CS130 : Computer Graphics
Lecture 17: Texture Mapping (cont.)

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Perspective correct interpolation
\[ u = \frac{1}{2} u_1 + \frac{1}{2} u_2 \]
Issue: to shade a fragment which is part of a textured triangle we need the barycentric coordinates of the fragment. These will be the weights for the weighted average of the vertex texture coordinates. However, after a perspective transformation, the relative distances inside the triangle have been distorted due to foreshortening. I need to get my weights based on object or world space coordinates.
Interpolation with screen space weights is incorrect

\[ u = \frac{1}{2} u_1 + \frac{1}{2} u_2 \]
Perspective correct interpolation

Using screen space weights looks wrong for textures

[Heckbert and Morton, 1990]

http://en.wikipedia.org/wiki/Texture_mapping#Perspective_correctness
Do we need to transform back to object space?

\[ u = \frac{1}{2} u_1 + \frac{1}{2} u_2 \]

Do we need to transform back to object space?

\[ v_{sc} = M_{vp} M_{pers} M_{cam} v \]
Do we need to transform back to object space?

NO!

\[ u = \frac{1}{2} u_1 + \frac{1}{2} u_2 \]
Perspective correct interpolation

- In assignment 1, we found barycentric coordinates in 2D screen space
- but not the correct object space barycentric coords
- these coordinates were okay for z-buffer test

\[ n = -1 \]
\[ f = -2 \]
Environment mapping
Environment Mapping

Use a texture for the distant environment to simulate the effect of ray tracing more cheaply.

[Diagram showing environment mapping with labels for skybox, reflected ray, normal, and camera ray]
Sphere Mapping

- Project objects in the environment onto sphere centered at eye
- Unwrap and store as texture
- Use reflection direction to lookup texture value

How is environment mapping different from ray tracing?
- Typically only the direction of the reflection vector is used to look up the texture value—this doesn’t reproduce the true intersection of the reflected ray the object it hits
- Note: realism of environment map degrades as model is displaced from where the textures were generated
Cube Mapping

- Compute six projections, one for each wall
- Store as texture
- Use reflection direction to lookup texture value
Different environment maps

- Blinn/Newell latitude mapping
- OpenGL spherical mapping
- Cube mapping

www.reindelsoftware.com
Environment Mapping

Create the effect of a mirror with two-pass rendering

1. First pass: render the scene from the perspective of the mirror
2. Second pass: render from original pov; use the first image as a texture for the mirror
Shadow Mapping

first pass from light’s perspective

1. render scene from pov of light and store z-buffer in a texture

2. render scene from desired pov, and test pixel against light’s z-buffer
Bump Mapping

- perturb normal vectors
- doesn’t affect silhouette