Miscellanea
Blending

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Recall rasterization:

- Triangle vertices are projected to screen space.
- Pixels associated with triangle are found.
- Color value and z-value (depth) calculated for each (often using interpolation on vertex values, as well as texture look-ups).
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Fragment = pixel coordinate + calculated color value and z-value. (A “potential” pixel in the final picture).
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Exactly how can be set in various way in OpenGL. Note: the averaging takes place individually on each of the color channels (including A-channel).
Blending Example

A typical example:

```c
 glEnable(GL_BLEND);
 glBlendFunction(GL_SRC_ALPHA, GL_ONE_MINUS_SRC_ALPHA);
```

\[
\text{Dest}_X = \text{Source}_{\text{alpha}} \cdot \text{Source}_X + (1 - \text{Source}_{\text{alpha}}) \cdot \text{Dest}_X
\]

for \(X = \text{red, green, blue, alpha}\). Dest is colorbuffer pixel value, Source is fragment value.

(All resulting channel values clamped to 1.0.)
Applications

Blending useful for e.g.:

▶ Translucent objects.
▶ Reflections.
▶ Morphing between textures.
▶ Billboardling.

(From OpenGL Programming Guide)
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Translucent Objects

Drawing translucent objects:

- First draw all opaque objects (no blending)
- Then draw all translucent objects, with blending enabled, in back-to-front order wrt. the viewer [BSP trees may be used].
Fog

Automatic depth-based blending with fog-color.
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Various depth-functions can be chosen:
Billboards

A plain rectangle with a texture, simulating objects.

Useful for many things (especially when combined with translucent edges via blending), e.g.:

- Clouds
- Trees
- Laser beams
- Smoke
- Explosions
Anti-Aliasing

OpenGL may be asked to anti-alias using blending.
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Another method is multisampling (several subpixels/rays per final pixel).
Further OpenGL Buffers

- Accumulation buffer: combining place for color buffer contents (entire pictures). Used for e.g. depth-of-field effects, motion blur effects.

- Stencil buffer: used to restrict drawings to various areas (think boolean bits per pixel - first set bits during a rendering to stencil buffer, then use bits during rendering to color buffer (stencil test)).
Picking

Picking = select an object via mouse on screen.
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How?!?

- Special render mode allows OpenGL to report on which rendered objects intersected the frustrum.
- You can name (number) the objects rendered.
- For each, OpenGL can report the min and max z-value inside the frustrum.
- Glu has command for setting up a pixels-wide frustrum.
Vertex order gives orientation on triangles [CCW side and CW side].
Several neighboring triangles: consistent orientation.
Backface Culling

Save time by not shading back-facing triangles of closed objects.
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Note: reflections are orientation reversing transformations:
Save time by not rendering objects occluded by others.

OpenGL can test-render an object, to see if any pixels in framebuffer was changed. That object can be a simple bounding box of a complicated model. Only render model if test returned true.

Other occlusion culling methods work by data structures (CPU side code) keeping track of the scene (not curriculum).