CS 563 Advanced Graphics
Measuring BRDFs, physically-based Weathering

by Emmanuel Agu

First: Parallax Photography

- Ke Colin Zheng , Alex Colburn , Aseem Agarwala , Maneesh Agrawala , David Salesin , Brian Curless , Michael F. Cohen, Parallax photography: creating 3D cinematic effects from stills, *Proceedings of Graphics Interface 2009*

- Graphics Interface Video

Historical notes

- Lights and materials have evolved historically
- 1970's: Empirical models
    - Phong's illumination model
- 1980s:
    - Physically based models
    - Microfacet models (e.g. Cook Torrance model)
- 1990's
    - Physically-based appearance models of specific effects (materials, weathering, dust, etc)
- Early 2000's
    - Measurement & acquisition of static materials/lights (wood, translucence, etc)
- Late 2000's
    - Last week: Measurement & acquisition of time-varying BRDFs (ripening, etc)

- Time varying BRDF?: reflectance changes over time
- Examples: ripening fruits & leaves, weathering, rust

This week

- Lights and materials have evolved historically
- 1970′s: Empirical models (trial-and-error)
  - Phong′s illumination model
- 1980s:
  - Physically based models
  - Microfacet models (e.g. Cook Torrance model)
- 1990′s
  - Physically-based analytic models of specific effects (weathering, dust, etc)
- Early 2000′s
  - Measurement & acquisition of static materials/lights (wood, translucence, etc)
- Late 2000′s
  - Last week: Measurement & acquisition of time-varying BRDFs (ripening, etc)

- **Capture:**
  - Digitize real material reflectance
  - Solve **inverse rendering** problem to get reflectance
  - Place reflectance data in database, many people can re-use
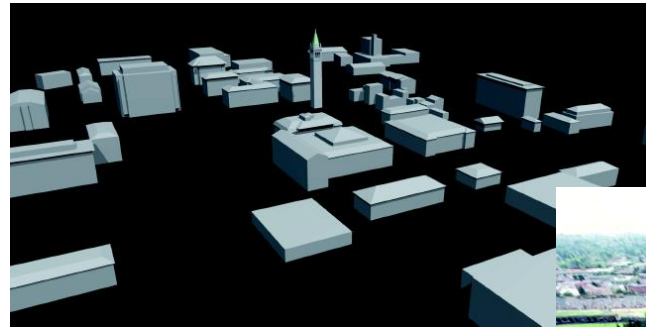- **Question:** What is Inverse rendering?

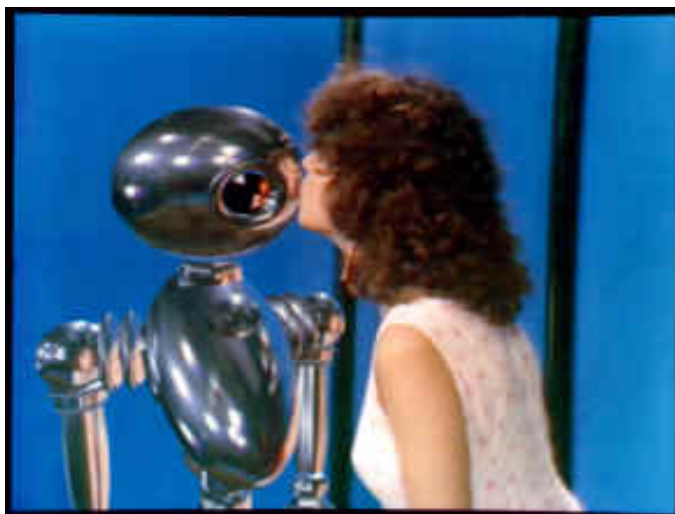- What is known/unknown??
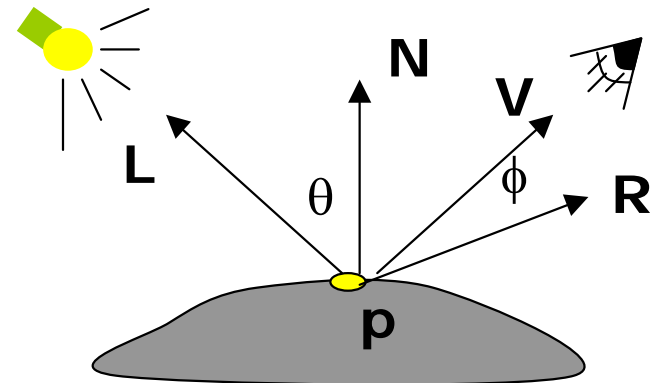
Exactly What Can We Capture?

