

Shading

Feb 18

Diffuse Shading

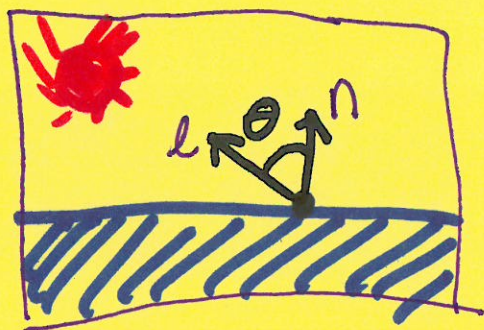
-ex: paper, unfinished wood (not shiny)

Lambert's cos law

$$\text{color} \sim \cos \theta$$

$$C \sim n \cdot l$$

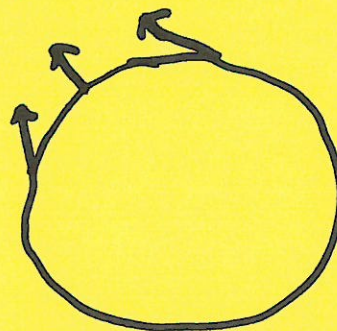
color for next few lectures



"directional light"



the right
idea



not right idea

Shading

Diffuse Shading
- ex: paper, unpainted wood

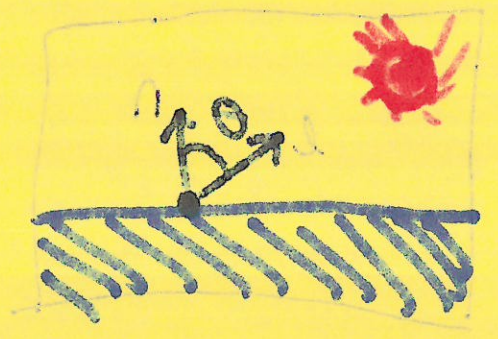
(not shiny)

Lambert's cos law

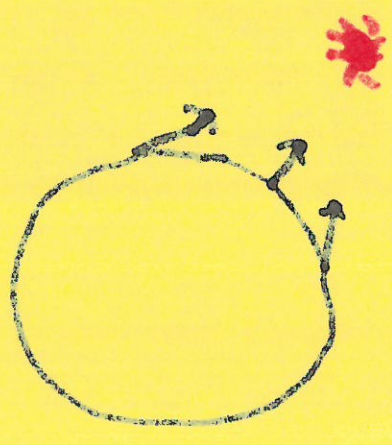
color in cos θ

$\sim \cos \theta$

color for rest of sphere



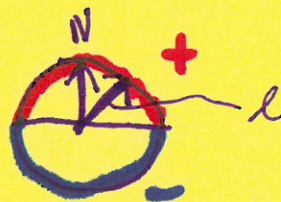
"directional light"



the light
color

not reflect color

Feb 18



$n \cdot l > 0 \Rightarrow$
facing light

$n \cdot l < 0 \Rightarrow$
not facing light

Diffuse reflectance

$$C_r \in [0, 1]$$

$$C \sim C_r * n \cdot l$$

normal at some point on surface

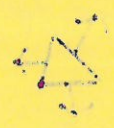
direction of the light source

material property

add light intensity $c_l \in [0, 1]$

$$C = C_r c_l n \cdot l$$





not for law
 $\mu \neq 0 \Rightarrow$
 for light
 $\mu = 0 \Rightarrow$

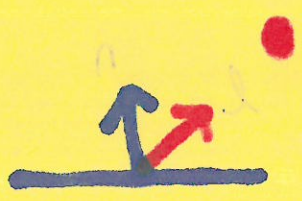
Electric reflection

$$C \in [0, 1]$$

level of our hand on surface

direction of the light source

vertical
 light



add light intensity $C \in [0, 1]$

$$C = C_{\text{ref}} \cdot \mu$$

"Real" ~~diffuse~~ reflectance

$$C = C_r \otimes C_e * \max(0, n \cdot l)$$

$$= \begin{bmatrix} C_{r, \text{red}} \\ C_{r, \text{green}} \\ C_{r, \text{blue}} \end{bmatrix} \otimes \begin{bmatrix} C_{e, \text{red}} \\ C_{e, \text{green}} \\ C_{e, \text{blue}} \end{bmatrix} * \max(0, n \cdot l)$$

$$= \begin{bmatrix} C_{r, \text{red}} * C_{e, \text{red}} \\ C_{r, \text{green}} * C_{e, \text{green}} \\ C_{r, \text{blue}} * C_{e, \text{blue}} \end{bmatrix} * \max(0, n \cdot l)$$

constant \neq diff. \neq rel.

