Lighting and Shading

Motivations

Approximate physical reality

Radiosity: Restaurant interior: Guillermo Leal, Evolution

Lighting and Shading

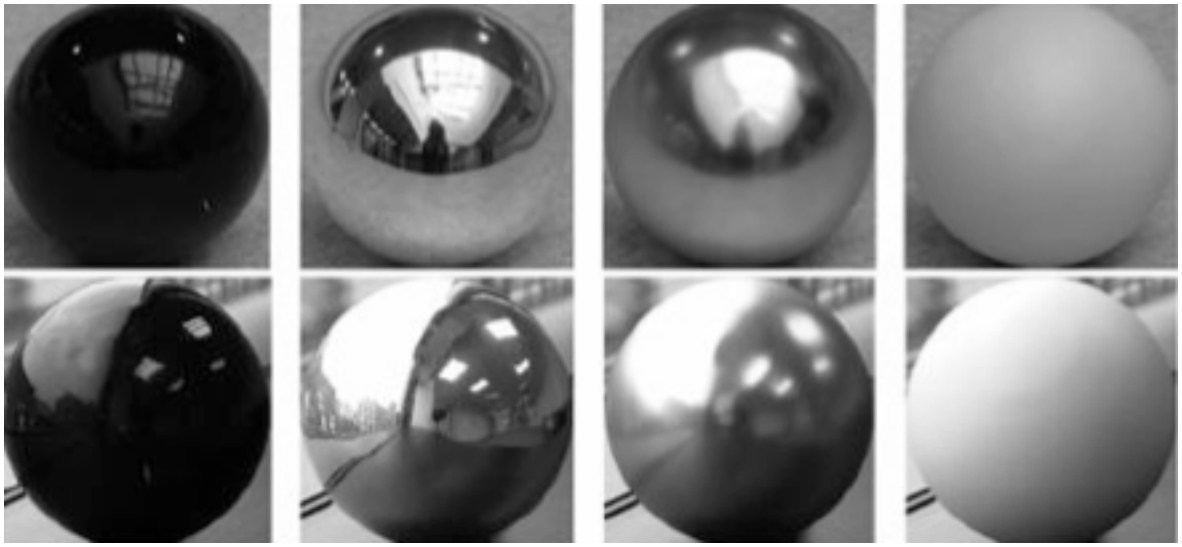
- Phong illumination model (this lecture)
  - Approximate only interaction light, surface, viewer
  - Relatively fast (online), supported in OpenGL
- Ray tracing (later this semester)
  - Follow light rays through a scene
  - Accurate, but expensive (off-line)
- Radiosity (advance CG)
  - Calculate surface inter-reflection approximately
  - Accurate, especially interiors, but expensive (off-line)

Raytracing example

Martin Moeck, Siemens Lighting

Shading

- Variation in observed color across an object
  - Strong affected by lighting
  - Present even for homogeneous material
- Caused by how a material reflects lights
  - Geometry
  - Light source, locations, and properties
  - Material properties

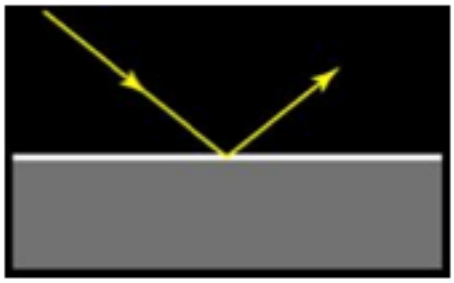


Shading for Computer Graphics

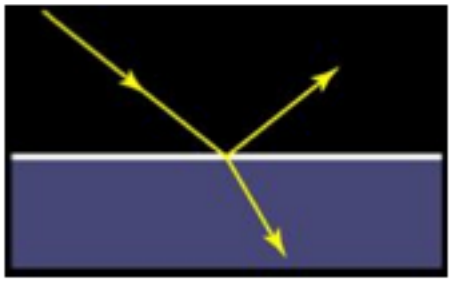
- Need to compute shading
  - Of particular geometry
  - Under particular illumination
  - From a particular viewpoint
- Basic question: how much light reflects from an object toward the viewer?

Simple materials

metal

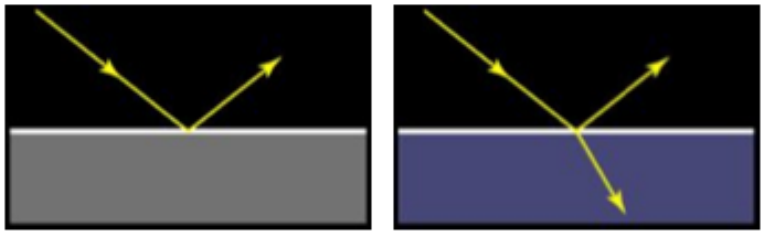


dielectric

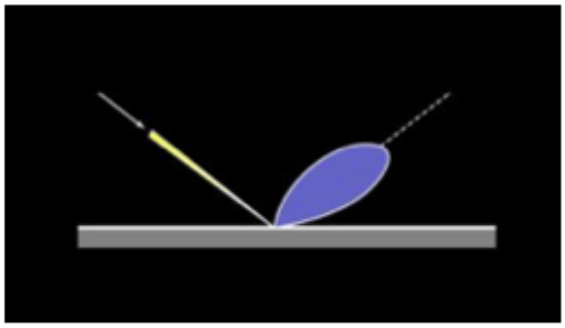


Smooth surfaces of pure materials have ideal specular reflection
Reflectance (fraction of light reflected) depends on angle)

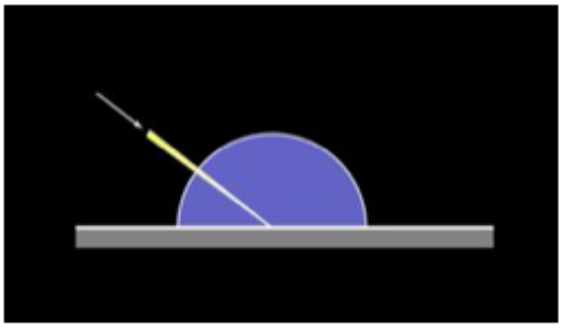
Classic reflection behavior



ideal specular (Fresnel)



rough specular



Lambertian

Adding microgeometry