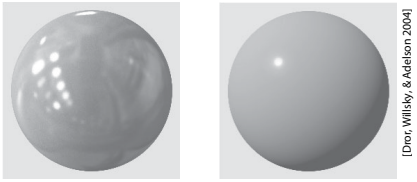
Cornell University CS 569: Interactive Computer Graphics

Reflections and environments

Lecture 6

Reflection mapping

- Early (earliest?) non-decal use of textures
- Appearance of shiny objects
  - Phong highlights produce blurry highlights for glossy surfaces.
  - Does making the highlight smaller make the surface look shiny?
  - A polished (shiny) object reflects a sharp image of its environment.
- The whole key to a decent-looking shiny material is providing something for it to reflect.



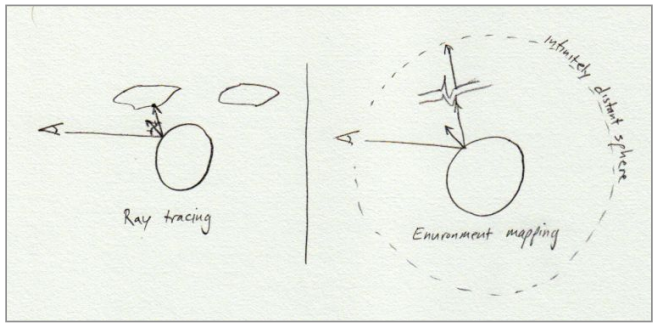
[Dror, Willsky, & Adelson 2004]

(a) (b)

Figure 2. (a). A shiny sphere rendered under photographically acquired real-world illumination. (b). The same sphere rendered under illumination by a point light source.

Reflection mapping

- From ray tracing we know what we'd like to compute
  - trace a recursive ray into the scene—too expensive
- If scene is infinitely far away, depends only on direction
  - a two-dimensional function



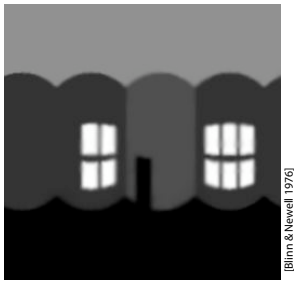
Environment map

A function from the sphere to colors,
stored as a texture.

[Blinn & Newell 1976]

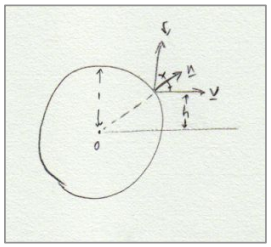
Environment map parameterization

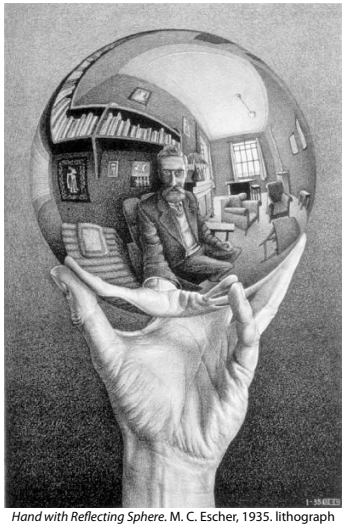
- Spherical coordinates
  - Blinn & Newell's original approach
- Pro
  - straightforward
  - view independent
- Con
  - slow coordinate calculation (exercise)
  - bunching up at poles



[Blinn & Newell 1976]

Environment map parameterization

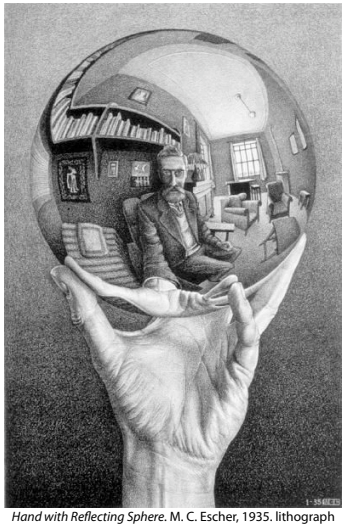




Hand with Reflecting Sphere. M. C. Escher, 1935. lithograph

Environment map parameterization

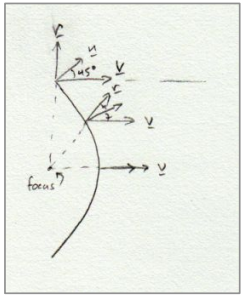
- Sphere map
- Pro
  - single texture—no seams
  - singularity hidden at back
  - capture via photography
- Con
  - view dependent
  - very nonlinear and nonuniform sampling



