Geometry Realized

Thomas Moh

tjm8339

User's Guide

Goals:

I hoped to create a 3D world in which the user could easily navigate the world. In this world I wanted to demonstrate the effects of Phong Shading, Gouraud Shading, Phong Lighting, and Blinn-Phong lighting.

To demonstrate these effects, I had a goal of creating a slowly spinning sphere in the middle of the world that made the differences between the different shading and lighting techniques obvious.

Specifically, the Gouraud shader should provide specular highlights that are limited by the number of triangles drawn, which causes some of the specular highlights to be non-circular and hexagonally or trigonally shaped.

The Phong shader should provide much smoother specular highlights than the Gouraud shader because the normal vectors are being interpolated per pixel, rather than per vertex.

Blinn-Phong and Phong lighting should have noticeable differences on the sphere.

Besides the shading and lighting done in this project, I also wanted to create an interesting geometric world which demonstrates the ability for jointed objects to still be drawn with the shaders in the correct way.

User Instructions

1. To open all of the instructions and controls, simply click on the button labeled "Open Instructions and Controls"
2. From here, a pop-up should display all of the instructions for the user. View Figure 1 below.

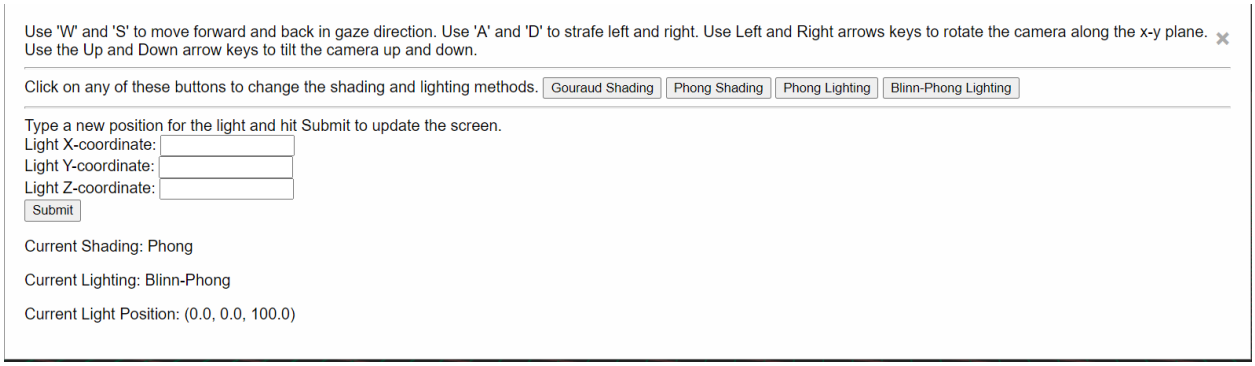


Figure 1: User Controls and Instructions

3. To reiterate, the user should Use 'W' and 'S' to move forward and back in gaze direction, use 'A' and 'D' to strafe left and right, use Left and Right arrows keys to rotate the camera along the x-y plane and use the Up and Down arrow keys to tilt the camera up and down.
4. To change the shading and lighting methods the user need only click on whichever shading and lighting method they like, and the Current Shading and Current Lighting text at the bottom of the pop-up will update.
5. To change the position of the light, the user inputs the x, y, and z coordinates and clicks submit. This will also update the Current Light Position text at the bottom of the pop-up.

