Lighting and Shading 2

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Textbook 14

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Today

- Announcements
  - Assignment 3 is available, at the usual place
- Assignment 3 demo
- Phong reflection model
- Blinn-Phong reflection and the halfway vector
- Odds and ends

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Note about Assignment 3

- This assignment has a slightly different flavor from the previous two
  - This is mostly classical OpenGL material. Simple and lots of sample code available on the Web. Please do look at this code, but implement it yourself so that you really understand what's going on
  - Grading will focus on whether you understand the parts you implemented
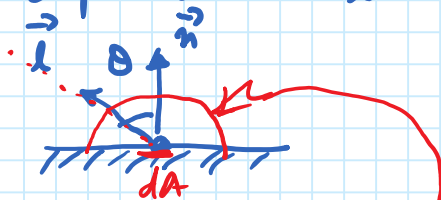
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Switch to tablet

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Phong Reflection Model

Diffuse

Perfectly Rough Surface   "Lambertian" Surface

Intensity of viewed light is independent of $\vec{v}$ but dependent on $\vec{l}$

Intensity of reflected light

$$g = \vec{l} \cdot \vec{n}$$

$$= |\vec{l}| |\vec{n}| \cos\theta$$

$$= \cos\theta \quad \text{if these are unit vectors.}$$
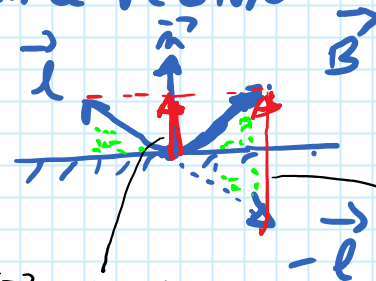
To avoid $-ve$ light

$$g = \max(0, \cos\theta)$$

Specular

"shiny part"

Intensity depends on both $\vec{l}$ and $\vec{v}$

Mirror direction

$B(l)$ "bounce" vector

Specular Reflection Lobe

Bounce vector

$(\vec{l} \cdot \vec{n}) \vec{n}$

$-\vec{l}$

$$\boxed{\vec{B} = -\vec{l} + 2(\vec{l} \cdot \vec{n})\vec{n}}$$

aside
$$= -l + 2 n n^T l$$
$$= [-I + 2 n n^T] l$$
$\underbrace{\qquad}_{3 \times 3 \text{ matrix}}$

To model dependence on $\vec{v}$ simplest idea

$\vec{n}$

$\alpha > \underline{1}$

$\vec{B}$

$\vec{v}$ view
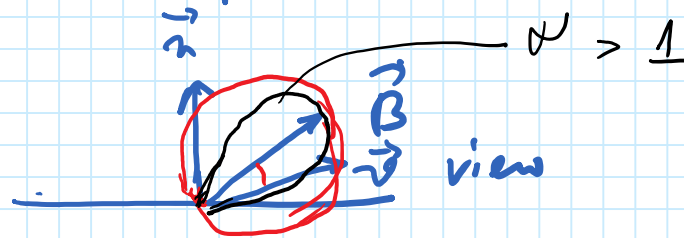
Idea 1: $S = \vec{B} \cdot \vec{v}$

Idea 2: $S = \left(\vec{B}(\hat{\imath}) \cdot \vec{v} \right)^{\alpha}$

α is called the "shininess exponent"

Demo

- https://threejs.org/docs/scenes/material-browser.html#MeshPhongMaterial

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Lighting and Shading
odds and ends

- Phong shading vs. Gouraud shading
  - Gouraud == per-vertex normals and illumination. Interpolate vertex colors to fragments
  - Phong == Interpolate vertex normals, per-fragment illumination
- Phong reflection vs. Phong shading
  - P. reflection == an approximation of BRDF, into specular + diffuse + ambient
- Global illumination and ambient
  - Ambient term is a crude approximation of global illumination

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