Why High-Quality Rendering?
Product Design

http://www.keyshot.com/gallery/
Automotive Design

Architecture

http://www.indigorenderer.com/images/minotti-room-1?size=_original
Architecture

http://www.impulse-arts.org/portfolio/wochenendhaus/#prettyPhoto[gallery]/1/
Movies / Entertainment

Pixar
Food

http://bertrand-benoit.com/blog/2012/09/22/bits-of-bread/
Offline Rendering

- Maximize quality, don’t take too much time
  - “Too much” is a slightly fuzzy limit

Interactive Rendering

- Maximize quality subject to never taking more than $x$ time
  - Time budget must essentially never ever be breached

Battlefield 3 (EA/DICE)
Blinn’s Law

“As technology advances, rendering time remains constant”

Voyager 2 Saturn Flyby (1981)
http://www.youtube.com/watch?v=SQk7AFE13CY
Blinn’s Law In Action
Two Options for Improving Quality / Time

- Increase quality
  - More accurate modeling of the physics of light

- Reduce time
  - More efficient algorithms
    - Especially numeric
  - Software optimizations, parallelism

Working to innovate in this space is the heart of what makes rendering so interesting (to me).
Four Pillars of Rendering

- Physics
- Math
- Algorithms
- Systems / Performance
Live Demo
Foundations of High-Quality Rendering

- Visibility algorithms and managing geometric complexity

PantaRay: Fast Ray-Traced Occlusion Caching of Massive Scenes
Pantaleoni et al., SIGGRAPH 2010
Foundations of High-Quality Rendering

- Modeling surface reflection

Ray-Based Reflectance Model for Diffraction
Cuypers et al., SIGGRAPH 2012

Building Volumetric Appearance Models of Fabric using Micro CT Imaging
Zhao et al., SIGGRAPH 2011
Foundations of High-Quality Rendering

- Modeling complex surface variation

Structure-aware Synthesis for Predictive Woven Fabric Appearance
Zhao et al., SIGGRAPH 2012
Foundations of High-Quality Rendering

- Modeling Illumination

An Analytic Model for Full Spectral Sky-Dome Radiance
Hosek and Wilkie, SIGGRAPH 2012
Foundations of High-Quality Rendering

- Global illumination / light transport algorithms

Virtual Ray Lights for Rendering Scenes with Participating Media
Novak et al., SIGGRAPH 2012

A Quantized-Diffusion Model for Rendering Translucent Materials
d’Eon and Irving, SIGGRAPH 2011
Course Overview

Instructor

Matt Pharr
Office Hours:

TAs
Readings

- Textbook: Physically Based Rendering, 2nd edition

- And various PDFs that will be available on the course website
The Rendering Competition

Tom Brow, Ranjitha Kumar (2006)


Georg Petschnigg and Inam Ur-Rahman Malik (2002)

Alexis Haraux (2011)
Resources

- [http://cs348b.stanford.edu](http://cs348b.stanford.edu)
- [Indigo Renderer Showreel](http://cs348b.stanford.edu)