SIGGRAPH 2002

Recreating the Past

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Creating the Models

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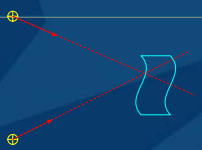
3D Scanning Overview

- Scanning determines 3d location of surface points
- Two general methods:
  - Triangulation
  - Time of Flight

Triangulation

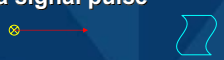
- Two known positions
- Find direction to a point
- Intersect line segments



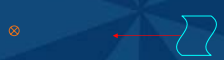
- Human depth perception
- Measures direction
- Occlusion problems

Time of Flight

- Send out a signal pulse



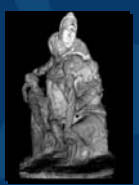
- Measure time for reflection to return



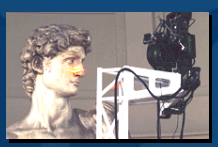
- Measures time
- No occlusion

Recent 3D Scanning Projects

Electricite de France



IBM Watson



Stanford University

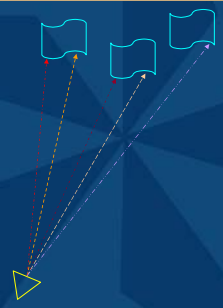
CNR Pisa

Low-cost, high speed, sculpture scanner – structured light approach

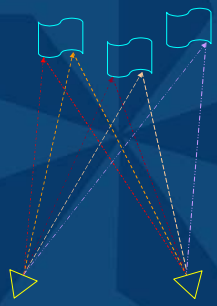
DLP Projector (1024x768)

Digital Video Camera (1024x1024)

- Projector sends out a unique signal pattern in each direction



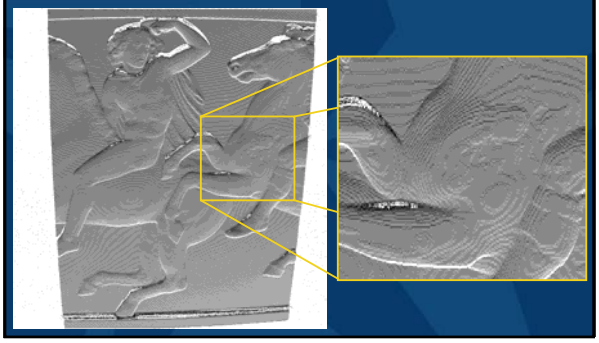
- Camera records signals returning from each direction, and analyzes the pattern



Advantages/Disadvantages

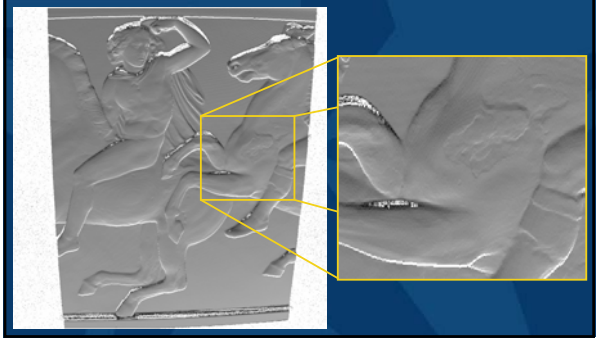
- **Advantages**
  - Cheap (several thousand for the hardware)
  - Fast (~15 seconds / 1,000,000 points)
  - Accurate
  - Can get textures at the same time
- **Disadvantages**
  - Hard to scan large objects (more than 8 ft)
  - Or in bright light
  - Calibration is not easy

