

# **Blending & Transparency**

**CSCI 4229/5229**

**Computer Graphics**

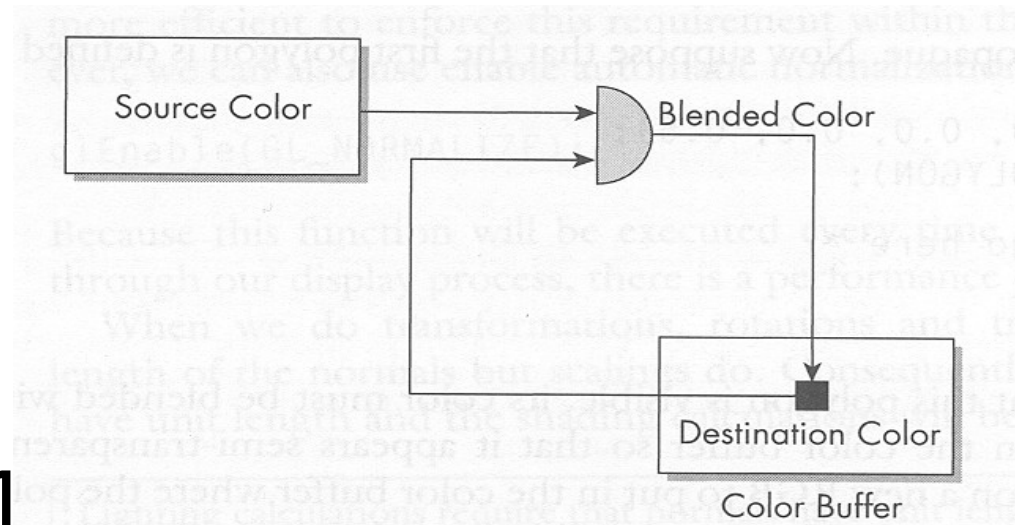
**Fall 2021**

# Blending Pixels

- Color (R,G,B, $\alpha$ ) (4x8 bits = 32 bit color)
  - $\alpha$  blending
  - $R_c = \alpha R_a + (1-\alpha)R_b$
  - $G_c = \alpha G_a + (1-\alpha)G_b$
  - $B_c = \alpha B_a + (1-\alpha)B_b$
- Uses
  - Transparency (1=opaque, 0=invisible)
  - Anti-aliasing
  - Transitions

# Blending in OpenGL

- `glEnable(GL_BLEND)`
- `glBlendFunc(source, destination)`
  - source (what we're drawing)  $\beta$
  - destination (what's there already)  $\gamma$
  - $R_c = \beta R_a + \gamma R_b$
  - $G_c = \beta G_a + \gamma G_b$
  - $B_c = \beta B_a + \gamma B_b$
  - $\alpha_c = \beta \alpha_a + \gamma \alpha_b$
- In general  $\beta + \gamma \neq 1$



# Source Factors ( $\beta$ )

- GL\_ZERO
- GL\_ONE
- GL\_DST\_COLOR
- GL\_ONE\_MINUS\_DST\_COLOR
- GL\_SRC\_ALPHA
- GL\_ONE\_MINUS\_SRC\_COLOR
- GL\_DST\_ALPHA
- GL\_ONE\_MINUS\_DST\_ALPHA
- GL\_SRC\_ALPHA\_SATURATE

# Destination Factors ( $\gamma$ )

- GL\_ZERO
- GL\_ONE
- GL\_SRC\_COLOR
- GL\_ONE\_MINUS\_SRC\_COLOR
- GL\_SRC\_ALPHA
- GL\_ONE\_MINUS\_SRC\_ALPHA
- GL\_DST\_ALPHA
- GL\_ONE\_MINUS\_DST\_ALPHA

# Blending Operations

- $GL\_ZERO = (0,0,0,0)$
- $GL\_ONE = (1,1,1,1)$
- $GL\_SRC\_COLOR = (R,G,B,\alpha)_S$
- $GL\_DST\_COLOR = (R,G,B,\alpha)_D$
- $GL\_ONE\_MINUS\_SRC\_COLOR = (1,1,1,1) - (R,G,B,\alpha)_S$
- $GL\_ONE\_MINUS\_DST\_COLOR = (1,1,1,1) - (R,G,B,\alpha)_D$
- $GL\_ONE\_MINUS\_SRC\_ALPHA = (1,1,1,1) - (\alpha,\alpha,\alpha,\alpha)_S$
- $GL\_ONE\_MINUS\_DST\_ALPHA = (1,1,1,1) - (\alpha,\alpha,\alpha,\alpha)_D$
- $GL\_SRC\_ALPHA = (\alpha,\alpha,\alpha,\alpha)_S$
- $GL\_DST\_ALPHA = (\alpha,\alpha,\alpha,\alpha)_D$
- $GL\_SRC\_ALPHA\_SATURATE = (f,f,f,1)$   $f = \min(\alpha_S, 1 - \alpha_D)$

# Mixing Objects

- First draw opaque objects
  - Make Z-buffer writable (`glDepthMask(1)`)
  - Set  $\alpha=1$  (but may not matter)
- Next draw translucent objects
  - Make Z-buffer readonly (`glDepthMask(0)`)
  - Set  $\alpha < 1$
  - `glBlendFunction(GL_SRC_ALPHA, GL_ONE)`
- Order (mostly) doesn't matter