$$C = C_1 \otimes C_2 + \max(0, v_1)$$

$$(l, n, 0)_{\text{mem}} \otimes \begin{bmatrix} C_1 \cdot v_1 \\ C_2 \cdot v_2 \\ C_3 \cdot v_3 \end{bmatrix} \otimes \begin{bmatrix} C_1 \cdot v_1 \\ C_2 \cdot v_2 \\ C_3 \cdot v_3 \end{bmatrix} =$$

$$(l, n, 0)_{\text{mem}} \otimes \begin{bmatrix} C_1 \cdot v_1 + C_1 \cdot v_1 \\ C_2 \cdot v_2 + C_2 \cdot v_2 \\ C_3 \cdot v_3 + C_3 \cdot v_3 \end{bmatrix} =$$

Add ambient lighting

Let c_a be ambient term

$$C = C_r (c_a + c_e \max(0, n \cdot l))$$

Problem C may be greater than 1

1) C clamp between $[0, 1]$

2) $c_a + c_e \leq (1, 1, 1)$

all constant lighting

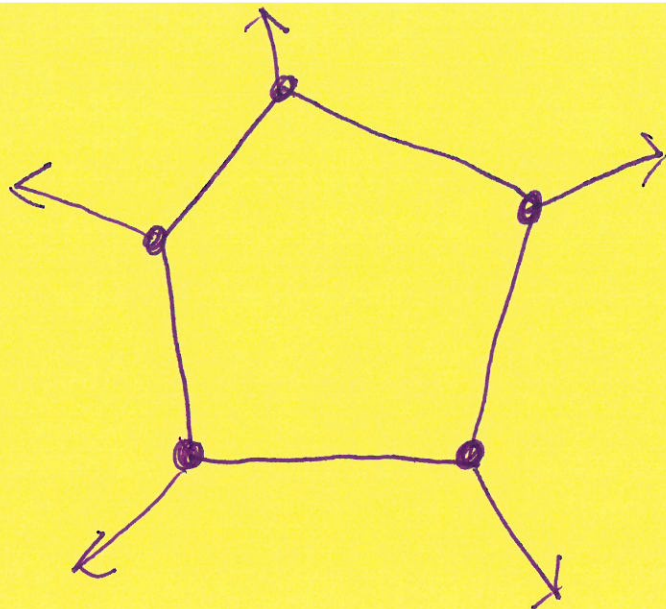
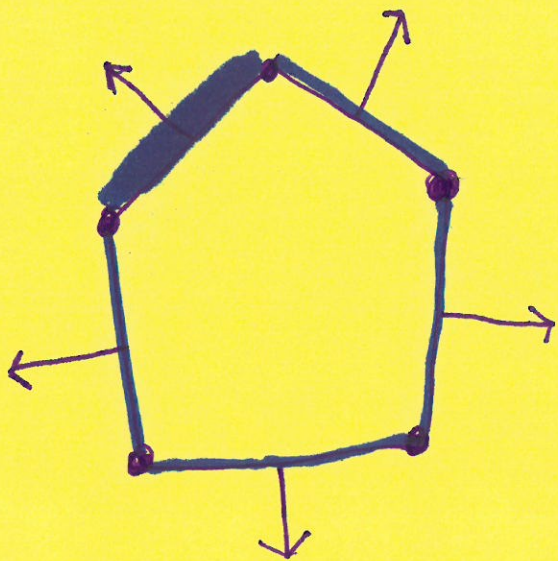
let C_1 be constant term

$$C = C_1 (C_1 + C_2 \max(0, u_1))$$

problem C may be greater than 1

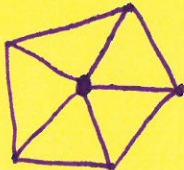
if C has between $[0, 1]$

$$C_1 + C_2 \max(0, u_1) \in (1, 1)$$



How do I get normals?

1) model comes w/ one

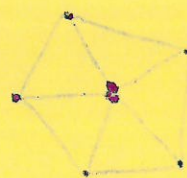
2)  (heuristic) average of normals of Δ s in fan around vertex

3) if model is Δ tion of smooth surface
compute from the surface



How do I get vertices
 (I will use it one)

to draw a graph (ordered)
 it is for each vertex



(2)

if it will be a graph of 3 vertices
 complete from the vertices