

For project2: polygon mesh and shading

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1 Some OpenGL functions

2 Shading

3 Q/A

glNormal

- Set the current normal vector
- Demo codes: `polygon.java`
- Normal is a state.
- The direction affects lighting effect.
- Normals specified with `glNormal` need not have unit length.

glPolygonMode

- Select a polygon rasterization mode.
- Demo codes: polygon.java
- GL_FRONT, GL_BACK, GL_FRONT_AND_BACK
- GL_POINT, GL_LINE, GL_FILL
- GL_LINE_WIDTH can be changed.

glColorMask

- Enable and disable writing of frame buffer color components
- Demo codes: colormask.java
- `GL_INVALID_OPERATION` is generated if `glColorMask` is executed between the execution of `glBegin` and the corresponding execution of `glEnd`.

glCullFace

- specify whether front or back facing facets can be culled
- Demo codes: colormask.java
- GL_BACK, GL_FRONT, GL_FRONT_AND_BACK.
- Initial value is GL_BACK.
- Call the glEnable and glDisable with GL_CULL_FACE.
- GL_INVALID_OPERATION is generated if glCullFace is executed between the execution of glBegin and the corresponding execution of glEnd.

glPolygonOffset

- Set the scale and units used to calculate depth values
- Demo codes: offset.java
- `void glPolygonOffset(GLfloat factor, GLfloat units)`
- `glIsEnabled` with argument `GL_POLYGON_OFFSET_FILL`, `GL_POLYGON_OFFSET_LINE`, or `GL_POLYGON_OFFSET_POINT`.
- `GL_INVALID_OPERATION` is generated if `glPolygonOffset` is executed between the execution of `glBegin` and the corresponding execution of `glEnd`.

glShadeModel

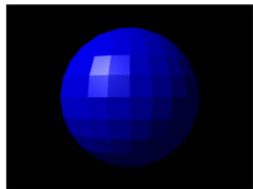
- Select flat or smooth shading.
- Don't use this function in project2, compute the normals by yourself :-)

1 Some OpenGL functions

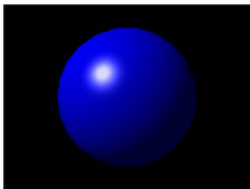
2 Shading

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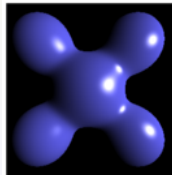
Different shading effects



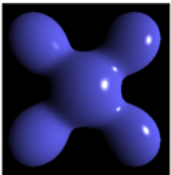
FLAT SHADING



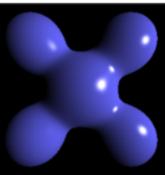
PHONG SHADING



Blinn-Phong



Phong



**Blinn-Phong
(Lower Exponent)**

How to distinguish

- Gouraud and phong: Rotate the Gouraud model.
- Blinn-phong and phong: The size of the specular highlights.
- (Run project2, with ellipsoid mesh.)

Toon shading on lighthouse3d

In the vertex shader:

- Calculate the light direction (normalize).
- Calculate the vertex normal (using `gl_NormalMatrix` instead of `gl_ModelViewMatrix`, why? uniform and non-uniform transformation).

In the fragment shader:

- normal in Vertex shader is interpolated, so need to be normalized.
- Calculate the $d = \max(0, \text{dot}(\vec{n}, \vec{l}))$.
- Simply choose three color values for different d .

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Any questions?