XX Symposium of CIPA,
the ICOMOS & ISPRS Committee on Documentation of Cultural Heritage
Torino 26th - 30th September 2005

FUSION OF 3D INFORMATION FOR EFFICIENT MODELING OF CULTURAL HERITAGE SITES WITH OBJECTS

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Outline

- Introduction
- 3D Acquisition & Modeling Chain
- Fusion of 3D information for site modeling
- Sites
  - Byzantine Crypt
  - Greek temple in Selinunte
- Discussion and conclusions

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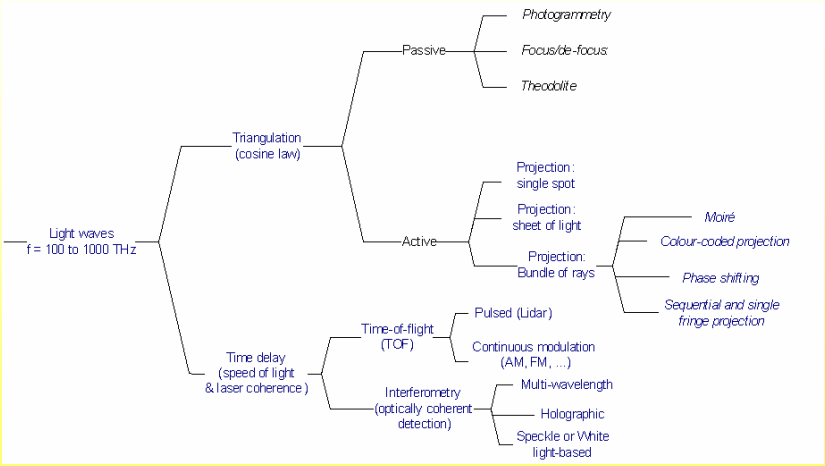
Measuring 3D shape: Light waves



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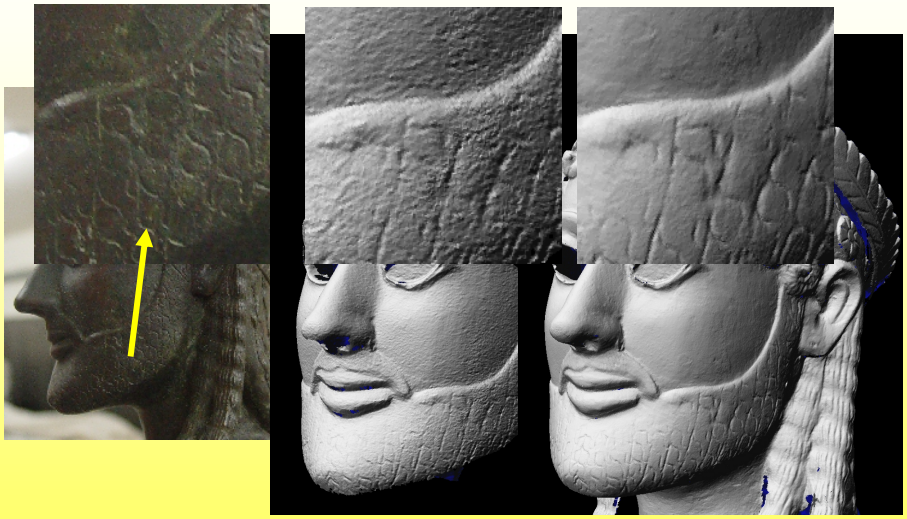
Resolution tests

