CIS 636 Introduction to Computer Graphics
CIS 736 Computer Graphics
Spring 2011

Homework 2: Machine Problem
Lighting, Shading, and Mapping Effects in OpenGL

Assigned: Wed 09 Feb 2011
Due: Fri 24 Feb 2011 (before midnight)

The purpose of this homework is to give you more experience with viewing and mapping effects in OpenGL.

This homework is worth a total of 20 points (2%). Upload an electronic copy of the assignment in PDF form (converted from your word processor, or scanned) to your K-State Online (KSOL) drop box before the due date and time.

Acknowledgements

This machine problem was inspired in part by Stanford's CS148 (fall, 2010): http://bit.ly/fkMGfZ

References

NewTek Lightwave tutorials:
- Lighting Techniques, Part I, by Amaan Akram: http://bit.ly/gRW3vS
- Texture Building, by Vance Kovacs and Vera Milosavich: http://bit.ly/hRiiPS

Photoshop rotoscoping tutorial: http://adobe.ly/gtChSN

NeonHelium tutorials: http://nehe.gamedev.net
OpenGL FAQ: http://www.opengl.org/resources/faq/
OpenGL viewing docs: http://www.opengl.org/resources/faq/technical/viewing.htm
OpenGL material smoothness documentation: http://bit.ly/eIVF4d
OpenGL Programming Guide, Chapter 9: Texture Mapping: http://bit.ly/fNFoxN

1. **(20% for 636, 10% for 736) Parsing scene files.** Download the sample scene files from http://bit.ly/gbI9fM and look at the inline specifications. Write a program in C/C++ to read in these scene files. Turn in your parser as part of `mp2.c`.

2. **(30% for 636, 20% for 736) 3-D low-polygon rendering.** Next, adapt your OpenGL programs from Labs 1 – 2 to do the following:

   a. **(10% / 10%) Vector test render.** Display a wireframe of the mushroom. Turn in your source (`mp2.c`) and a screenshot (`mp2_2a.jpg`).
   b. **(20% / 10%) Shading.** Display smooth-shaded versions of the rest, following NeHe tutorials 3 through 5. Turn in your source (`mp2_2b.c`) and a screenshot (`mp2-2b.jpg`).

3. Do only the parts that you are required to for the course you are enrolled in.
   For this machine problem, you will need to download trial versions of NewTek *Lightwave 10* and Adobe *Photoshop CS5*. (You may use your own copy of *Lightwave* or *Creative Suite* if you own either one; indicate which version you are using.)

(50%, 636 only) Lighting and rotoscoping.

a. **(20%) Lighting.** Experiment with different colors of light and objects: modify your OpenGL program from MP2-2 above to display a smooth-shaded version of the house that is colored light blue with yellow light, and set the light color to light red with a white house. To experiment with lighting colors and effects using *Lightwave*, follow the tutorials given above; may use any monochrome model and do not have to load the house. Turn in your source (`mp2.c`) and four screenshots: `mp2_3a-gl-BOYL.jpg` and `mp2_3a-gl-ROWL.jpg` for your OpenGL renders, and `mp2_3a-lw-BOYL.jpg` and `mp2_3a-lw-ROWL.jpg` for Lightwave. (Here color ranges over {R, G, B}, 'O' stands for "object", and 'L' stands for "light"; hence "BOYL" denotes "blue object, yellow light".)

b. **(30%) Material smoothness and rotoscoping.** In this exercise, you will use a commercial software product in conjunction with your own program to produce the desired visual effect.

   i. Follow the material smoothness and Photoshop-based rotoscoping tutorials given above to incorporate a **silver** version of your house into this picture: http://bit.ly/hlXjJy
   The image is © 2002 Electronic Arts, and is part of a CG still from *SimCity* artwork, and appears in Gino Santa Maria's tutorial on linear perspective (http://bit.ly/e2X2AR).

   ii. Composite your house into the scene as in this architectural mock-up: http://bit.ly/edOeMn
   This image is © 2009 by Amanda Lavete Architects and appears in the Arch Daily website under tag "amandalavete" (http://bit.ly/e24yjR).

   Turn in your source (`mp2.c` with rotoscope section identified by comments in your code, or a separate source code listing named `mp2_3b.c`). Also, include a screenshot of your final render (`mp2_3b.jpg`).

(50%, 736 only) Transparency and Mappings.

a. **(20%) Blending and transparency.** Follow NeHe Tutorial 8 (http://bit.ly/fF3AKG) to display an opaque red instance of the house behind a translucent light blue one. The result should be purplish as expected. Turn in your source (`mp2_3a.c`) and a screenshot of the result (`mp2_3a.jpg`).

b. **(30%) Reflection *aka* environment mapping.** Follow NeHe tutorial 23 (http://bit.ly/e3Zb8h) to make your house "silver" using a sphere map. Use this image as your environment:
   http://bit.ly/evINlk
   The image is © 2008 by Tartiflop and appears in http://bit.ly/h58W4M
   Turn in your source code (`mp2_3b.c`) and a screenshot (`mp2-3b.jpg`) of the house after the mapping.

Extra Credit: Submit an entry to the Logo Design Contest preliminaries for 636 and 736 – instructions will be posted on K-State Online and the public mirror.

Class Participation (required): Consult the project ideas (http://bit.ly/gCJXAi) posted by the instructor to the Discussions message board and commit to a term project topic by Fri 18 Feb 2011. Either select one of the options you posted by Fri 11 Feb 2010, or select a new topic based on discussion with the instructor in office hours during the week of Mon 14 Feb 2010. Post a draft proposal in the class mailing list CIS636-L@listserv.ksu.edu before you finalize your choice, and ask any questions you like.