1. Appearance

2. Geometry

3. Reflectance & Illumination

4. Motion

Original Motion Data

- Stephen R. Marschner, Stephen H. Westin, Adam Arbree, and Jonathan T. Moon. , Measuring and Modeling the Appearance of Finished Wood, Siggraph 2005

- Question: What is anisotropic BRDF?

SIGGRAPH VIDEO

Taxonomy of aging

- Chemical
    - Corrosion/rust
    - Tarnish
    - Fading due to UV rays
    - Charring

- Mechanical
    - Peeling
    - Cracking (stressed)
    - Impact/Compaction (crushing)
    - Delamination
    - Deposition and flow (e.g. by rain or air)

- Biological
    - Growth of algae, fungi, mold, moss
    - Lifecycle: e.g. leaves change color
    - Skin aging/wrinkling

Ref: Dorsey, Rushmeier and Sillion
Digital modeling of material
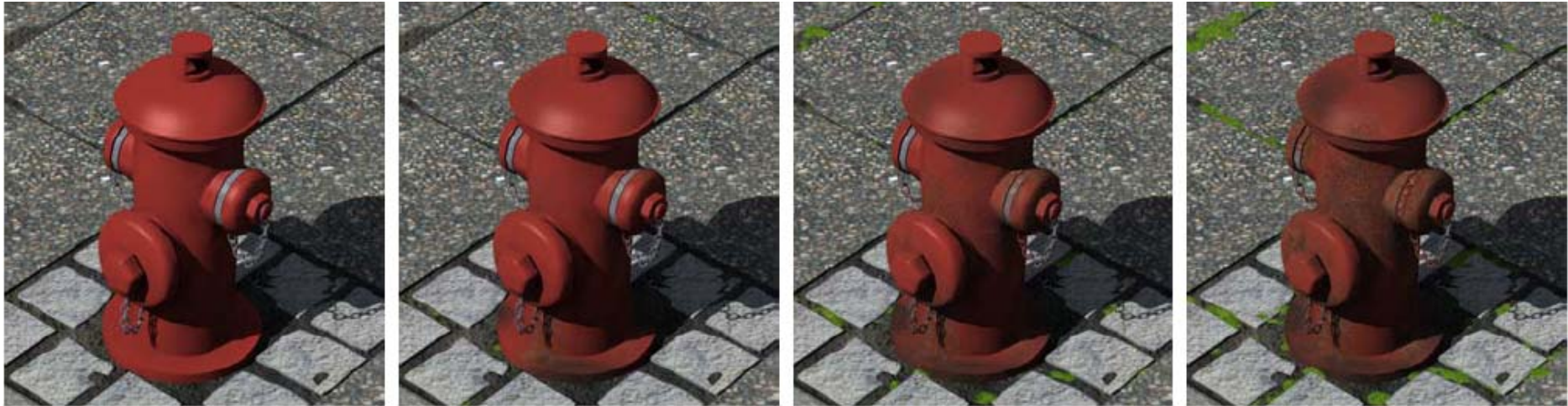Appearance, Morgan-Kaufman, 2007

A Sense of Time (ref: Dorsey and Hanrahan, SIGGRAPH 1996)

- Y. Chen, L. Xia, T. Wong, X. Tong, H. Bao, B. Guo and H. Shum, "Visual Simulation of Weathering by Gamma-Ton Tracing" ACM Siggraph 2005

- [SIGGRAPH VIDEO](#)