25 mm X 25 mm

Δxy=0.19mm
σz=0.04mm

Δxy=0.09mm
σz=0.02mm



M900

SG-102

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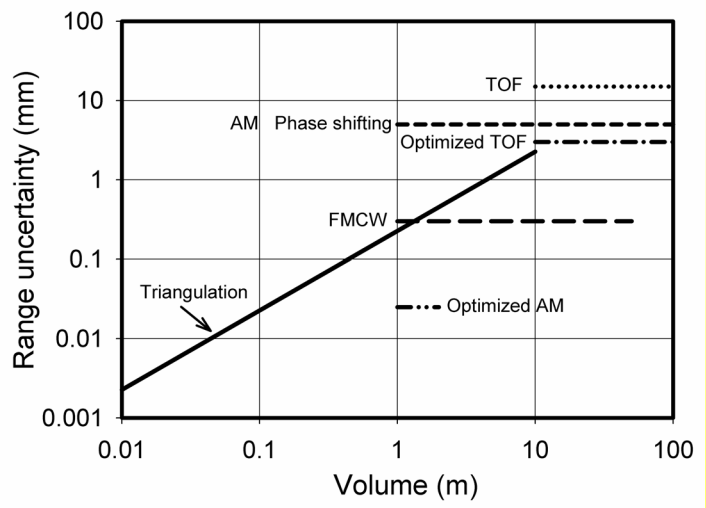
Range uncertainty for different laser scanner techniques



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fs > 100 pts/sec SNR >>

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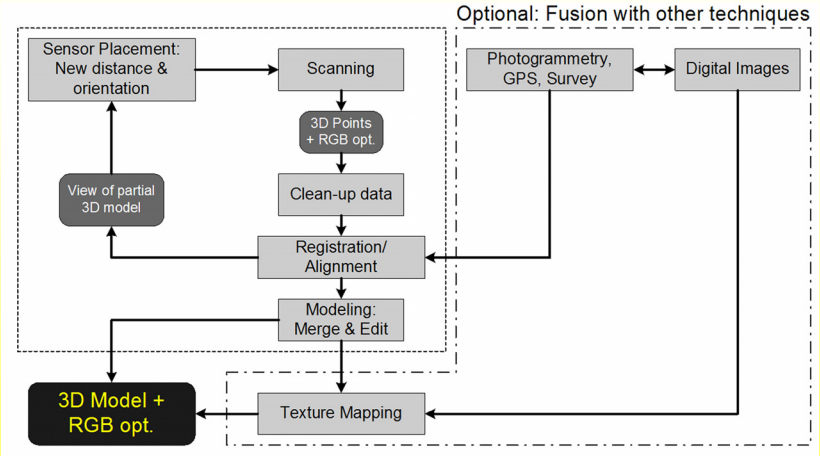
Range-Based Modeling



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Scaffolding + Mirror = Gymnastics

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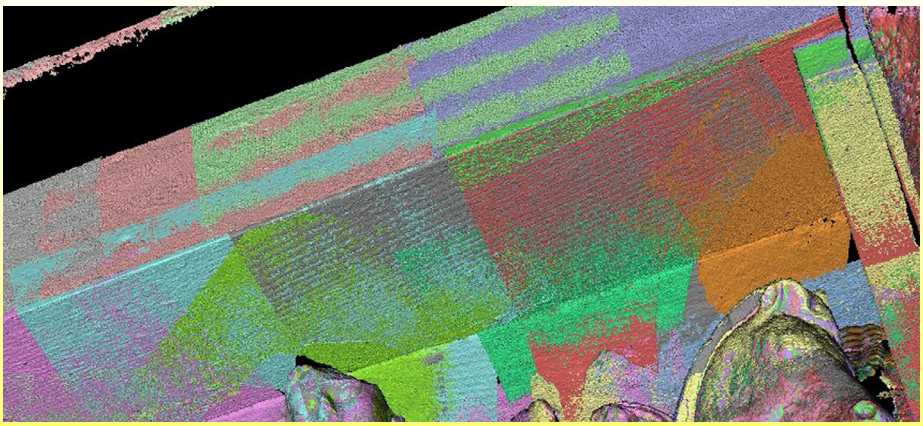
Wave phenomenon: motion of the 3D camera with respect to the object



