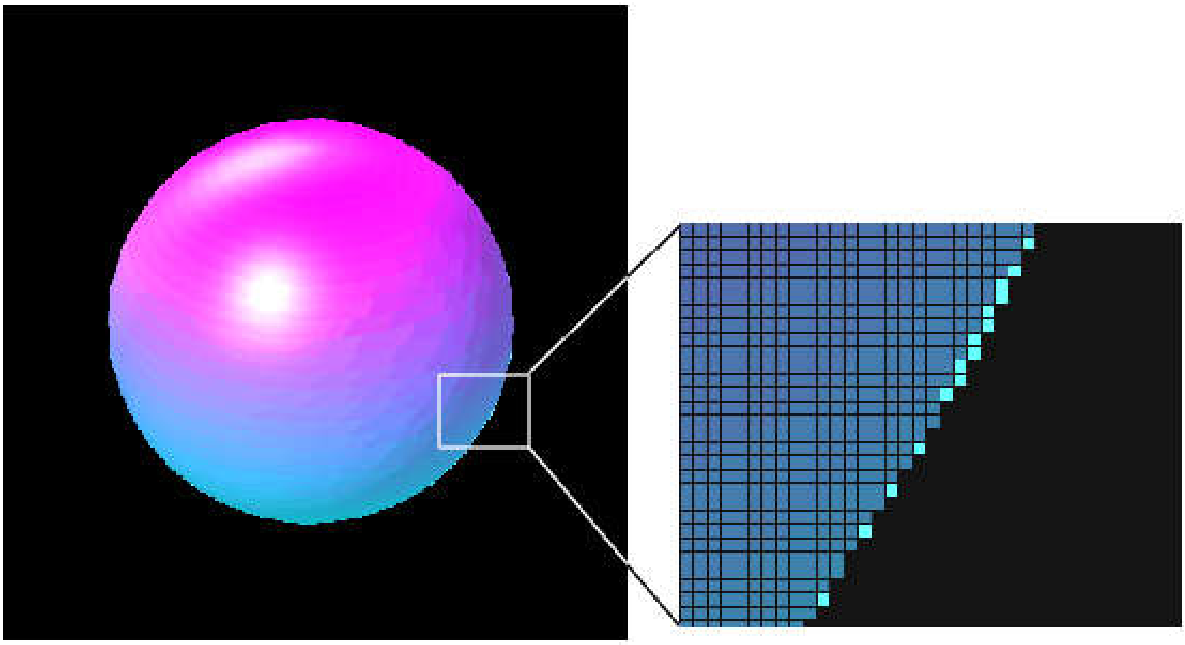
Back face lighting is useful for showing the difference between internal and external faces. These pictures of cut-away cylindrical surfaces illustrate the effects of back face lighting.



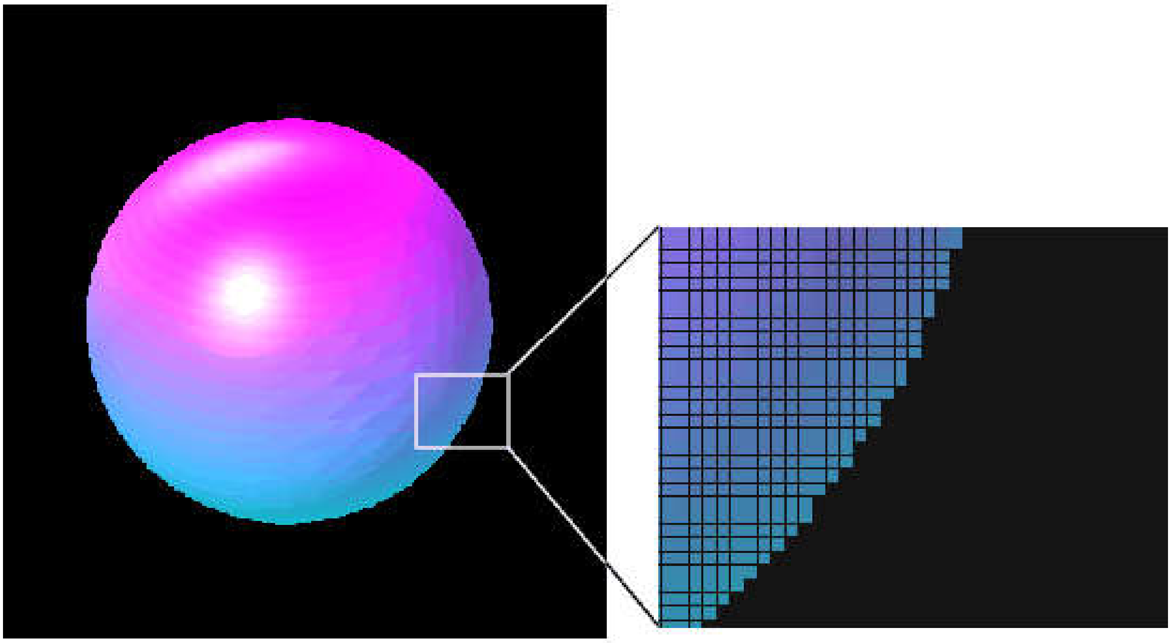
The default value for `BackFaceLighting` is `reverselit`. This setting reverses the direction of the vertex normals that face away from the camera, causing the interior surface to reflect light towards the camera. Setting `BackFaceLighting` to `unlit` disables lighting on faces with normals that point away from the camera.

