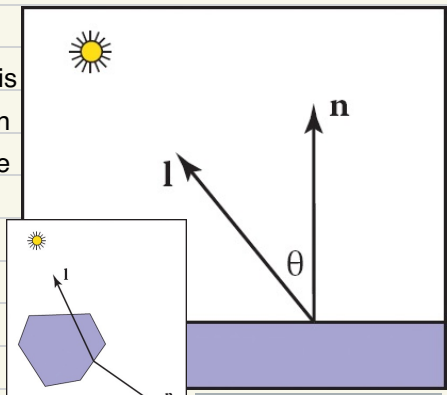
Chapter 10 - Surface Shading

shading - surface “painted” with light

1. Diffuse Shading

Lambertian object - no colour change with viewpoint change

1.1. Lambertian Shading Model



Lambert’s cosine law - colour c of the surface is proportional to the cosine of the angle between surface normal and direction to the light source

$c \propto \cos \Theta$, vector form: $c \propto n \cdot l$

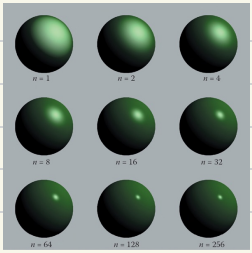
l - directional light; position only by direction

cr - fraction of light reflected by surface (RGB)

cl - light source intensity(RGB)

$c = cr\ cl\ n.l$ (RGB), however $n \cdot l < 0$ ->

=> $c = cr\ cl \max(0, n.l)$



1.2. Ambient Shading

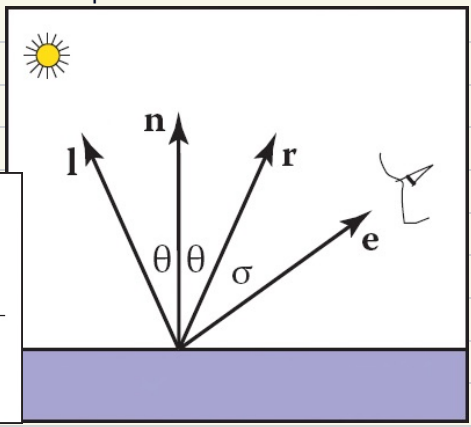
$c = cr\ (ca + cl \max(0, n.l))$

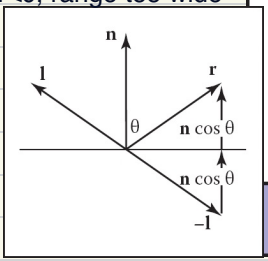
ca - ambient light (RGB); $ca + cl <= (1,1,1)$

2. Phong Shading

highlights (reflections) - move across a surface as viewpoint moves

2.1. Phong Lighting Model





e = r - highlight point

$c = cl\ (e.r)$, however $e.r<0$, range too wide

=> $c = cl \max(0, e.r)^p$

p - Phong exponent

$r = -1 + 2\ (l.n)\ n$

h = (e+l) / ll e+l ll

c = cl (h.n)^p

=> c = cr (ca + cl max(0, n.l)) + cl (h.n)^p

c = cr (ca + cl max(0, n.l)) + cl cp (h.n)^p

cp - control term; allows dimming highlight (RGB)

metal: cp = cr

cp - neutral value, s.t. cl cp <= (1,1,1)

cp = 1 - M, M - max component of cr