OpenGL Transparency

OpenGL has a nice feature that lets you display see-through objects. This is useful in visualization when wanting to see some objects through other objects.

OpenGL calls it “transparency”, but in fact it is really “blending”. Be sure to remember this. Real transparency is a subtractive-color process. For example, looking below at a pure red object through a pure green piece of glass should give you black because the object’s red light will get blocked by the green glass.

OpenGL “transparency” would instead blend the RGB of the red object with the RGB of the green glass, giving a shade of yellow.

When Defining Your Object

Instead of using glColor3f() to specify the red, green, and blue of an object, use glColor4f() to specify red, green, blue, and alpha. Alpha is the transparency factor.

Or, if you are using lighting,

    glMaterialfv( GL_FRONT, GL_AMBIENT, rgba );
    glMaterialfv( GL_FRONT, GL_DIFFUSE, rgba );

• An alpha value of 0.0 means that this object is completely transparent (i.e., invisible – not too useful).
• An alpha value of 1.0 means that this object is completely opaque (also not useful as a transparency).

\[
C' = \alpha C_{new} + (1 - \alpha) C_{old}
\]

In the Display() Callback

1. Draw the solid things first
2. Enable color blending:
   
   glDisable( GL_BLEND );

3. Make the Z-buffer read-only:
   
   glEnable( GL_DEPTH_TEST );

This is important because you don’t want the presence of a transparent object close to your eye to prevent the writing of its blend with an object a little farther away.
4. Define how much of the about-to-be-written pixel color (the “source”) and how much of the already-existing pixel color (the “destination”) will end up being used:

```c
glBlendFunc( src, dst );
```

The value for `src` multiplies the about-to-be-written source pixel color (S) and the value of `dst` multiplies the already-existing destination pixel color (D). While there are several options for `src` and `dst`, the most useful combination is:

<table>
<thead>
<tr>
<th>Src (C&lt;sub&gt;src&lt;/sub&gt;)</th>
<th>Dst (C&lt;sub&gt;dst&lt;/sub&gt;)</th>
<th>Result (C&lt;sub&gt;res&lt;/sub&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GL_SRC_ALPHA</td>
<td>GL_ONE_MINUS_SRC_ALPHA</td>
<td>C&lt;sub&gt;res&lt;/sub&gt; = αS + (1-α)D</td>
</tr>
</tbody>
</table>

5. Draw the transparent things.

6. After drawing all the transparent elements of the scene, set the depth mask back to read-write and disable blending:

```c
glDepthMask( GL_TRUE );
glDisable( GL_BLEND );
```