



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)

Last week: Time-varying BRDF

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



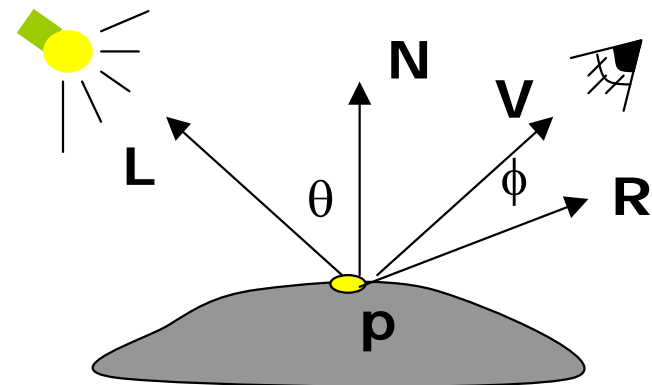
- Lights and materials have evolved historically
- 1970's: Empirical models (trial-and-error)
 - Phong's illumination model
- 1980s:
 - Physically based models
 - Microfacet models (e.g. Cook Torrance model)
- 1990's
 - Physically-based analytic models of specific effects (weathering, dust, etc)
- Early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

Measurement how?

- **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?

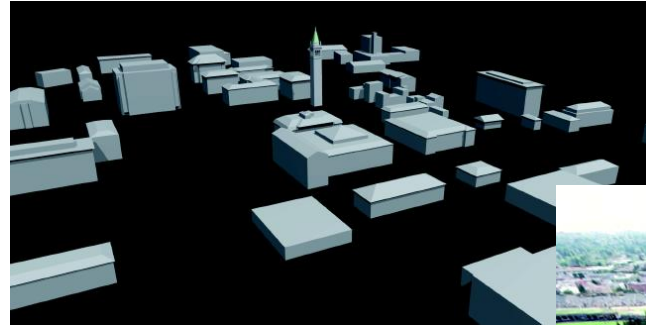


- What is known/unknown??



Exactly What Can We Capture?

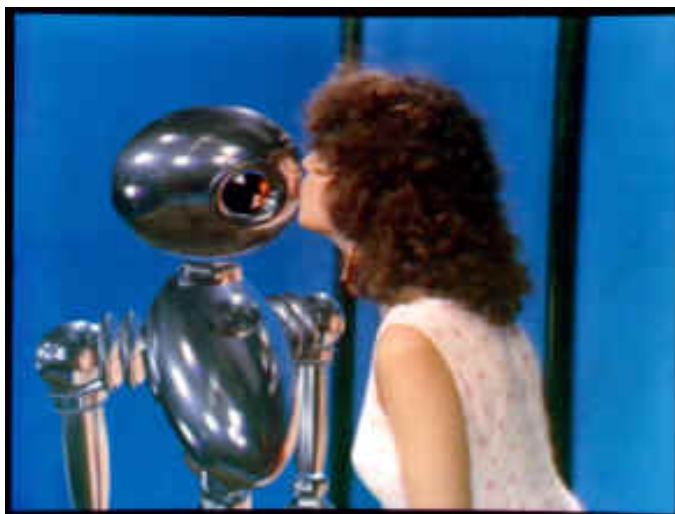
1. Appearance



2. Geometry



3. Reflectance & Illumination



4. Motion



Static BRDF Measurement developments

- 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

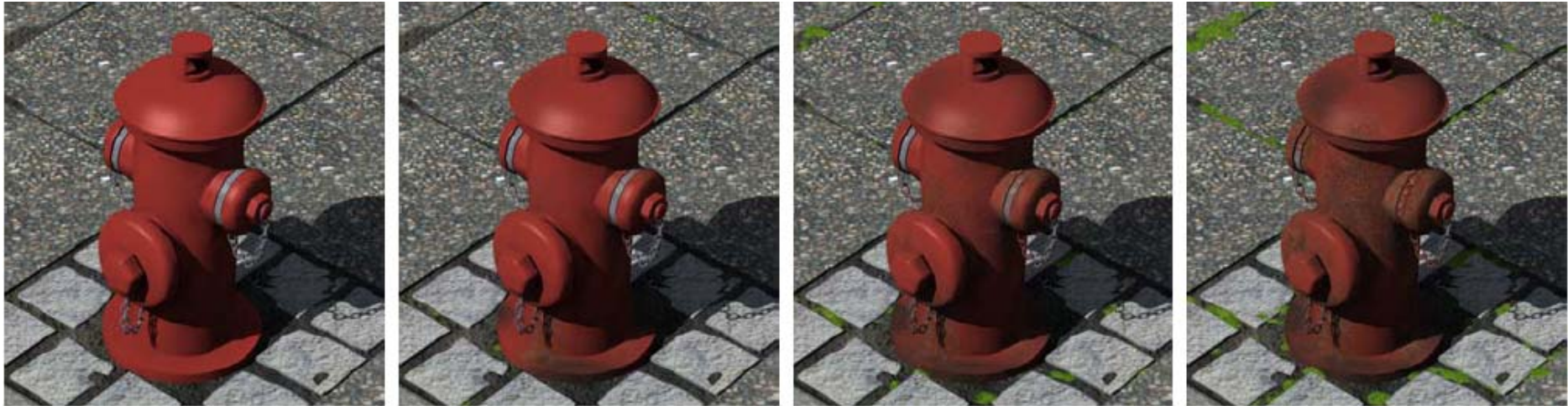
Earlier work on Patinas



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

Physically-based modeling of weathering developments

- 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](#)