ARCHAVE :
A Virtual Reality Interface for Archaeological 3D GIS

Master's Thesis Proposal

by

Daniel Acevedo Feliz

Brown University

February 4, 2000

Presentation Outline

1.- Motivation and definitions.

2.- Problem to be solved.

3.- Hypothesis.

4.- System description.

5.- Testing.

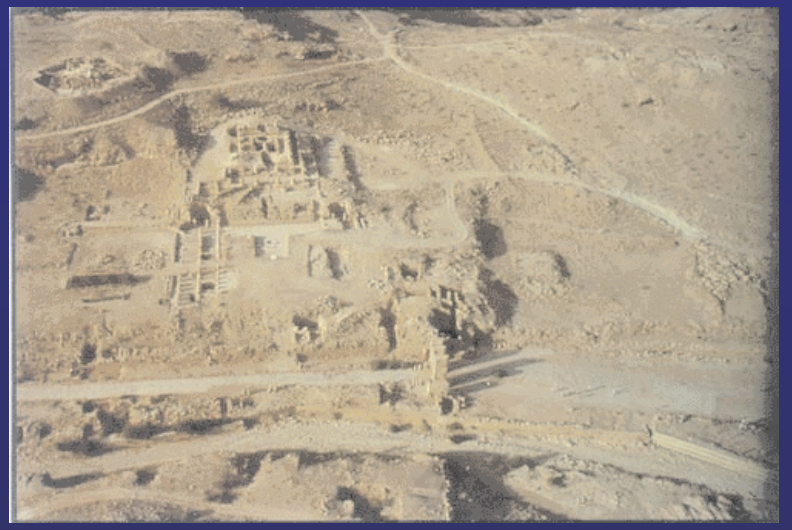
6.- Timeline.

7.- Contributions.

