

# 7M836 – Animation and Rendering

## ***Exercise 4a: Lights and reflections***

In this exercise

- we learn to use light sources,
- we learn to define colours for objects,
- we learn the influence of coloured light sources.

Background information in the on-line documentation:

- *3.7.1 The Pointlight Source*
- *3.7.2 The Spotlight Source*
- *3.8.1 Surface Finishes*

Open the files `ch4/lights.pov`. Render the scene.

Change the first point light source into a spot light source that is targeted at the origin (0,0,0) of the scene. Make a fully illuminated cone of 1.5 degrees (use the `radius` and `falloff` statements). Render the scene.

Now try to make a fully illuminated cone of 1.5 degrees that gradually reduces to no illumination at 2 degrees. Render the scene.

Restore the light source to a point light source.

Give the white pawn a brown colour. Try to find out which values for red, green, and blue must be provided to get a brown colour. Render the scene.

Remember that what you see as an object's colour is the result of light reflecting from the object's surface. When an image is illuminated by white light, you see the colours you expect. However, the colour of a light source will strongly influence what you perceive as an object's colour. At present, the two lights in the `lights.pov` file both give a different strengths of white light. Change them to red lights by setting their green and blue components to zero. Redraw the image.

Compare the appearance of the board and pawns in this version of the image to the appearance of the board in the previous image. How do the colours red, white and blue appear under red light?

Change the lights back to their original colours for the remainder of the activities in this section.

## ***Exercise 4b: Reflections***

In this exercise

- we become familiar with the `finish` statement.

Background information in the on-line documentation:

- *3.8.1 Surface Finishes*
- *3.9.3 Finishes*
- *6.8.1 Finish*

Currently all of the scene's surfaces are diffuse reflectors, because the `finish` statement specifies diffuse reflection only. Consider the following `finish` statement:

```
finish {ambient 0 diffuse .8}
```

This means that ambient reflection is at 0% strength and diffuse reflection is at 80% strength. Increase the ambient reflection of the plane, board, and pawns to 20% and redraw the scene. What can you say about the shadows in this new version when you compare it to the first image you created?

What happens if ambient is set to 1 and diffuse to 0?

To add Phong highlights to an object add the word `phong` to the `finish` statement. The `phong` exponent is specified by the `phong_size` statement.

```
finish {ambient 0.2 diffuse 0.8 phong 1 phong_size 1}
```

A value of 1 for `phong` indicates that we want a specular highlight of 100%. Change the green pawn to have `phong` highlights. Redraw the scene. Experiment with the `phong_size` statement to see the influence of the exponent on the size of the highlight.

In POV-Ray another way to add specular highlights to an object, is to add the word `specular` to its `finish` statement:

```
finish {ambient 0 diffuse .8 specular 1}
```

A value of 1 for `specular` indicates that we want a specular highlight at 100% strength. Change the purple and blue pawn to have a specular reflection, using the `specular` statement, and render the scene. How many highlights do you see on the spherical top of each pawn? How does the number of specular highlights on a sphere correspond to the number of light sources you have in a scene?

Specular reflections depend not only on surface properties and the position of the light source, but also on the position of the viewer. At present, the camera location is on the left side of the checker board, which means that you are currently viewing the left sides of the pawns. On what sides of the pawns do you see specular highlights?

Change the camera position to be in front of the checker board. You can do this by changing the eye point of the camera to `<5, 5, -20>`.

Render the scene and make note of the highlights. Now move the camera to the right side of the board by changing the eye point to `<15, 5, 0>` and redraw the image. Where are the highlights now? Compare this image to images where the camera was in front and to the left of the pawns. When the camera position moves, what happens to the highlights?