You can also use `BackFaceLighting` to remove edge effects for closed objects. These effects occur when `BackFaceLighting` is set to `reverselit` and pixels along the edge of a closed object are lit as if their vertex normals faced the camera. This produces an improperly lit pixel because the pixel is visible but is really facing away from the camera.

To illustrate this effect, the next picture shows a blowup of the edge of a lit sphere. Setting `BackFaceLighting` to `lit` prevents the improper lighting of pixels.



BackFaceLighting = reverselit



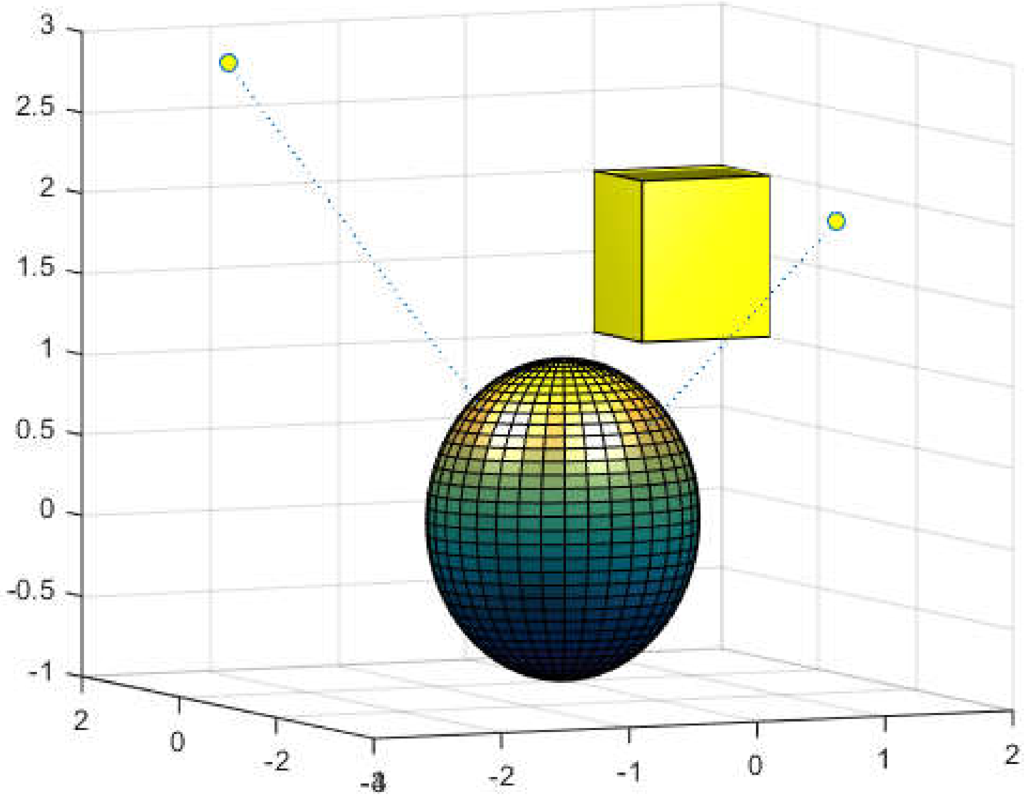
BackFaceLighting = lit

Positioning Lights in Data Space

This example creates a sphere and a cube and illuminates then with two light sources. The light objects are located at infinity, but in the directions specified by their position vectors.

```
% Create a sphere
sphere(36);
axis([-3 3 -3 3 -3 3])
hold on
% Create a cube
fac = [1 2 3 4;2 6 7 3;4 3 7 8;1 5 8 4;1 2 6 5;5 6 7 8];
vert = [1 1 1;1 2 1;2 2 1;2 1 1;1 1 2;1 2 2;2 2 2;2 1 2];
patch('faces',fac,'vertices',vert,'FaceColor','y');
% Add lights
light('Position',[1 3 2]);
light('Position',[-3 -1 3]);
hold off
```

The `light` functions define two light objects located at infinity in the direction specified by the `Position` vectors. These vectors are defined in axes coordinates [*x*, *y*, *z*].



3
2.5
2
1.5
1
0.5
0
-0.5
-1
2
0
-2
-3
-2
-1
0
1
2