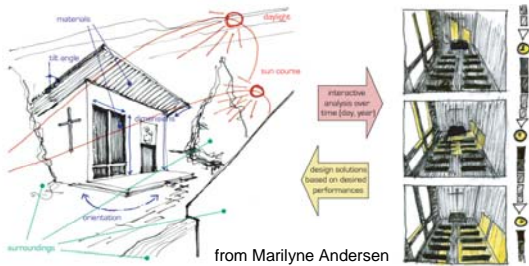
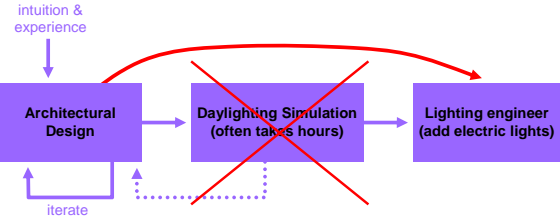


COMM 4945/6965 Seminar in HCI Daylighting Design & Simulation Tools

Professor Dan Glaser & Professor Barb Cutler
Fridays noon-2pm



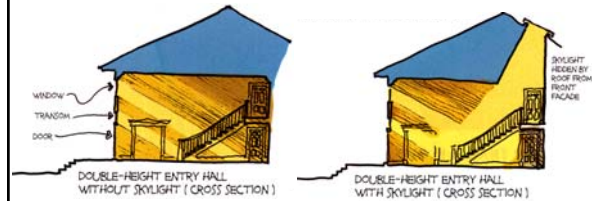
Daylighting Simulation in Design



Course Goals

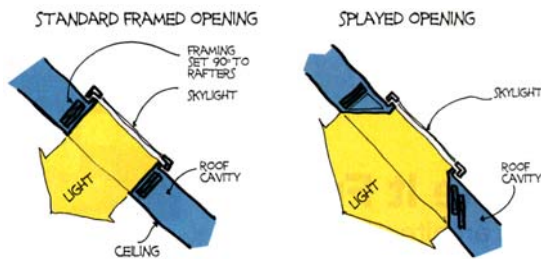
- Prototype tools for architectural daylighting to be used in the *early stages of design*
- Improve efficiency of iterative design
- Increase occupant comfort
- Reduce the need for electric lighting
- ~~Put lighting engineers out of work~~
- Reduce fossil fuel usage & Save the world!

Skylight Design



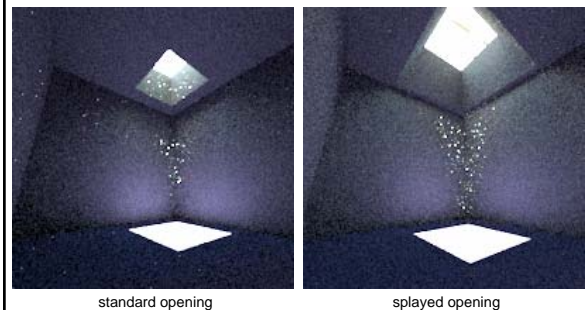
This Old House Magazine, June 2005

Skylight Design

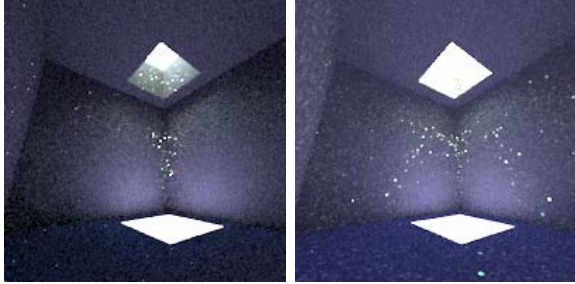


This Old House Magazine, June 2005

Skylight Shape



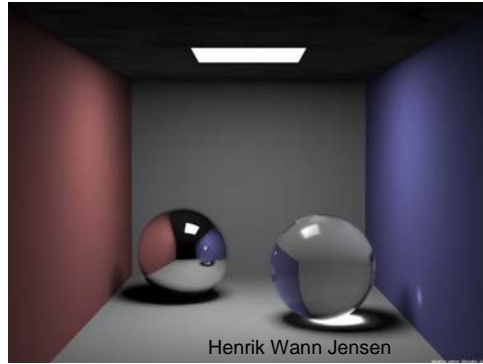
Skylight Material



matte white paint

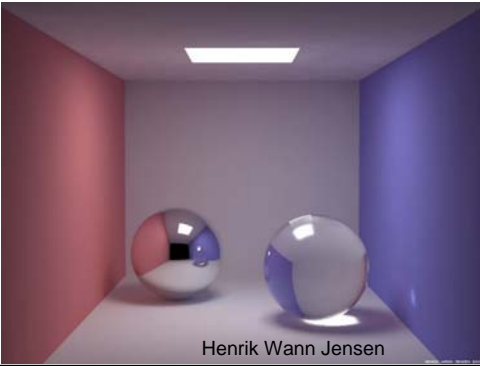
reflective metal

Traditional Ray Tracing



Henrik Wann Jensen

Global Illumination



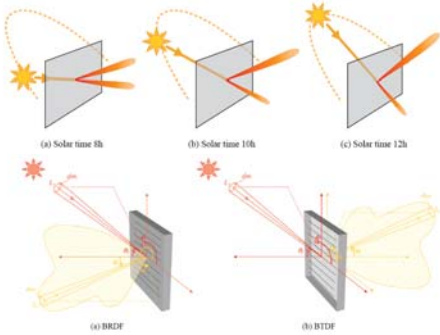
Henrik Wann Jensen

Indirect Illumination (global-direct)