Hand with Reflecting Sphere. M. C. Escher, 1935. lithograph

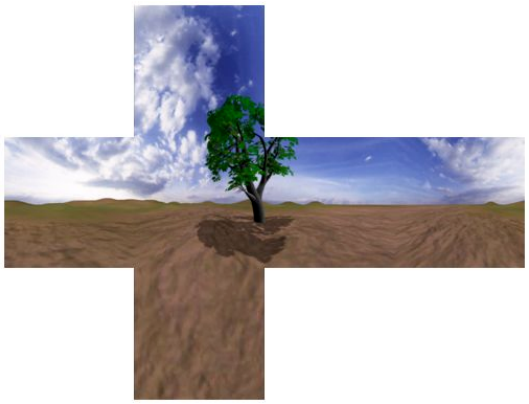
Environment map parameterization

- Paraboloid map
- Pro
  - simple mapping
  - more uniform than sphere
- Con
  - awkward distortion required



Environment map parameterization

- Cube map
- Pro
  - simple, efficient
  - view independent
  - reasonably uniform
  - standard projection
- Con
  - cumbersome?



[Ned Greene]

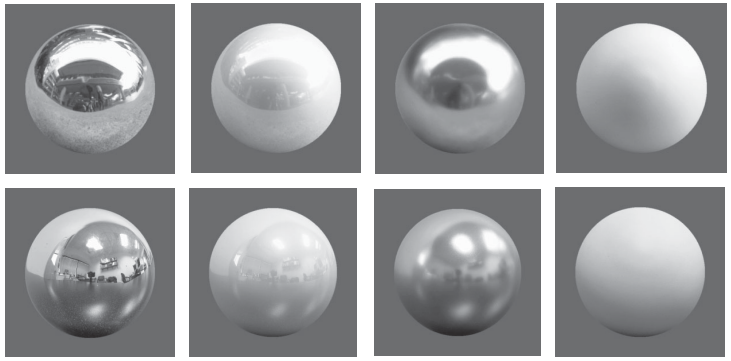
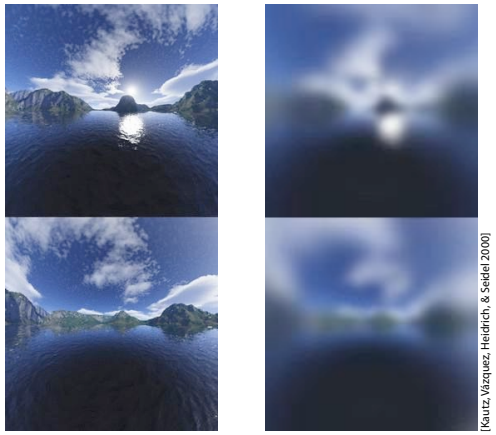
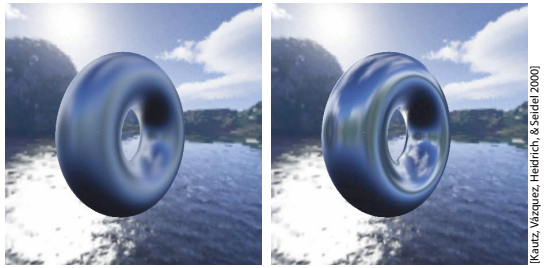


Figure 4. The two images in each column are photographs of the same sphere. The four images in each row were photographed in the same location, under the same illumination.

[Dror, Willsky, & Adelson 2004]

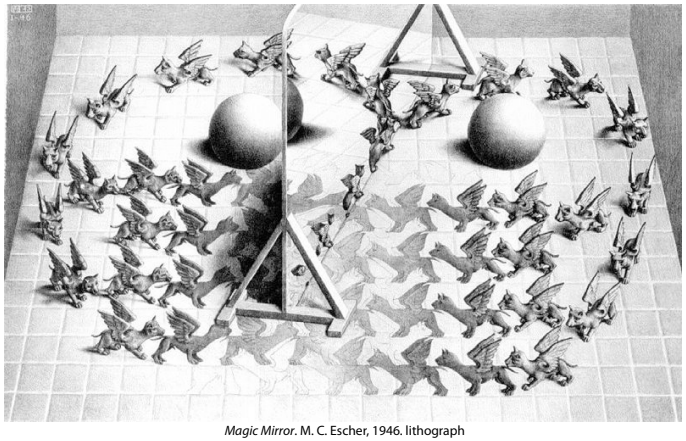


[Kautz, Vázquez, Heidrich, & Seidel 2000]



[Kautz, Vázquez, Heidrich, & Seidel 2000]

Planar reflections



Magic Mirror. M. C. Escher, 1946. lithograph