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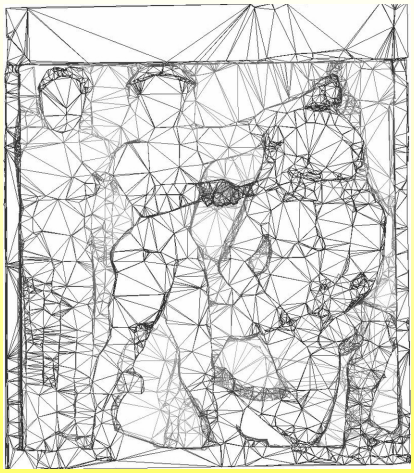
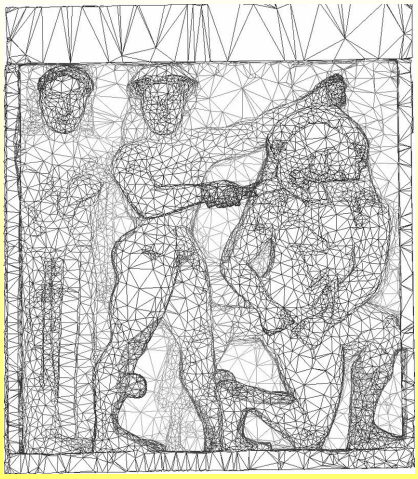
The operator is part of the chain!

36 000-polygon model



20 000-polygon model



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Fusion of 3D information for site modeling

- Goal: Complete high-resolution 3D model (shape and appearance) of present and/or previous states
- Raw data: Drawings, CAD, Survey data, GPS, photos, photogrammetry, 3D scanner data, …
- Bottom line: all of these have uncertainties
- Approach: use the best information from each
  - Information augmentation
  - Uncertainty management

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Site Modeling: Carpiniana

Byzantine Crypt of Santa Cristina, Carpignano (Italy)
For documentation and visual communication

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Site Modeling: Carpiniana

Byzantine Crypt of Santa Cristina, Carpignano (Italy)
For documentation and visual communication

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Dimensions: 16.5 m X 10 m X 2.5 m

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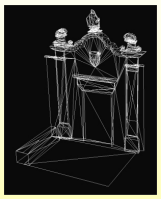
Entrances to the Crypt:
Built with photogrammetry

a)

b)

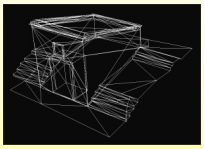


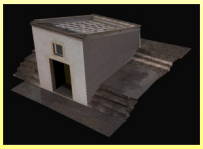
c)

Main entrance:
a) Photograph, b) mesh, c) model with texture.

a)

b)





c)

Second entrance:
a) Photograph, b) mesh, c) model with texture.

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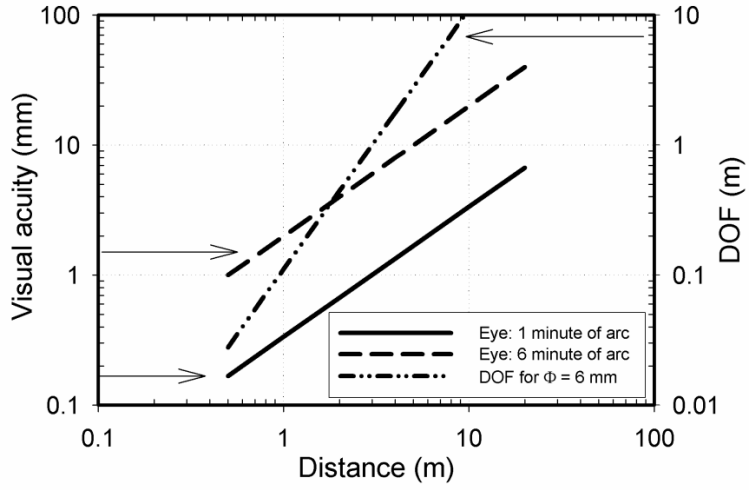
Visual communications:
keep in mind the visual acuity



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Orthophoto generated from 3D model

9000 X 3000 pixel-image

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Reconstruction of Temple C of Selinunte

3D model at high resolution (shape and color) of the frieze and metopes: using 3D laser scanning technology

