CPSC 314
Project 3: Shading

Due 11:59pm, March 15, 2016. **Updated 11:15am, March 15**

1 Introduction

The goal of this project is to explore lighting and shading of 3D models. You will be simulating four different styles of shading : Gouraud, Phong , Blinn-Phong and Cool-to-Warm(cartoon-like). In this project you will be *adding* new pairs of shaders (both vertex and fragment shaders) to carry out these tasks.

2 Tasks

(~~15~~ 17 pts) **Gouraud Shading** In this part you will calculate the lighting of an object at each given vertex. The colour from the lighting must be interpolated across each face of the object as shown in the Figure below taken from Wikipedia. Lighting computation based on a Phong reflection model can be used.
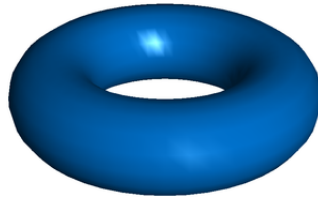

Figure 1: Gouraud shaded torus with Phong reflection model.

(~~15~~ 17 pts) **Phong Reflection and Phong Shading.** The full Phong *reflection* model expands on this by computing the lighting per fragment, using the interpolated values of the fragment's position and normal. This will give a much nicer looking shading.

The following image, taken from the Wikipedia article on the Phong reflection model, shows how the different components look individually and summed together:
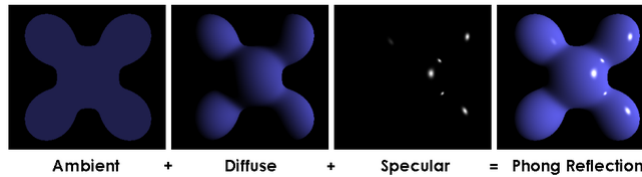
Figure 2: Phong Reflection Model

The main calculations should all go in the fragment shader (in file phong.fs.glsl). Note that you will still need a vertex shader (in phong.vs.glsl), to pass the appropriate information to your fragment shader.

(~~15~~ 17 pts) **Blinn-Phong Shading** Instead of continuously recomputing the dot product between the reflected light vector and viewer, a dot product between the halfway vector between light and viewing direction, and the surface normal can be used. This is the essence of the Blinn-Phong shading model. Implement a shader which simulates the Blinn-Phong shading model.

(~~15~~ 9 pts + 2 pts extra credit) **Cool-to-Warm Shading.** This shader is an example of a non-photorealistic rendering (NPR). There are many variations of NPR; what you should implement for this project is covered in the last two slides of

http://www.ugrad.cs.ubc.ca/~cs314/Vjan2016/slides/lighting.pdf

Your shader will emulate the way illustrators create stylized images ~~with strong black strokes for silhouettes and creases~~ with varying colour across the surface in a way that approximates a red light coming from one direction and a blue light coming from another. This combination of shading choices provides a strong sense of 3D for the model that is quite different from a photograph.

~~The creases can be detected by checking the angle between normals of adjoining faces, and similarly the silhouettes can be detected by checking the relationship between those two normals and the vector between the edge and the eye.~~

Update: The full NPR approach covered in the slides includes creases and silhouettes, in addition to the cool-to-warm shading itself. **You do not have to implement creases or silhouettes for this project**. Silhouettes are optional: you can implement them for a total of 2 points extra credit (hint: think about the direction of the current normal with respect to the view vector). We do not recommend that you try doing creases with the current shader architecture, as those are typically handled through a second pass.

(10 pts) **Apply the shaders on the armadillo.** Use keys 1-4 to apply Gouraud,

Phong, Blinn-Phong and Cool-to-Warm shaders respectively on the armadillo. Here is an example of what the output might look like:
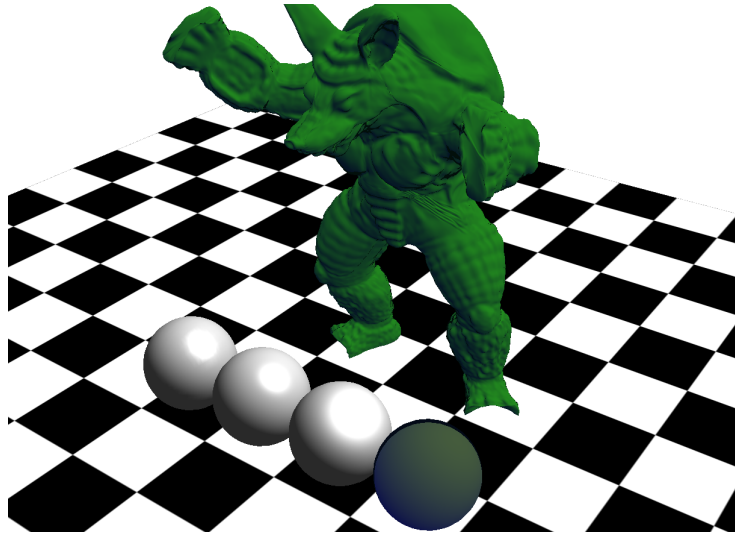

Figure 3: The spheres are shaded using Gouraud, Phong, Blinn-Phong and Cool-to-Warm shaders from left to right respectively. The armadillo is using a Cool-to-Warm shader, with the extra-credit silhouettes.

Handin/Grading/Documentation

Update: The grading, required documentation, and handin will be the same as with project 1, except for two changes. First, use the command `handin cs314 p3`. Second, there is no need to submit image files since there will not be a Hall of Fame for this project. Stay tuned for the ultimate Hall of Fame competition with Project 4!