Computer Graphics Labs

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LAB. 6

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ILLUMINATION OF 3D SCENES

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2. Direct illumination in OpenGL (revisited)
3. Example: The Teapot
4. Programming exercises

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ILLUMINATION OF 3D SCENES

In this lab we intend to learn how create illuminated 3D scenes.

1.   Learning Goals

At the end of this chapter **you should be able to**:

1. To build up illuminated 3D scenes.

2. To use normals as a fundamental step to illuminate and shade 3D objects and scenes.

3. To use the flat shading and Gouraud shading, as well as to distinguish between them.

2.   Illumination in OpenGL (revisited)

Before proceeding any further, have a look at the following web links to be aware of the illumination model in OpenGL:

http://www.glprogramming.com/red/chapter05.html
http://pheatt.emporia.edu/courses/2003/cs410s03/hand20/hand20.htm

3.   Example: The Teapot

The program teapot.c is available at the web page of the course at:
http://www.di.ubi.pt/~agomes/cg

In this program, we can see how direct illumination works:
- **emission** of light is specified in the `_InitLights` function, where the behavior of two lights (GL_LIGHT0 and GL_LIGHT1) is set up;
- **reflection** of light is specified in the `_InitMaterial` function, where the reflective behavior of the teapot is set up.

Questions:

(1) Which are the objects of the scene?
(2) Which is the location of the viewer?
(3) Where is the projection plane?
(4) Why the `_InitMaterial` function concerns the teapot and not else?

4.   Programming Exercises

1. Change the previous program (`teapot.c`) in order to include a cube in the scene. The cube can be generated using the `glutSolidCube` primitive. The program must be able to stop and resume the rotation of those two objects, the teapot and the cube.
2. Elaborate a program that builds up an illuminated cube without using the `glutSolidCube` primitive. For that purpose, you must use the `glNormal` primitive to put a normal vector on each face of the cuve. Why? Read the following web page to know how to do:

   `http://support.microsoft.com/kb/131130`

   The program can be written by changing the previous one.
3. Re-write the previous program in a way that normal vectors are placed on vertices instead of faces. What is the difference in visual terms?
4. Change the program that displays an urban scene, which was built up across the labs, in order to include a street lamp. This street lamp consists of a cylinder and a ball on the top of it. The ball will be the lamp that lights the scene. Have a look at the program `bolasiluminadas.c` to start with.