Reconstruction of Temple C: Historical documents + CAD + Photogrammetry of ruins

Temple as of 2003 AD

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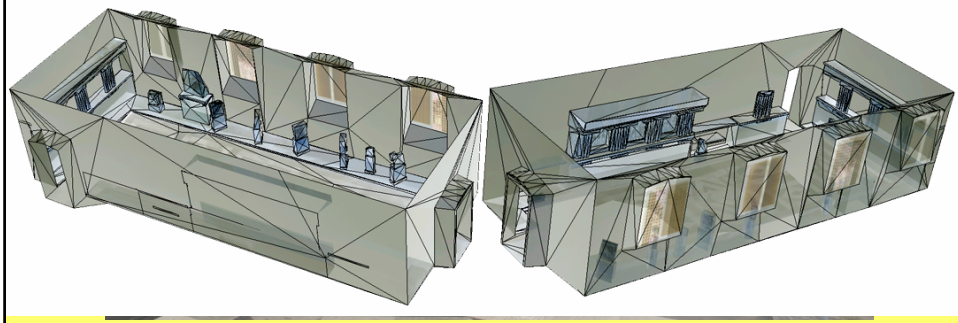
Section of the Frieze of Temple C

• Acquisition and 3D modeling of the **Metopes of Temple C of Selinunte** located in the "Museo Archeologico Regionale di Palermo"



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Museum room: 21 m X 8.1 m X 8.5 m

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Metopes of Temple C of Selinunte + 3D Model of the Frieze of Temple C

3D Model with texture | Wiremesh

Size of a Metope: 1 m X 1 m X 0.4 m
Number of 3D images per Metope: 200

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Multi-PC rendering

Byzantine Crypt - 2002

- 5 million-polygon model
- Full-res textures
- 64 lights
- 6700 frames 720 X 576
- 27 PCs

- 0.4 million-polygon
- 1/5-res textures
- 13 lights
- 5000 frames 720 X 576
- 4 PCs

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3D animation

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Progetto LAND-LAB: Attività 4

Room dedicated to Selinunte
Museo Archeologico Regionale di Palermo

3D Model with texture

Wireneed

Photo of room

3D Model of room created with 3D laser scanning, photogrammetry, CAD

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VR Theatre

- 2 standard PCs
  - 2 WILDCAT 7210, 384 MB, AGP 8X
- Model size:
  - 2 000 000 polygons
  - 256 Mb texture
- Real-time
- Coming soon (end of 2005):
  - Full spatial resolution
    - 25 000 000 polygons
  - Full texture
    - 1 GByte
  - Including before and after physical restorations of 2004

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Hologram from digital 3D model 180 cm x 85 cm

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CONCLUSIONS

- 3D Model building
  - Most of the time spent goes into finding next best view
  - Not all surfaces can be measured: Mirror + Gymnastics
  - Vibrations due scaffolding (scanners still too slow!)
- Most of the technology exist
  - *To create, analyse, transform a high-resolution 3D model*
- Choosing the right technology: sensor fusion
  - For general public (Education)
  - For experts and heritage conservator/curators
  - Archival quality
- Research issues: Still many improvements are necessary in order to get make the technology ubiquitous
  - artifacts, speed, ….

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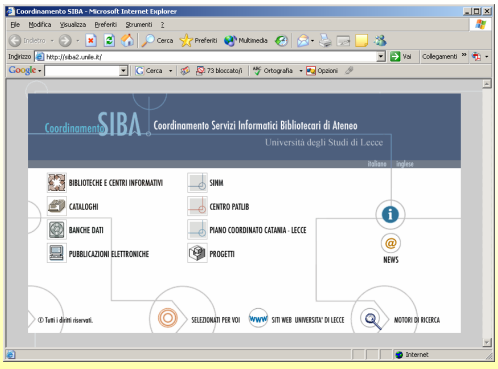

http://siba2.unile.it

SIBA Coordination, directed by Virginia Valzano, is the structure of the University of Lecce that co-ordinates, manages and develops the Telematic Information System for Research and Education.

It moreover coordinates the development of the University libraries computerization and of the relations with other national and international Universities and Research Centres for the achievement of information systems and other shared projects.

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3D Database Project

Digital acquisition, processing, virtual restoration and three-dimensional reconstruction of archaeological finds, architectural structures, sites and objects of high historical and artistic value, as well as the preservation, enhanced knowledge and increased accessibility.

Piano Coordinato
delle Università di Catania e Lecce

Progetto
LAND-LAB A4

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