Johns Hopkins
Engineering for Professionals

605.767 Applied Computer Graphics

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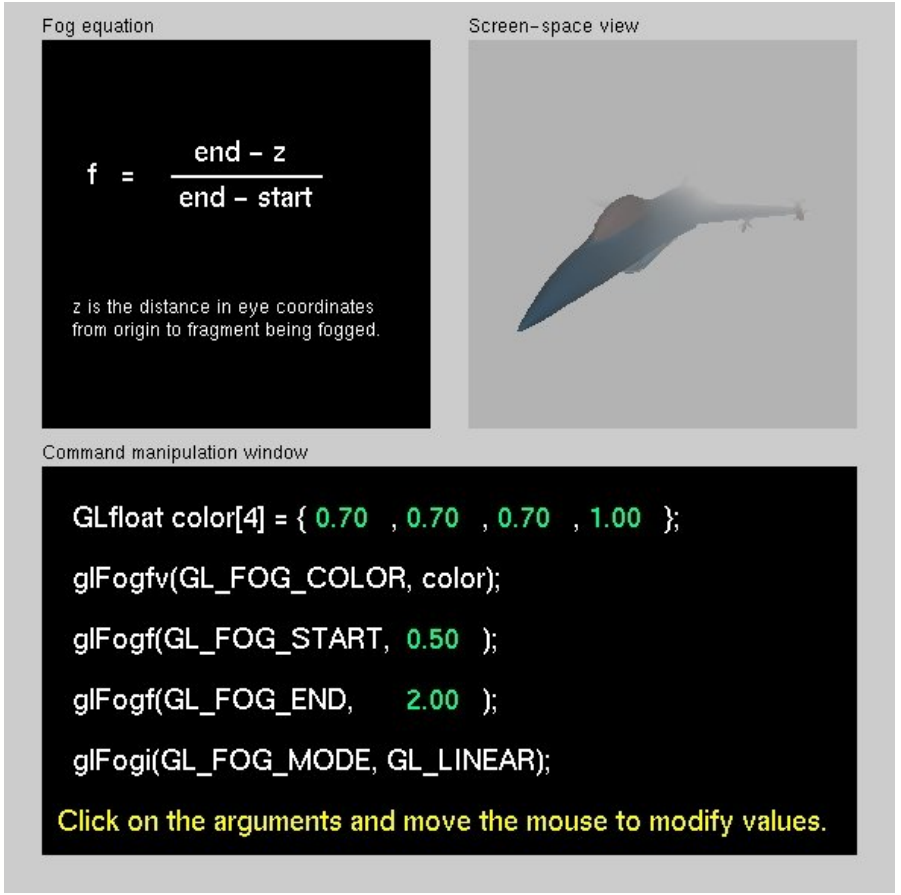
Module 7F
Fog

Fog

- Fog is a general term describing atmospheric effects such as haze, mist, smoke, or pollution
  - Objects in fog fade into the distance
  - Important feature in visual-simulation applications
    - Flight simulators
  - Can provide an additional depth cue
- Objects fade into a ‘fog color’ based on distance from the viewpoint
  - Similar to pixel blending, input color is blended with the fog color
- Fog is different than attenuation
  - Attenuation lowers intensity of lit objects based on distance from light sources
  - Fog blends a fog color with the input color based on distance from viewpoint
  - Black fog color would simulate attenuation form a light source at the viewpoint

Fog



Nate Robbins
OpenGL Tutorials
http://www.xmission.com/~nate/tutors.html

OpenGL Fog

- Enable and disable fog
  - **glEnable** (GL_FOG);
  - **glDisable** (GL_FOG);
- Set fog parameters
  - **glFog{if}** (GLenum pname, GLfloat param)
    - GL_FOG_MODE: GL_LINEAR, GL_EXP, and GL_EXP2
    - GL_FOG_DENSITY: Specifies the fog density used in both exponential fog equations. Must be >=0. Default = 1.0.
    - **GL_FOG_START: Specifies start, the near distance used in the linear fog equation. Default = 0.0.**
    - **GL_FOG_END: Specifies end, the far distance used in the linear fog equation. Default = 1.0.**
  - **glFog{if}v** (GLenum pname, const GLfloat *params)
    - GL_FOG_COLOR: **specify C_f, the fog color**
- Specify the accuracy (type) of fog calculation
  - **glHint** (GL_FOG_HINT, GLenum mode);
    - GL_NICEST The most correct, or highest quality, option should be chosen.
      - Per-pixel fog calculation (if supported by the OpenGL implementation)
    - GL_DONT_CARE or GL_FASTEST: Per-vertex calculation of fog effects.

OpenGL Fog

- Fog blends the fog color with the input object color using a fog blending factor f
  - Final color is: $C = fC_i + (1-f)C_f$
    - Ci is the input color, Cf is the fog color
  - f is calculated with one of 3 equations and is clamped to the range [0,1]
    - $f = e^{-(density \cdot z)}$ GL_EXP
    - $f = e^{-(density \cdot z)2}$ GL_EXP2
    - f = (end - z) / (end -start) GL_LINEAR
    - z is the distance from the viewpoint to the object in view coordinates
- Per vertex fog
  - Fog is applied after matrix transformations and lighting
    - Before projection and clipping
- Per pixel fog (if supported)
  - Blend a fog color into the post-texturing color
  - Needs to transform each pixel (at least the z value) back into view coordinates
    - Invert z viewport to get z_s from -1 to 1
    - Then using the inverse projection matrix r:

$$z_v = \frac{r[10]z_s + r[14]}{r[11]z_s + r[15]}$$