CMSC 635

Texturing

Texture map

- Map image onto surface
- Like applying a decal
- Variations
  - Use of texture results
  - How to map texture to surface

Use of texture results

- $C = C_b I_a + \sum I_L (C_b (N \bullet L) + C_s (N \bullet H)^e)$
  - C_b: Texture map
  - C_s: Gloss map
  - C_s, e: Material map
  - I_L: Light map

Bump mapping

- Height-field in texture: Bump map
- P ; $N = P_u \times P_v$; $N' = N/|N|$
- $P = P + f N'$
- $N = P_u \times P_v$
  - $= (P_u + f_u N' + f N'_u) \times (P_v + f_v N' + f N'_v)$
  - $= P_u \times P_v + f_u P_v \times N' + f_v P_u \times N' + f N'_u \times N'_v$
  - $\approx N + f_u U - f_v V$
  - $N' = N / |N|$

Embossed bump mapping

- $N \approx N + f_u U + f_v V$
  - $= N + \nabla f$
- $N \bullet L = N \bullet L + \nabla f \bullet L$ *(book stops here)*
- $N \bullet N = N \bullet N + \nabla f \bullet \nabla f$
- $N' \bullet L = (N \bullet L + \nabla f \bullet L) * 1/\mathrm{sqrt}(N \bullet N)$
  - Texture: f
    - diffuse + $f(u+L_u, v+L_v) - f(u-L_u, v-L_v)$
  - Texture: $1/\mathrm{sqrt}(N \bullet N)$

Normal map bump mapping

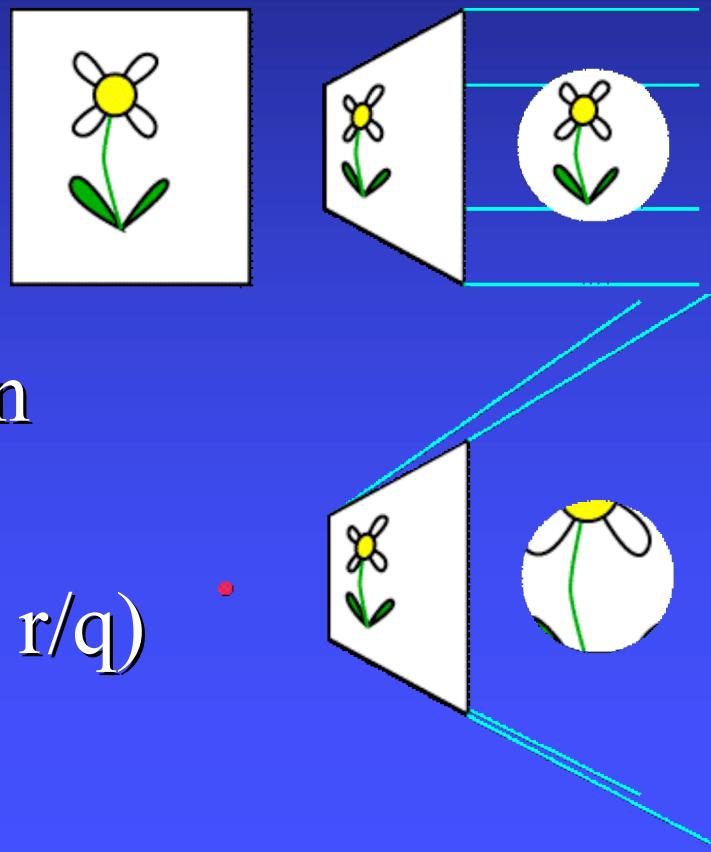
- Normal in texture: Normal map
  - Store N in object-space (N_o)
  - Xform N to world space after lookup
    - $(N_o\ M_{ow})\ L_w$
  - Or L to object space before
    - $N_o\ (M_{ow}\ L_w)$

Texture coordinate mapping

- *Texture coordinates* created with model
  - At each vertex
  - At each control point
- Direct mapping to texture image
  - tex(s,t) *(traditionally u,v or s,t)*
  - 3D textures: tex(s,t,r)

Position-based mapping

- Parallel projection
  - (s,t,r) = M P
  - Position P
  - Texture matrix M
- Perspective projection
  - (s,t,r,q) = M P
  - (s’,t’,r’) = (s/q, t/q, r/q)



Two-stage mapping

- Direct mapping + projection
  - Direct map onto simple object
  - Project from simple object to real object
- Cylindrical projection
  - $s = \text{atan2}(y, x)/2\pi$
  - $t = z$
- Spherical projection
  - $s = \text{atan2}(y, x)/2\pi$
  - $t = \text{atan2}(\text{sqrt}(x^2+y^2), z)$

Cool things with perspective

- Slide projector
- Light profile
  - Light map + projection
- Shadow map
  - Covered in detail next time