Johns Hopkins
Engineering for Professionals

605.767 Applied Computer Graphics

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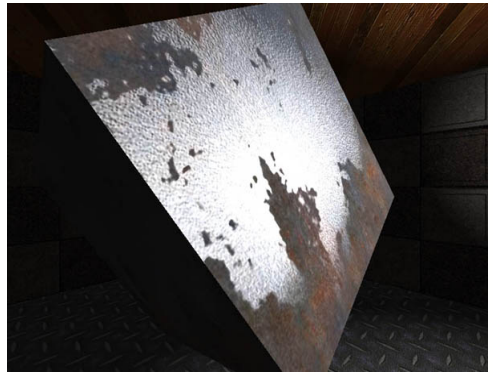
Module 9D
Material Mapping

Material Mapping

- Textures can be used to modify a material property affecting the shading equation
  - Objects often have properties that vary over the surface
  - Fragment shader can read texture values and use them in shading equation
- Diffuse color – diffuse color map
  - Most image textures supply “base” color - ambient+diffuse
    - Color modulated by light(s) intensity
- Specular color – generally a grayscale / single valued texture
  - Often called a gloss map
    - http://www.ozone3d.net/tutorials/glsl_texturing_p05.php



Specular Component Modulated with values from a Gloss Map.
Rusty parts of the surface do not appear shiny

Gloss Mapping

- Not all objects are uniformly shiny over their surface
  - **Gloss mapping** can approximate material property differences over a surface
    - Where some parts are shiny and some parts are dull
- Gloss mapping can approximate per-pixel specular component without per-pixel shading
  - Texture modulates specular contribution
  - Two pass (for non-shader apps.)
    - Apply diffuse component first (0,0,0 specular color)
    - Add in specular component (0,0,0 diffuse color) modulated by a single-channel texture
      - 1.0 - full specular contribution
      - 0.0 – no specular contribution

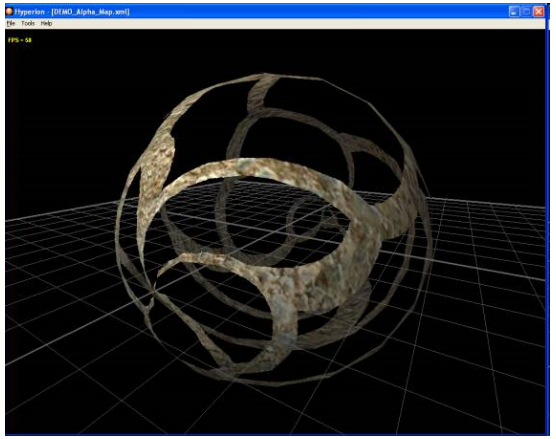
Alpha Mapping

- Use of alpha values in the texture (RGBA) to apply transparency
- Decaying
  - Applying only parts of a picture to an object
    - Text uses example of decaling a flower onto a teapot
    - Clamp texture and use a transparent border to apply a single decal
- Cutouts
  - Common example is a tree
    - Tree rendered as a single quadrilateral with tree texture
      - Transparent where tree is not present
    - Illusion fails if rotate view around the “tree” quadrilateral
      - Rotate 90 degrees along the trunk and draw again
      - Creates a 3D tree – often called a cross tree
        - Figure 6.28 (6.25 in 3rd Edition)
        - Not a bad representation when viewed from ground level
- Combining alpha blending and texture animation
  - Effects such as flickering torches, explosions, atmospheric effects

Texture Maps with Alpha

- STB Image supports loading images with an alpha channel
  - Load with format: STBI_grey
- Alpha maps can also be single-valued textures
  - Create areas that are drawn vs. totally transparent
  - http://www.ozone3d.net/tutorials/glsl_texturing_p05.php

Alpha map



```
uniform sampler2D colorMap;
uniform sampler2D alphaMap;
void main (void)
{
  vec4 alpha_color = texture(alphaMap, gl_TexCoord[0].xy);
  if(alpha_color.r<0.1) discard;
  gl_FragColor = texture(colorMap, gl_TexCoord[0].xy);
}
```