

OpenGL Quick Reference #3

Lighting and Materials

Illumination at a given vertex is a sum of **ambient**, **diffuse**, **specular** and **emitted** light. It is computed from *light source properties* and *material properties*.

I. Setting Up Lighting

Light sources are identified by *lightIDs*:

```
GL_LIGHT0, GL_LIGHT1, . . . , GL_LIGHT7.
```

To use lighting you must enable lighting calculations:

```
glEnable( GL_LIGHTING );
```

You must also turn on any specific light sources you are using:

```
glEnable( lightID );
```

When you use lighting, you will normally do the following as well before you draw:

```
glutInitDisplayMode( GLUT_DOUBLE | GLUT_RGBA | GLUT_DEPTH );
```

```
glEnable( GL_DEPTH_TEST );
```

```
glPolygonMode( GL_FRONT, GL_FILL );
```

Each polygon you draw [with `glBegin(GL_POLYGON) ... glEnd()`] will require normals in addition to vertices:

```
glNormal3d( x, y, z );
```

If you want OpenGL to normalize {x,y,z} normals to length 1 for you, you should add this at the beginning of your program:

```
glEnable( GL_NORMALIZE );
```

When you clear the viewport you should make sure you clear the depth buffer too:

```
glClear( GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT );
```

II. Light Source Properties

Position (subject to matrix transformations):

```
glLightfv( lightID, GL_POSITION, pt ); // locates the light at position pt[] = {x,y,z,h}.
```

Ambient light (i.e., light which is spread uniformly throughout space) contributed by this source:

```
glLightfv( lightID, GL_AMBIENT, rgba ); // use light color rgba[] = {r,g,b,a}, range 0.0–1.0.
```

Diffuse light (i.e., light which is spread uniformly throughout space) contributed by this source:

```
glLightfv( lightID, GL_DIFFUSE, rgba ); // use light color rgba[] = {r,g,b,a}, range 0.0–1.0.
```

Specular light (i.e. light which bounces primarily from the source to the eye) contributed by this source:

```
glLightfv( lightID, GL_SPECULAR, rgba ); // use light color rgba[] = {r,g,b,a}, range 0.0–1.0.
```

III. Material properties

Emitted light (light that seems to make an object glow from within– but does *not* illuminate its surroundings)

```
glMaterialfv( GL_FRONT, GL_EMISSION, rgba ); // use light color rgba[] = {r,g,b,a}, range 0.0–1.0.
```

Reflectivity in various colors for various illumination components

```
glMaterialfv( GL_FRONT, GL_AMBIENT, rgba ); // use light color rgba[] = {r,g,b,a}, range 0.0–1.0.
```

```
glMaterialfv( GL_FRONT, GL_DIFFUSE, rgba ); // use light color rgba[] = {r,g,b,a}, range 0.0–1.0.
```

```
glMaterialfv( GL_FRONT, GL_SPECULAR, rgba ); // use light color rgba[] = {r,g,b,a}, range 0.0–1.0.
```

```
glMaterialfv( GL_FRONT, GL_AMBIENT, rgba ); // use light color rgba[] = {r,g,b,a}, range 0.0–1.0.
```

Shininess (specular exponent)

```
glMaterialfv( GL_FRONT, GL_SHININESS, shine ); // use shine[] = {s}, s in range 0–100+
```