SIGGRAPH Impressions

John Rugis
SIGGRAPH Conference sessions:

Art Gallery
Computer Animation Festival
Courses
Educators Program
Emerging Technologies
Panels
Papers
Research Posters
Sketches
Course:

“Computational Photography”

M. Levoy - Stanford University
Shree Nayar – Columbia University
What’s Beyond Film-Like Photography?

Thought Experiment:

• COMPARE:
  – Digital Camera result.
  – Digitized (Scanned) Film result.

? Can we See more, Do more, Feel more?

? Has photography really changed yet?
Goals for a New Photography

PHYSICAL

3D Scene
- light sources, BRDFs, shapes, positions, movements, ...

Eyepoint
- position, movement, projection, ...

Light & Optics

Sensor(s)

Computing

Visual Stimulus

Vision

PERCEIVED or UNDERSTOOD

3D Scene
- light sources, BRDFs, shapes, positions, movements, ...

Eyepoint
- position, movement, projection, ...

Meaning...

Tangible Record
- estimates we can capture, edit, store, display
4-D Light Field / Lumigraph

Measure all the **outgoing** light rays.
4-D Illumination Field

Same Idea: Measure all the *incoming* light rays
Dual photography from diffuse reflections

Sen et al, Siggraph 2005
Emerging Technology: True 3D Display

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Real 3D display by Holografika

Artificial three dimensional visualisation has been existing for long time. It was holography. This invention set the minimum requirements for 3D visualisation. Viewers should see a 3D image on the screen, as they would see in reality. Systems that cause any discomfort or restrain the viewer will not be broadly accepted. Several announcements were made about the invention of the ultimate 3D display but none of these are "true" 3D display solutions, since none of them comply with all the following criteria:

• No glasses needed, the 3D image can be seen with unassisted naked eye

• Viewers can walk around the screen in a wide field of view seeing the objects and shadows moving continuously as in the normal perspective. It is even possible to look behind the objects, hidden details appear, while others disappear (motion parallax)

• Unlimited number of viewers can see simultaneously the same 3D scene on the screen, with the possibility of seeing different details

• Objects appear behind or even in front of the screen like on holograms

• No positioning or head tracking applied

• Spatial points are addressed individually

HoloVizio is the only operating 3D display that meets all the above requirements simultaneously
An Interactive Multi-User Holographic Environment

SIGGRAPH 2006
Emerging Technologies Program

Holografika, Hungary -- www.holografika.com
CRS4, Italy -- www.crs4.it/vic/
C-S, France -- www.c-s.fr
University of Bonn, Germany -- www.cg.cs.uni-bonn.de

January 2006
“Exaggerated Shading for Depicting Shape and Detail”

S. Rusinkiewicz, M. Burns - Princeton University
D. Decarlo – Rutgers University
“Exaggerated Shading for Depicting Shape and Detail”

**Figure 1:** Simple diffuse lighting (left) results in lower contrast in the upper-left and lower-right regions of this golf ball, where the surface is facing towards or away from the light. Our proposed exaggerated shading (right) brings out detail throughout the surface by locally moving the light direction to be grazing with respect to the surface. While this example shows greatly increased contrast, a user could adjust the parameters of our model to produce a more subtle effect.
Paper: Surfaces

“Real-Time GPU Rendering of
Piecewise Algebraic Surfaces”

C. Loop, J. Blinn – Microsoft Research
Abstract
We consider the problem of real-time GPU rendering of algebraic surfaces defined by Bezier tetrahedra. These surfaces are rendered directly in terms of their polynomial representations, as opposed to a collection of approximating triangles, thereby eliminating tessellation artifacts and reducing memory usage. Our approach leverages the strengths of GPU computation and is highly efficient.

Figure 2: A Quadratic Bézier tetrahedron. On the left, the layout of Bézier weights within a tetrahedron. On the right, vertex labeling together with an algebraic surface restricted to the tetrahedron.
Figure 5: Some sample piecewise algebraic surfaces composed of Bézier tetrahedra and rendered using our technique.
Sketch: Fun With Lasers

“Tomographic Reconstruction of Transparent Objects”

B. Trifonov, D. Bradley, W. Heidrich
– University of British Columbia
Abstract
The scanning of 3D geometry has become a popular way of capturing the shape of real-world objects. Transparent objects, however, pose problems for traditional scanning methods. We present a visible light tomographic reconstruction method for recovering the shape of transparent objects, such as glass. Our setup is relatively simple to implement, and accounts for refraction, which can be a significant problem in visible light tomography.
The refractive index of the fluid is adjusted to be similar to that of the target, and refraction within the cylinder is negligible as a result. This property is the key component of our setup that allows us to use tomographic acquisition.

Depending on the desired resolution of the reconstruction, the number of images taken varies between several dozen and a few hundred.
The Fourier Slice Theorem states that the inverse Fourier transform of a scanline in an orthographic integral projection image corresponds to a 1D slice of densities in the volume. This observation allows for very efficient reconstruction of the volume densities, but it is limited to the case of parallel illumination or, with modifications, point sources. In our application, the rays in a single integral projection image do not usually form an orthographic or projective transformation. We therefore have to use more general, albeit slower, methods such as Algebraic Reconstruction Techniques.

Figure 11: A glass jar (right), its reconstruction (left), and a detail image of the thread at the top (center).
Research Poster

“Projecting Surface Curvature Maps”

J. Rugis – University of Auckland
Flat shading of triangle mesh.
Smooth shading of triangle mesh.
With a strip of projected surface curvature.
Projecting Curvature Maps (onto the back of David’s left leg)
The standard lighting model, two overlapping scans.
Projecting Curvature Maps

We introduce a multiple source averaging lighting model that overcomes this problem.

The diffuse component for each of the projection sources is averaged into a total value that is used to modulate the final standard lighting value.

\[
I_\lambda = \text{Ambient} + \sum \text{Specular} + \left( \frac{\sum_{i=1}^{n} \text{Projection}}{n} \right) \sum \text{Diffuse}
\]
Projecting Curvature Maps (onto the back of David’s left leg)
The new lighting model, seamless scan strip overlap.