Workshop on Rendering, Perception, and Measurement

A dose of reality…

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Workshop on Rendering, Perception, and Measurement

...Lighting Design and Advanced Visualization
A Picture is not my end product

- Preview impact of design idea
- Explore visual perception issues
- Help engineer illumination
  - metrics compliance, distribution
- Sells my design...

Unambiguously!
A Picture is not my end product

- Part of my design process
  - explore many possibilities
  - collaborative “sketchpad/storyboard”

- Part of my student’s process
  - supplementary light lab (undergrads)
  - professional tool kit (grads)
Theatre litmus test...
Who is the audience?

Global Illumination is used by a fraction of the professionals who might find it useful.
Who is the audience?

Typical User Profile:

- **Grasps** pros and cons of physically based rendering
- **Needs** to evaluate the impact of a visual environment
- **Has** access to software, computing and support
Who is the audience?

- **Comfortable with CG including**
  - illumination issues
  - 3d modeling
  - material attributes
  - image processing
  - background rendering, file manipulation..

- **Time** to experiment and learn
Who is the audience?

• **Primary users:**
  
  – advanced engineering and scientific visualization
    • space program, defense...
  
  – illumination engineering
    • industrial, commercial, transportation, daylighting,...
  
  – lighting design
    • corporate, retail, theatre, theme parks, hospitality,...
Who is the audience?

• Secondary users:
  – architecture, interior design...
  – education - teaching of design
  – game developers...
  – computer graphics enthusiasts…

• Potential new users?
  – More of the above!!!
“I don’t have the time
to invest in learning another program…
and anyway, who is going to pay extra for renderings?”

“I hear that there is a dreadful learning curve…
and I have to model in 3d as well? What’s Unix?”

“Are you telling me that these pictures can show what a person might see?”
Listening to the front lines...

“I used it once but the picture didn’t really look like the finished room. They said it would be photorealistic.”

“We used to have an artist paint our concept pictures, now we use photoshop.”

“I do not have time to change my design methods… and who is going to teach me?”
1. We are not doing a good job at announcing the current capabilities and benefits of advanced rendering.

2. The software interface needs to be familiar and in the language of the intended user - perhaps plugins to interfaces already in use.

3. (from Rob) Be patient. Its only a matter of time before current students infiltrate the front lines in sufficient mass to change perception and practice.
Rendering system challenge

Towards the Accuracy of Lighting Simulations in Physically Based Computer Graphics Software
- Houser, Tiller and Pasini
IESNA Journal Winter 1999

Radiance
Lightscape
IQCam
(digital image photometer)
Photograph
Stumbling blocks

- Personal insights inspired from this reality check article.
  - Photometry representation...
  - Material attribute acquisition...
  - Render time…
Photometric data

Revisit the capture and representation of photometry for near field applications.

Why?

IESNA files, the available source of physically based photometry, are a point source representation.
Photometric data

What if: Combine detailed spectral and photometric data

- increased resolution will capture more distribution detail.
(PAR36 WFL field edge pattern)

- spectral data to depict color shifts
(gimble mount MR16 colored field edges)
Photometric data

no pattern
no color shift
Photometric data

What if: Develop distribution change factors
Similar to light loss factors. Accounts for

-a deteriorating specular reflector
  becoming more diffuse
-a dirty fresnel lens producing
  a narrower field...
Material attributes

Create material attribute standards, archives, translators and sensors.

Why?...
Tons of samples distributed to design firms every year. We have the data..
Material attributes

What if: Personal desktop material sensor driven by visualization software system to selectively sample sufficient information to look-up or produce a reasonable digital representation directly accessible by the software system.
Rendering

What if: An Interactive, Iterative Design Process

Why?…

The time between pushing the render button and seeing the resulting, highly detailed picture, is toooo long and stifles the creative process.
As interfaces improve, providing greater access, rendering speed will be the last stumbling block.
Is it a matter of interface? Process? Time?...
Complexity...
Complexity

• **Issues of quantity**
  - lots of actors
  - skyscrapers
  - harbor fronts
  - thousands of luminaires
  - a surging mass of new and varied materials...

I have solved most of what I have encountered
BUT I HAVE A RESEARCH LAB
Complexity

• Of equal importance are the advances in details that will improve the quality, delivery and usefulness of a simulation

For example...
What if...

A transparent window into a simulated scene

Current display technology:

- like looking at most scenes through sunglasses
- low contrast, low luminance, narrow color gamut
- granular when the image fills the field of view
What if...

Progressively refine photometry, materials and geometry?

Available photometry:
- Idealized (test conditions optimized)
- Low resolution (PAR36 example)
- Point source description
- No associated spectrum distribution
- No distribution change factors
Currently...

Scenic descriptions:
- Generally quite surreal

- pristine geometry (perfectly flat walls..)

- uniformly distributed material attributes (unscuffed floors, squeaky clean windows..)

- in a vacuum (no dust, pollutants, humidity..)
Consider...

Progressive convergence between

Idealized and installed photometry
- distribution, intensity and color

Surreal and installed surfaces
- color and reflectance
- pristine geometry and imperfections

Predicted and observed visual phenomena
- glare and veiling reflections
- normalization, adaptation...
Once a reasonable data set is created, how can it be updated, automatically, so it converges with the visual effect of the physical implementation of the design?
Scenario...

> Develop a light plot in a design studio
  - luminaire: location, aiming, shutters, color..
> Create concept images via simulation
  - store intensity data for each Q
> Install light plot in theatre, focus etc
  - load intensity data in control console
> Refine intensities during rehearsal
  - making adjustments in control console
> Return to design studio to further refine intensities using simulation...
Scenario...

WOOPS!!!
Control console intensities are the only data transferred from the theatre to the simulator..

MY DREAM restated
A practical method to update all simulation data once the design is implemented and as modifications are made during rehearsal.
...materials, geometry, photometry, visual phenomena...
Stereo IQCams? image recognition?..?!!
What if...

- advanced graphics lighting control systems
  - off-line stage/studio lighting design editing
    - traditional and automated luminaires
  - on-line augmented reality interface

[a TCVC current project]
So much potential...

1. observe problem
2. pick performer "showme"
3. pick effect arrow "find"
4. "match" "keep"
What if...

Seamless interaction between actors, synthetic scenery and light

> Jane is in an HDTV studio in NYC
> Jim is in another HDTV studio in LA
> The virtual set is being rendered at NCSA

continued...
no light or shadow interaction... YET!

[Diagram showing a combination of characters and color choices leading to an animated scene]
Scenario...

>Jim enters the scene and turns on a light switch beside a door, illuminating the room and brightening Jane, who is standing in front of a dining table.

>Jim and Jane are lighted from a virtual pendent fixture and their shadows appear on the virtual table and on the virtual door.
The issue...

This scenario changes TV production methods.

HDTV supports highly detailed environments.

Distant collaboration offers economic benefits.

Virtual scenery, with no light interaction, is being broadcast.
A dose of reality...
…there are many problems still to solve!

Thank you