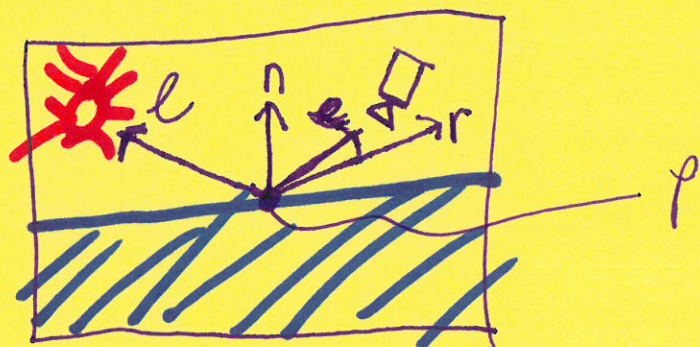


Phong Shading

02/20/2020



1st approx of modeling a highlight
color of light C_l reflected across normal
 $C = C_l (e \cdot r)$ reflected light vector
vector from point p to camera

problems

1. $(e \cdot r)$ may be neg $\Rightarrow C$ could be neg
fix $C = C_l \max(e \cdot r, 0)$

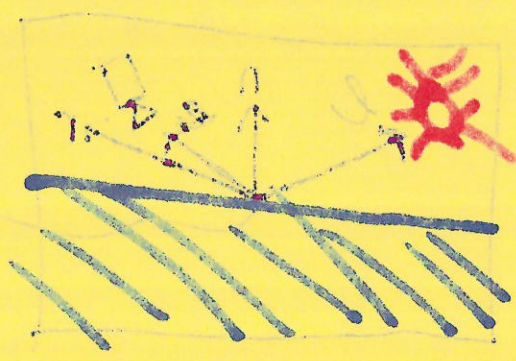
2. highlight is much bigger than in reality

fix Phong exponent $p \in \mathbb{R}^+$

$$C = C_l * [\max(e \cdot r, 0)]^p$$

05/20/2020

9/10/2020

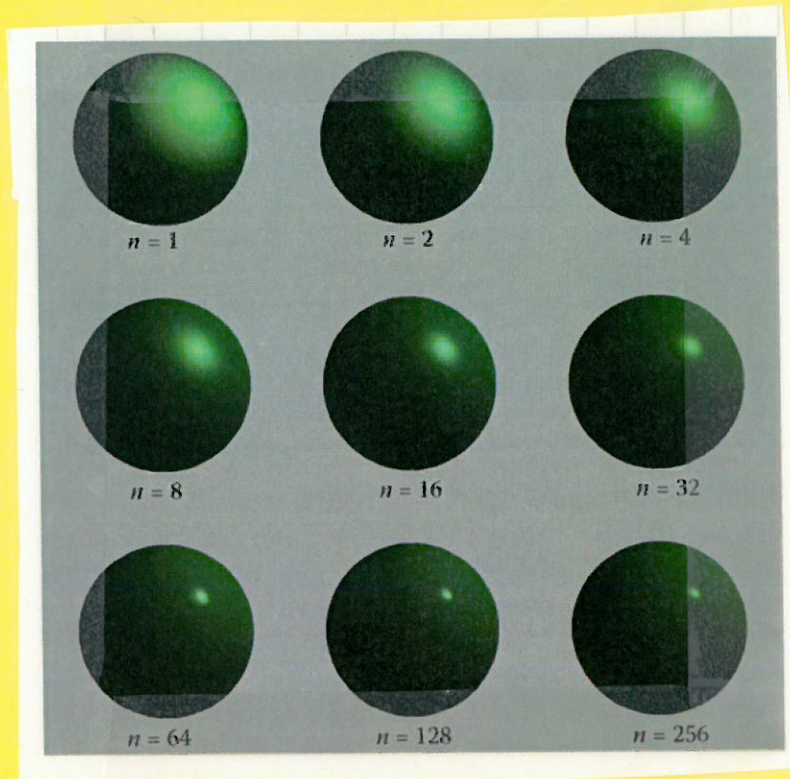


Effect of working in light
 Color of light
 $C = C_0 \cos^2 \theta$
 where θ is the angle