Pixel Accuracy

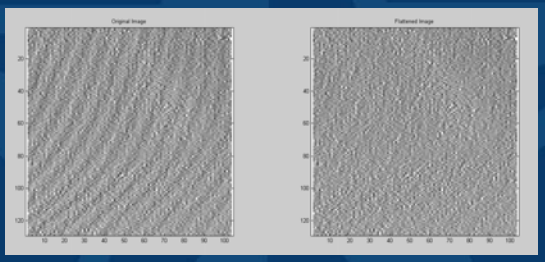


Pixel Close-up

Sub-pixel Accuracy



Sub-pixel Curve Modeling

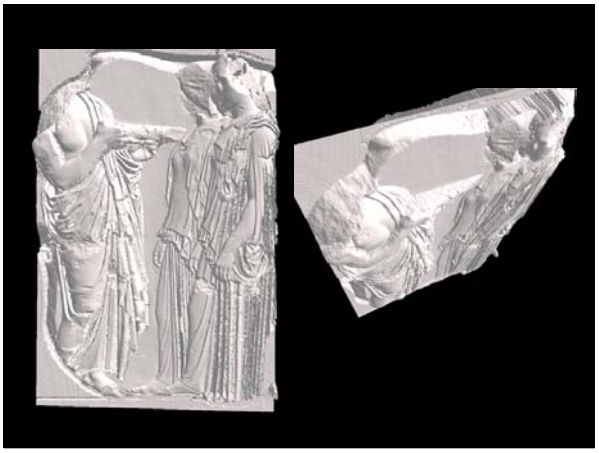


Chris Tchou Master's Thesis 2002

3D Scanning Parthenon Sculptures

Basel Skulpturhalle, October 2001

Musee du Louvre, October 2001



Additional Evidence:

Drawings can provide additional lost information. How can this be incorporated?

3D Scan, 2001

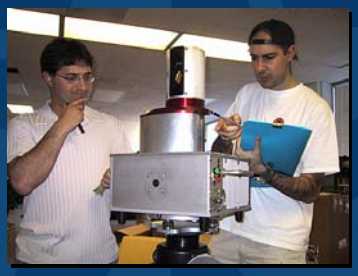
Carrey Drawing, 1674

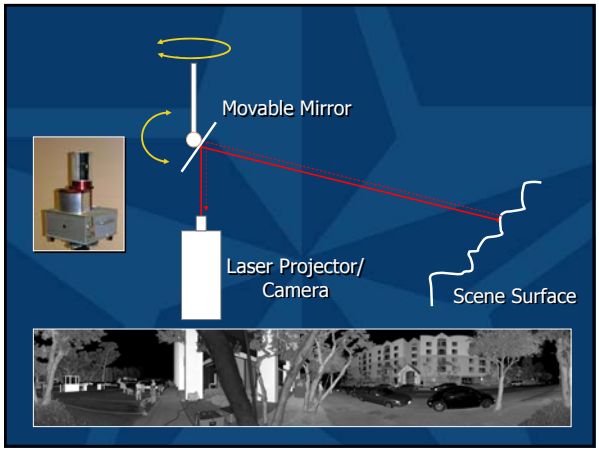
Scanning Casts:

Sometimes in better condition than originals

Scan with and without texture

Scanning Environments





Rendering Archaeological Models with Global Illumination and Image-Based Lighting

Acquiring Real-World Illumination

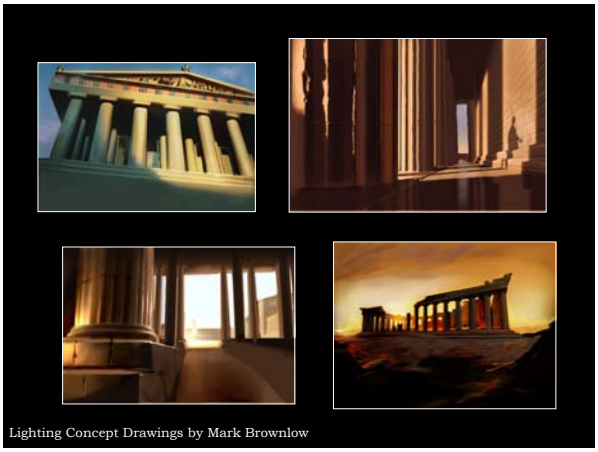
Outdoor Light Probes

Outdoor Light Probes

Outdoor Light Probes

Outdoor Light Probes

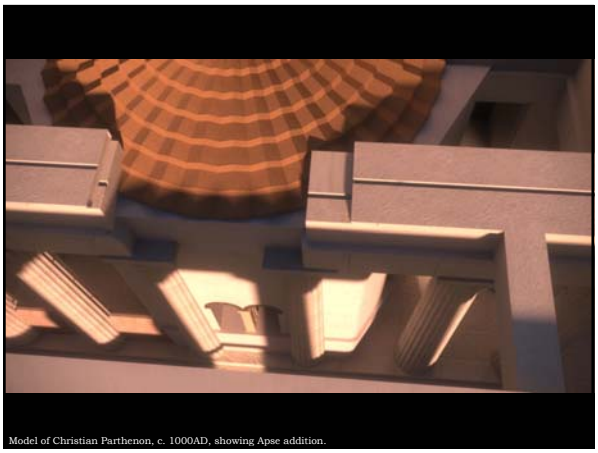
Untextured Model rendered with real-world illumination