Results

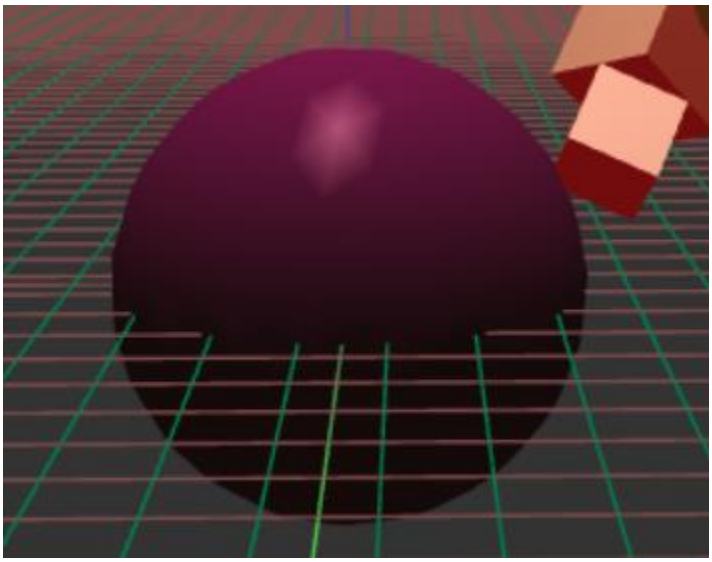


Figure 2: Gouraud Shaded Sphere with Phong Lighting

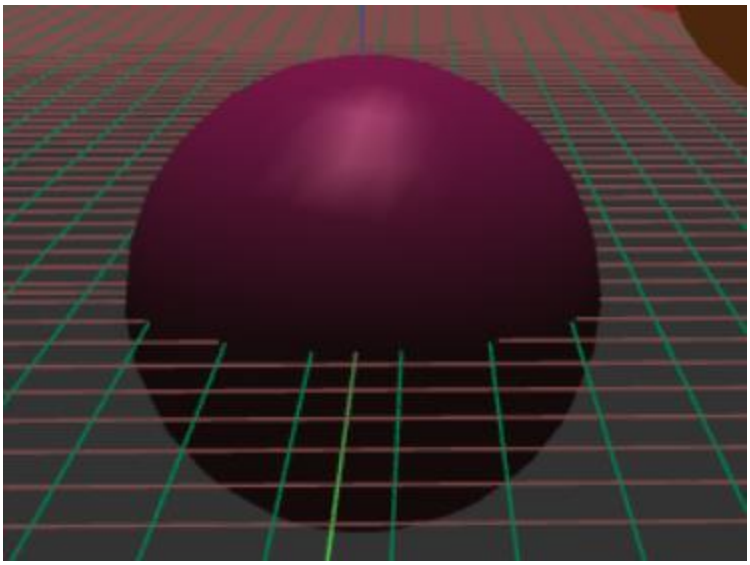


Figure 3: Gouraud Shaded Sphere with Blinn-Phong Lighting

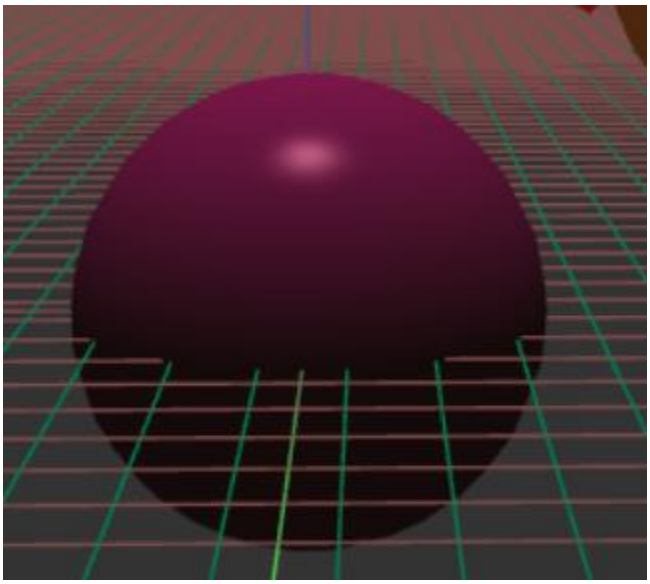


Figure 4: Phong-shaded sphere with Phong Lighting

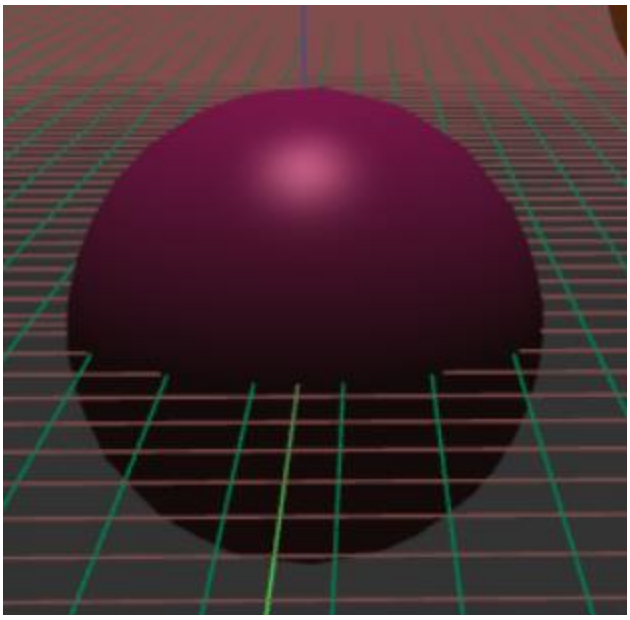
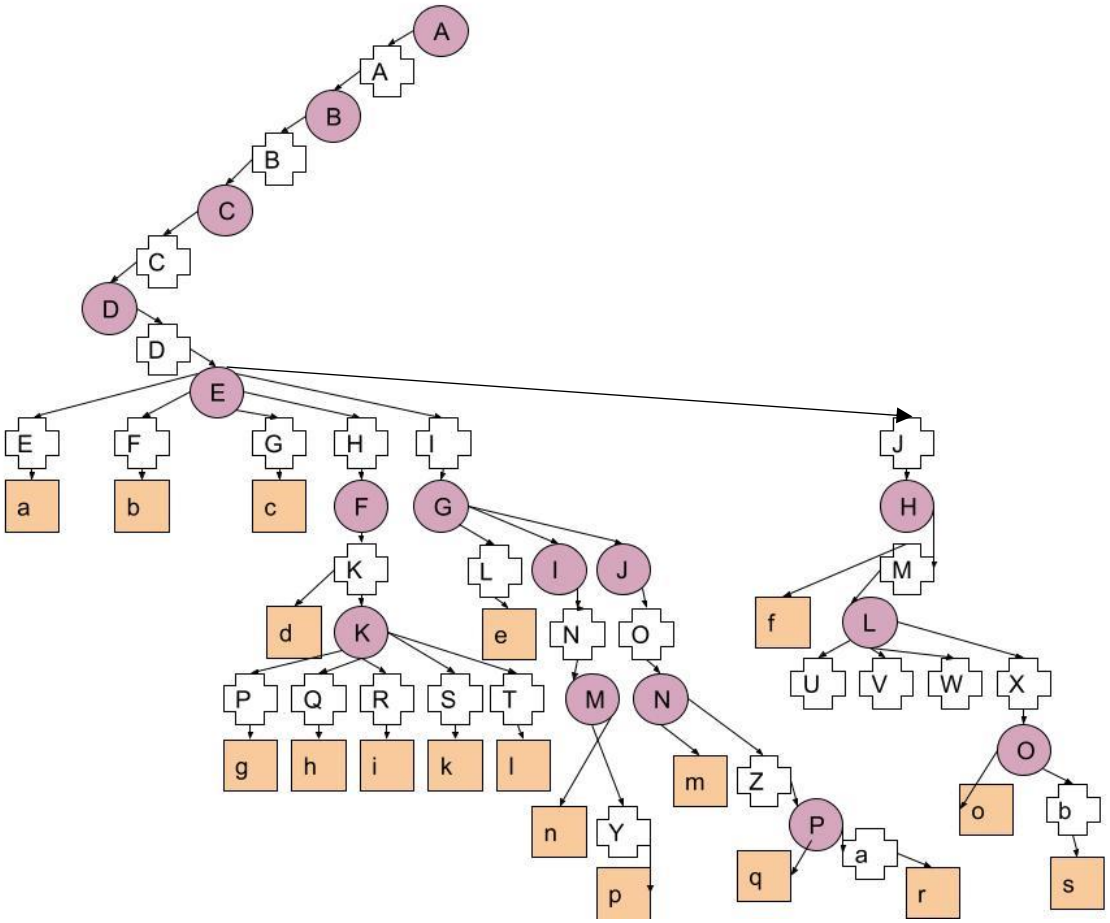


Figure 5: Phong-shaded sphere with Blinn-Phong lighting

From Figures 2, 3, 4, and 5 we can clearly see the stark differences between the four types of shading/lighting, as desired. In particular, the Gouraud shading has specular highlights with distinct edges, while the Phong shading creates rounded specular highlights. The Blinn-Phong lighting appears to create more spread out specular highlights than the Phong lighting.

The other goals set out in the project can be seen just by opening the graphical application. In particular there are 3 jointed assemblies, in the 3D space, and their shading updates correctly.

SCENE GRAPH



Group Nodes:

- A- Canvas
- B- CVV
- C- CAM
- D- World
- E- All objects + assemblies
- F- Flying figure
- G- Sphere stack
- H- Tiles
- I- Box stack 1
- J- Box stack 2
- K- Body parts
- L- Other tiles
- M- Sub boxstack a
- N- Sub boxstack b
- O- Jointed boxes
- P- Jointed boxstack