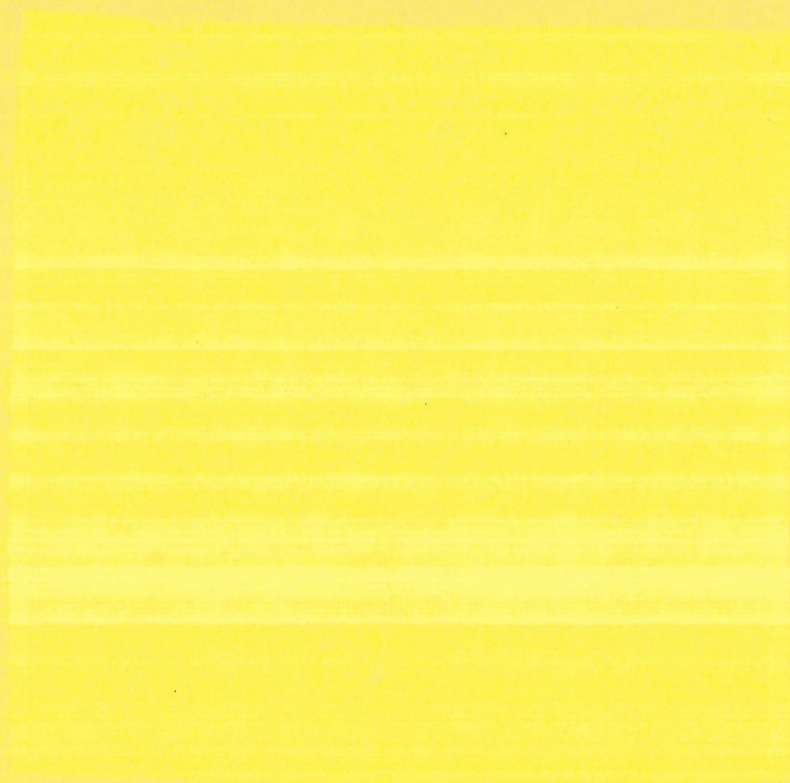
problem
 1. (a) not to use C could be up
 for $C = C_0 \cos^2 \theta$

3. light is much better than in reality
 for good exposure
 $C = C_0 \cos^2 \theta$

phong exponent



6/10/19
6/10/19



Put it together

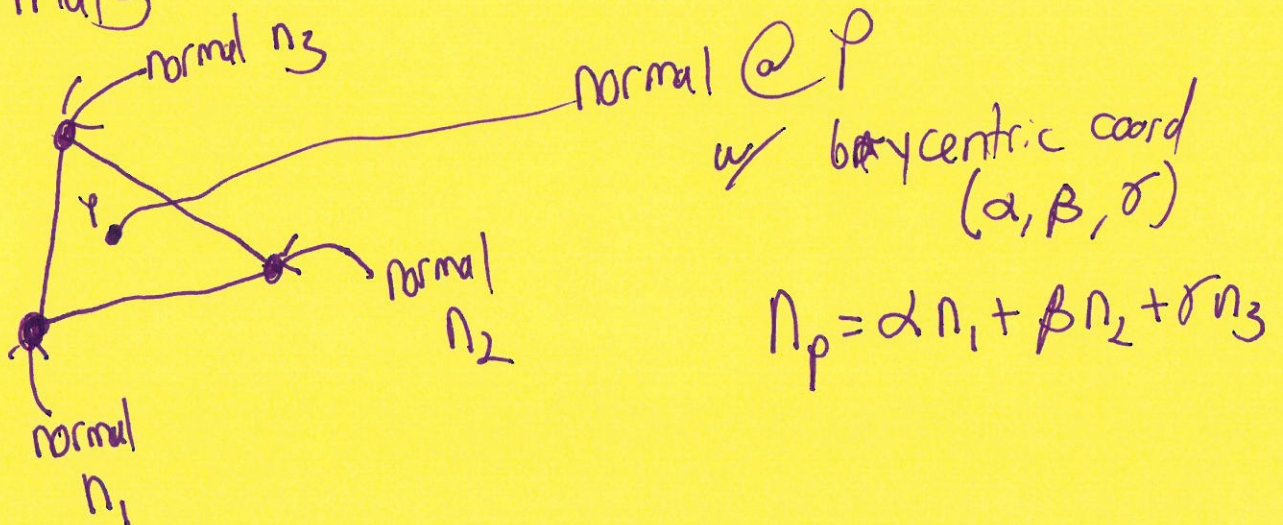
- compute r

$$r = -l + 2(l \cdot n)n$$

Combine w/ diffuse & ambient

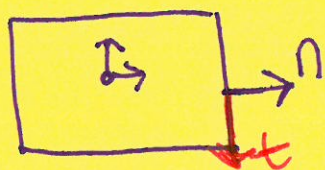
$$C = C_r (C_a + C_e * \max(0, n \cdot l)) + C_e \max(0, e \cdot r)^p$$