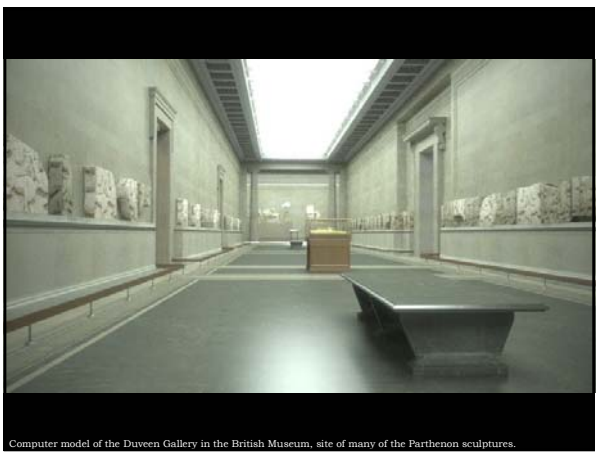
Lighting Concept Drawings by Mark Brownlow

Computer model of Parthenon, c. 1830, illuminated with image-based lighting, Arnold global illumination, depth of field

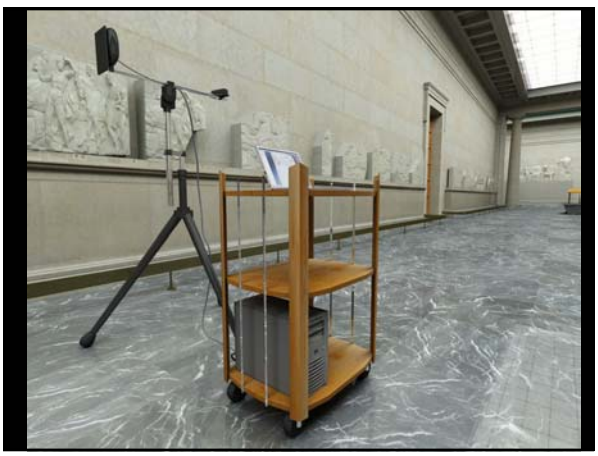
Model of contemporary Parthenon, illuminated by evening light of Marina del Rey, CA

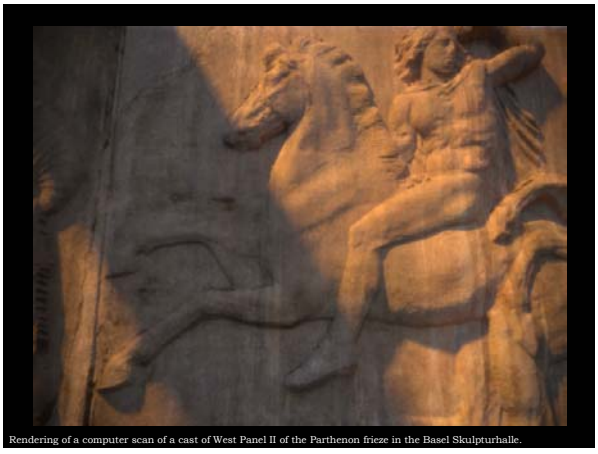


Model of Christian Parthenon, c. 1000AD, showing Apse addition.

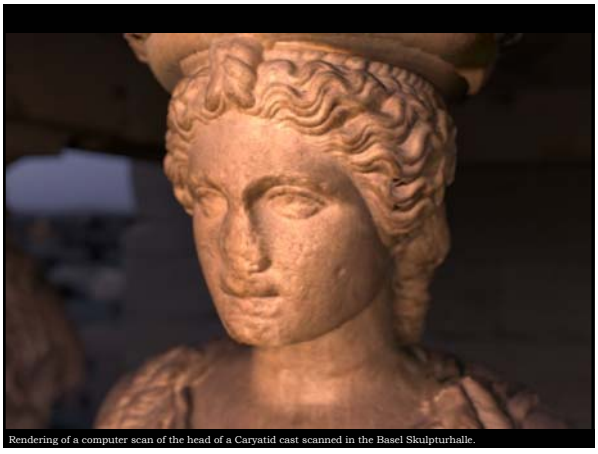


Computer model of the Duveen Gallery in the British Museum, site of many of the Parthenon sculptures.





Rendering of a computer scan of a cast of West Panel II of the Parthenon frieze in the Basel Skulpturhalle.



Rendering of a computer scan of the head of a Caryatid cast scanned in the Basel Skulpturhalle.

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Scanning Hardware
Tim Hawkins
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Paul Asplund

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