Vertex to Pixel

A brief introduction
Textbook Chapter 12

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Announcements

- Assignment 2 deadline extension to Sunday 22 (but do not expect TAs or me to respond on the weekend)
- Signup sheet will be available early next week
Path from vertex to pixel

Rasterization

- This is part of the fixed function pipeline
- There are very clever and sophisticated algorithms underneath the hood, but most users just set a few knobs using OpenGL function calls
- We will skip these issues for now, with the goal of getting to the fun topic of lighting asap!
- We may return to some of these issues at the end of the course, if we have time
Today: Modeling Material Appearance

- Rich variety of materials: characterized by surface reflectance and scattering
Shading and Lighting

Interaction of light with objects. Essential for perceiving 3D shape.

A simple mathematical model of reflectance

What affects the visible color of an object?

- Reflectance
- View vector
- Light vector
- Surface normal

A simple representation of color, represented in a “basis” of 3 colors

\[
\begin{pmatrix}
\text{Red} \\
\text{Green} \\
\text{Blue}
\end{pmatrix}
\]

Each component is a float \([0, 1]\)

Each color channel can be treated independently.
Light blob from PVC plastic

- PVC blob
  - Note that this figure just describes the result of light that comes in from the specific shown direction $\vec{I}$. For other incoming directions we would need a different blob to visualize the resulting scattering.
  - The plastic will appear brightest when observed in the directions clustered about the ‘bounce’ direction of the light: $B(\vec{I})$

Recall: Given any vector $\vec{w}$ (not necessarily of unit norm) and a unit normal vector $\vec{n}$, we can compute the bounce vector (mirror reflection) of $\vec{w}$ as

$$B(\vec{w}) = 2(\vec{w} \cdot \vec{n})\vec{n} - \vec{w}$$
Experimental data suggest reflection depends on both \( \mathbf{l} \) and \( \mathbf{v} \).

"Bidirectional Reflectance Function" (BRDF)

A common approximation: Phong Reflection Model

\[
\text{Ambient} + \text{Diffuse} + \text{Specular}
\]

\[
\text{depends on } \mathbf{l} \quad \text{but not on } \mathbf{v}
\]

Demo: experiment with different settings in this page

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