Normals

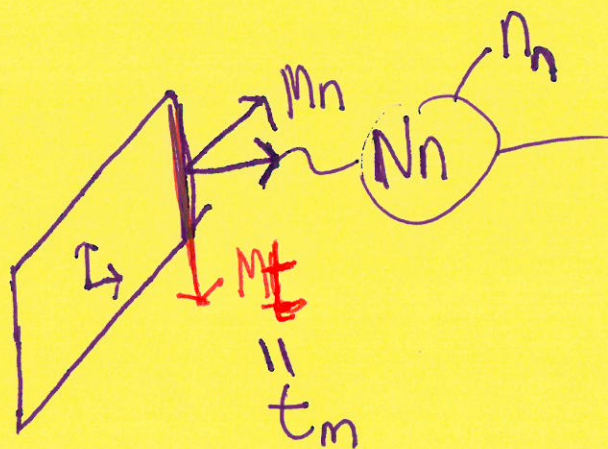


Transforming normals:

Surface normal:
a vector that is \perp
to tangent plane



M
as
a "selection
transform"



what is
the N
matrix
that is
our transform

Derive N

— surface normal \vec{n}
and tangent \vec{t} are $\perp \Rightarrow \vec{n}^T \vec{t} = 0$

— want to find $\vec{n}_n^T \vec{t}_m = 0$

Observe:

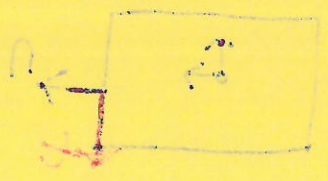
~~below I'll write as~~

$$0 = \vec{n}^T \vec{t} = \vec{n}^T \vec{I} \vec{t} = \vec{n}^T (\vec{M}^{-1} \vec{M}) \vec{t} = (\vec{n}^T \vec{M}^{-1}) (\vec{M} \vec{t})$$

$$= (\vec{n}^T \vec{M}^{-1}) \vec{t}_m = 0$$

Time-varying magnetic fields

Surface normal: \hat{n}
 a vector that is \perp to the surface of the loop



if \vec{B} is parallel to \hat{n} , then $\vec{B} \cdot \hat{n} = B$
 if \vec{B} is perpendicular to \hat{n} , then $\vec{B} \cdot \hat{n} = 0$



if \vec{B} is parallel to \hat{n} , then $\vec{B} \cdot \hat{n} = B$
 if \vec{B} is perpendicular to \hat{n} , then $\vec{B} \cdot \hat{n} = 0$

Since \vec{B} is parallel to \hat{n} , then $\vec{B} \cdot \hat{n} = B$

and tangent \vec{t} are \perp to surface normal \hat{n} —
 want to find $\oint \vec{B} \cdot d\vec{l}$

~~as $\vec{B} \cdot d\vec{l} = B dl \cos 90^\circ = 0$~~

$$(\oint \vec{B}) \cdot \hat{n} = \oint (\vec{B} \cdot \hat{n}) = \oint B = 0$$

$$0 = \oint \vec{B} \cdot d\vec{l} = \oint \vec{B} \cdot \hat{n} dl = \oint B dl = 0$$

$$n_n^T = n^T M^{-1}$$

$$\Leftrightarrow n_n = (n^T M^{-1})^T = (M^{-1})^T n$$

IV looking for before

IV written as cofactor matrix

$$N = \begin{bmatrix} m_{11}^c & m_{12}^c & m_{13}^c \\ m_{21}^c & m_{22}^c & m_{23}^c \\ m_{31}^c & m_{32}^c & m_{33}^c \end{bmatrix} = \begin{bmatrix} m_{22}m_{33} - m_{33}m_{22} & m_{23}m_{31} - m_{31}m_{23} & m_{21}m_{32} - m_{32}m_{21} \\ m_{13}m_{32} - m_{12}m_{33} & m_{11}m_{33} - m_{13}m_{31} & m_{12}m_{31} - m_{11}m_{32} \\ m_{12}m_{23} - m_{13}m_{22} & m_{13}m_{21} - m_{11}m_{23} & m_{11}m_{22} - m_{12}m_{21} \end{bmatrix}$$

$$M^T A = A^T$$

$$A^T (M^T)^T = (M^T A)^T = A^T \quad \text{Q.E.D.}$$

not needed if
before

written as column matrix

$$= 11$$