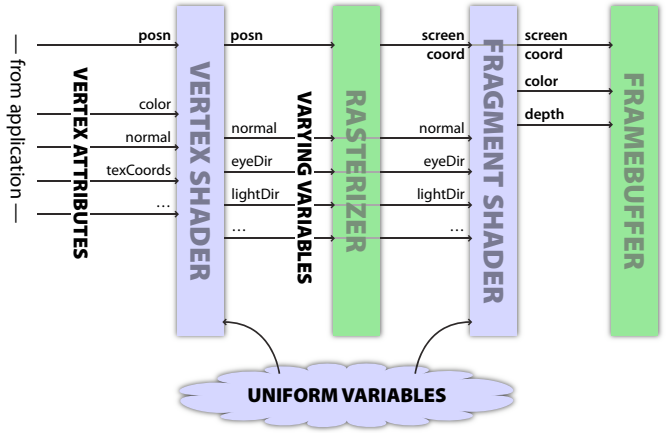
Cornell University CS 569: Interactive Computer Graphics

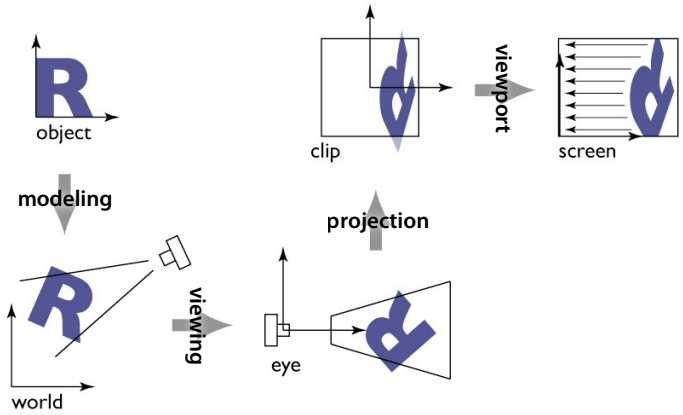
Shaders and shading models

Lecture 2

Basic programmable shading pipeline



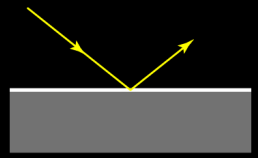
Review: pipeline transformations

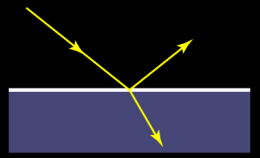


Simple materials

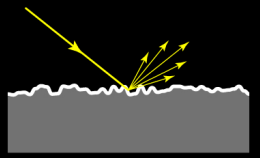
metal

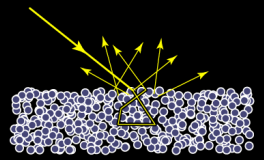
dielectric



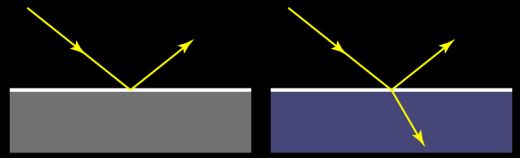


Adding microgeometry

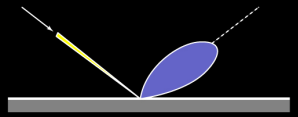




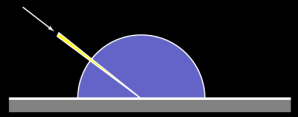
Classic reflection behavior



ideal specular (Fresnel)



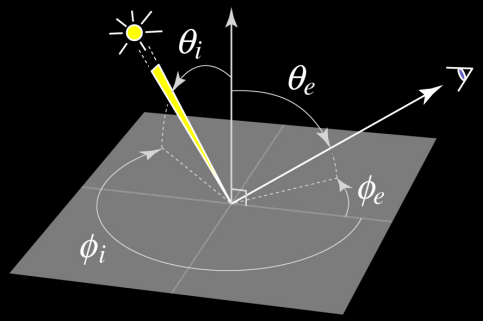
rough specular



Lambertian

Surface scattering

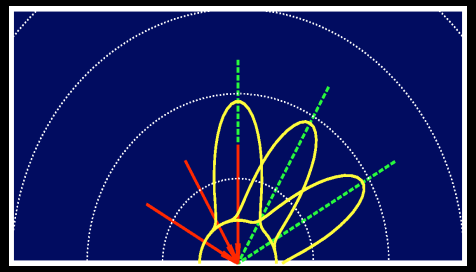
(opaque: BRDF)



$f_r(\theta_i, \phi_i, \theta_e, \phi_e)$

The Phong Model

- Computationally simple
- Visually pleasing



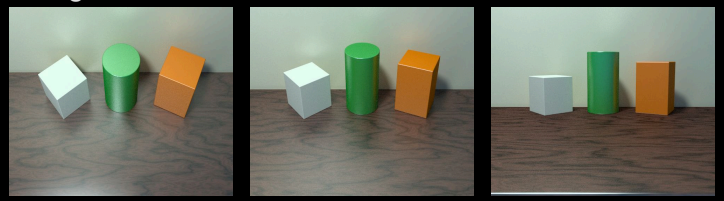
Phong: Reality Check

Real photographs

Phong: Reality Check

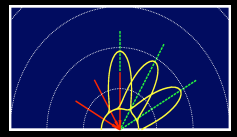
Real photographs

Phong model

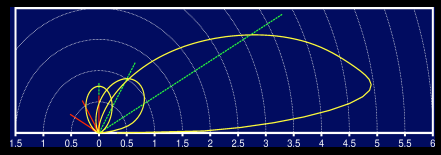


Phong: Reality Check

Phong model



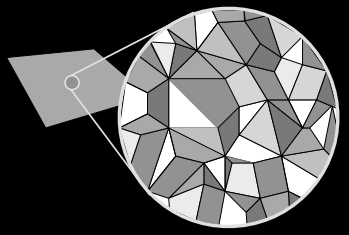
Physics-based model



- Doesn't represent physical reality
  - –energy not conserved
  - –not reciprocal
  - –maximum always in specular direction

Cook-Torrance BRDF Model

- A *microfacet* model
  - –surface modeled as random collection of planar facets
  - –an incoming ray hits exactly one facet, at random
- Key input: probability distribution of facet angle

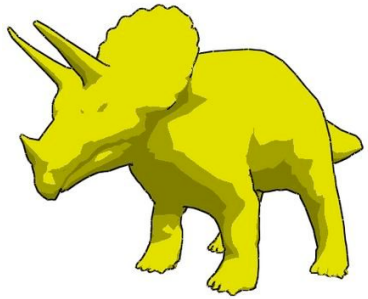


Cook-Torrance BRDF Model

- "Specular" term (really directional diffuse)

$$R_s = \frac{F}{\pi} \frac{DG}{(N \times L)(N \times V)}$$

Toon shading



[postulate.org]

