MSIM 441/541 & ECE 406/506  
Computer Graphics & Visualization

Homework Eight

**Assigned November 12, Due 12:00 PM November 19**

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### Overview

This homework covers the lecture on Chapter 5. Please only submit one single file that includes solutions to the tasks specified below.

### Tasks

1. Describe the components in a synthetic camera model. What are the characteristics of geometric optics?
   1. Components of synthetic camera model:
      1. Objects
      2. Viewer or center of project (COP)
      3. Projectors: lines from objects to COP
      4. Projection plane
   2. Characteristics of geometric optics:
      1. Projection surface is a plane
      2. Projectors are straight lines
2. Define the canonical viewing volume.
   1. When projection metric is applied to view space (view space is normalized). Only x- and y-coordinates will be mapped on to screen and z-component is used for depth.
3. Calculate the projection matrix corresponding to the following OpenGL command

glFrustum(–2, 2, –2, 2, 1, 30) = (l, r, b, t, n, f).

1. Given the OpenGL command gluLookAt(2, 5, 3, 8, 2, 3, 0, 1, 1). Calculate the direction of positive *z*-axis of the camera coordinate system and the matrix that transforms world coordinates to camera (eye) coordinates.
2. Run the program projection.exe provided by Nate Robin’s tutors, experiment with various parameters, and capture several program windows.

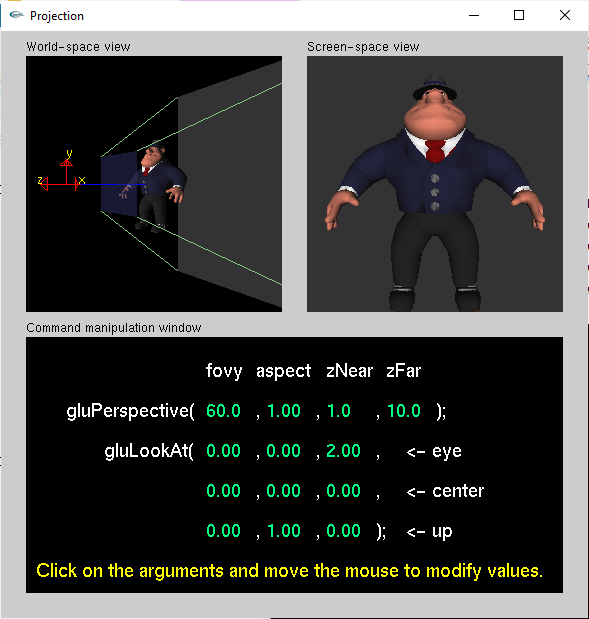


Figure 1. original

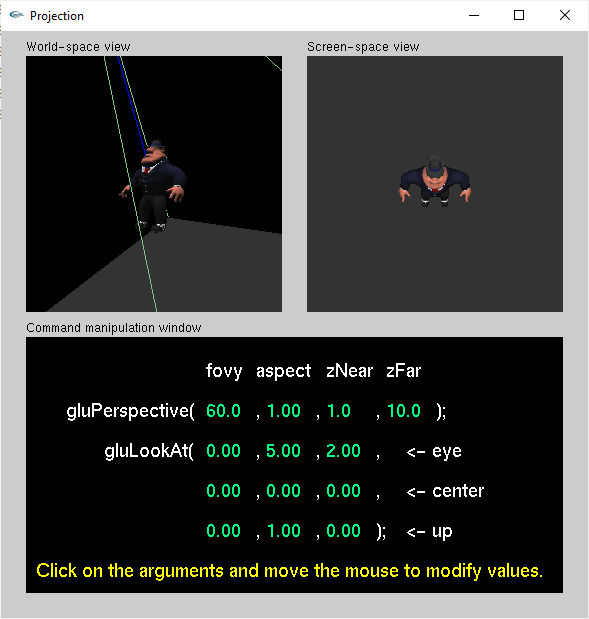


Figure 2. Experiment 1

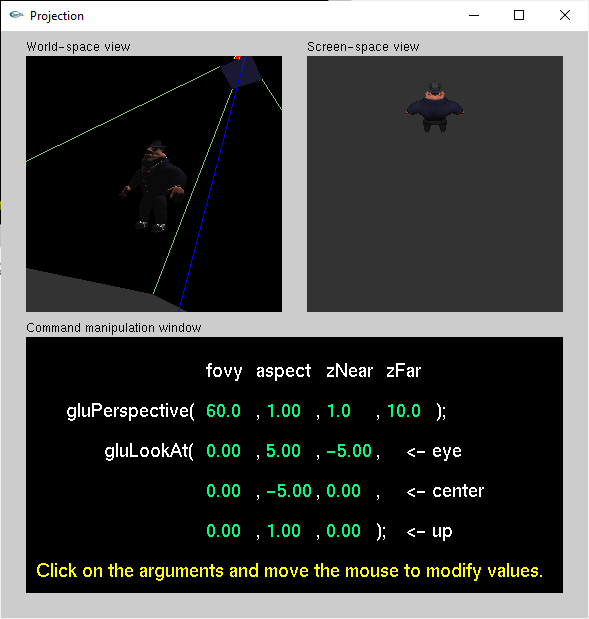


Figure 3. Experiment 2

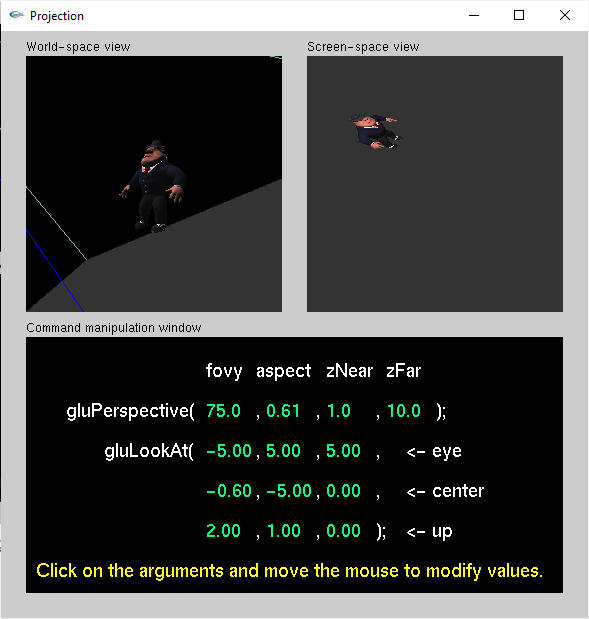


Figure 4. Experiment 3