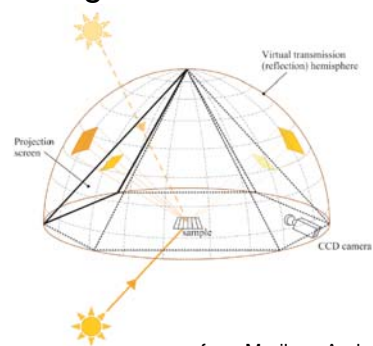
Henrik Wann Jensen

Materials – BRDF & BTDF



from Marilyne Andersen

Measuring Materials

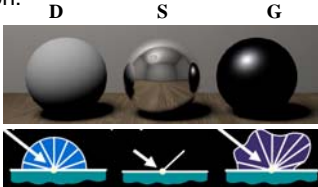


from Marilyne Andersen

Ray Grammar

Classify local interaction:

- E = eye
- L = light
- S = perfect specular reflection or refraction
- G = glossy scattering
- D = diffuse scattering

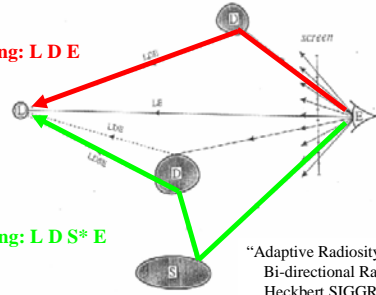


From Dutre et al.'s slides

Classic Ray Casting/Tracing

Ray casting: L D E

Ray tracing: L D S* E

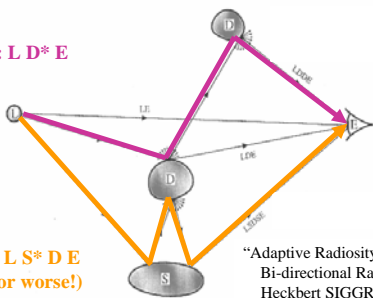


"Adaptive Radiosity Textures for Bi-directional Ray Tracing" Heckbert SIGGRAPH 1990

Photon Tracing

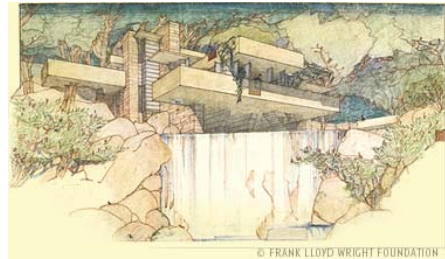
Radiosity: L D* E

Caustics: L S* D E
(or worse!)



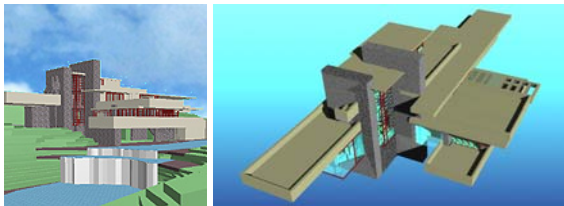
"Adaptive Radiosity Textures for Bi-directional Ray Tracing" Heckbert SIGGRAPH 1990

Artistic Illustration



Frank Lloyd Wright's *Fallingwater*

Standard Computer Rendering



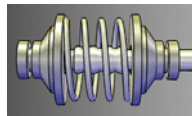
Non-Photorealistic Rendering (NPR)



Computer-generated pen-and-ink illustration
Winkenbach & Salesin 1996



Painterly rendering with curved brush strokes of multiple sizes
Hertzmann 1998

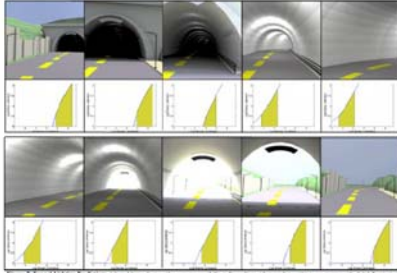


A non-photorealistic lighting model for automatic technical illustration
Gooch, Gooch, Shirley, & Cohen 1998



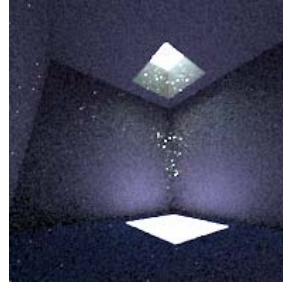
NPR for architectural daylighting

High Dynamic Range & Perception



Time-dependent visual adaptation for fast realistic display.
Pattanaik, Tumblin, Yee, & Greenberg 2000.

High Dynamic Range & Perception



- Does a room with a blue carpet really look this blue?
- Is the spot of the floor really this blindingly white?
- How can we tell if it's bright enough or too bright?

Possible Topics to Explore [Barb]

- Improve algorithms
 - Use graphics hardware
 - Problem specific optimizations (material, etc.)
- Make interface to algorithms easier to use
 - preparing model
 - selecting rendering parameters
- Improve display of noisy/approximate results (NPR)
- High Dynamic Range (HDR) & Perception