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

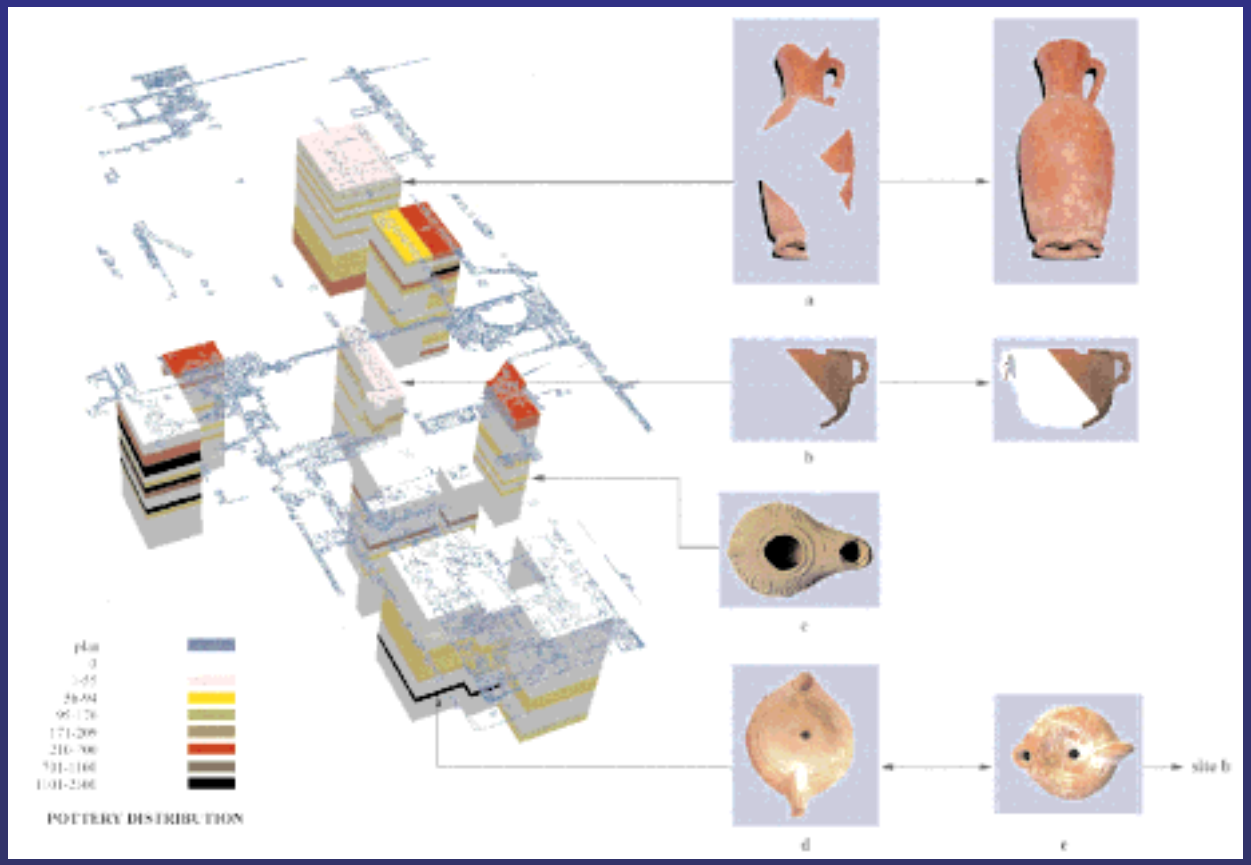
Motivation

- Brown University excavations at the Great Temple of Petra (Jordan) since 1993.



1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

- Database of the findings and GIS.
- SHARP group.



ARCHAVE: A Virtual Reality Interface for Archaeological 3D GIS

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

- Collaborators:

Martha Joukowsky	(Lead Archaeologist, Brown Univ. Great Temple Excavations, Petra (Jordan))
David Laidlaw	(CS Assistant Professor)
Eileen Vote	(PhD candidate Dept. Old World Archaeology and Art)
Talal Akasheh	(Dean of Research and Graduate Studies, Hashmite University (Jordan))

- Committee:

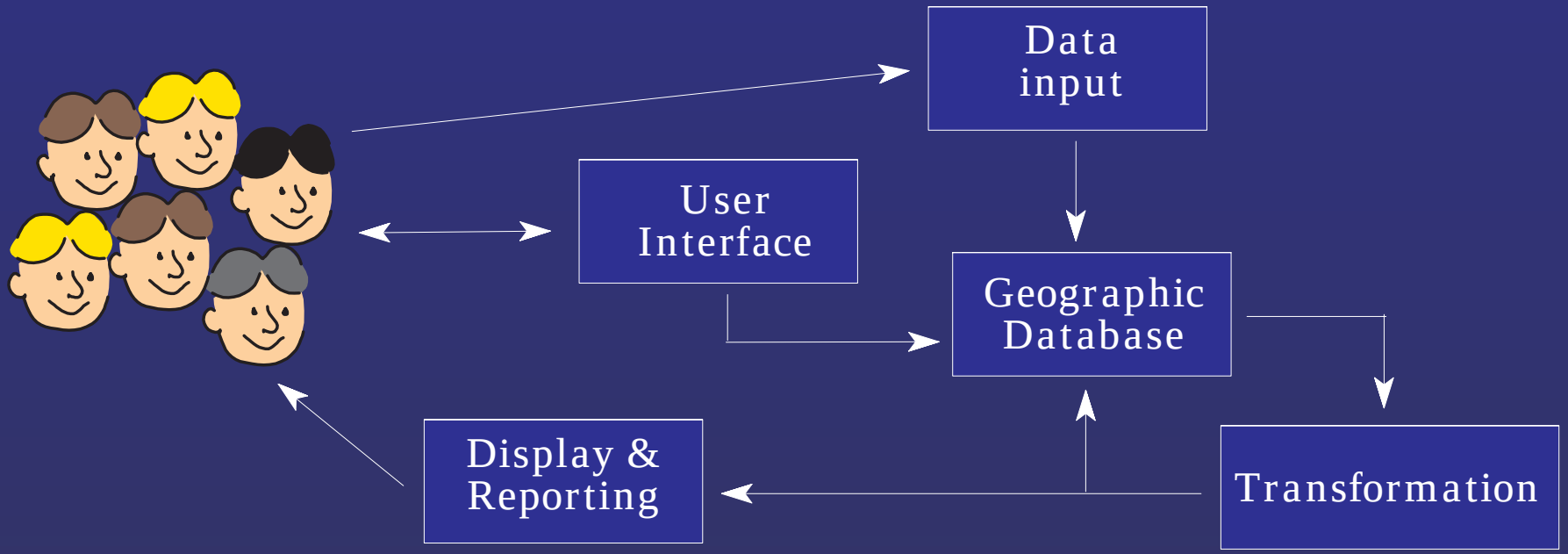
John Hughes	(CS Professor)
Nancy Pollard	(CS Assistant Professor)
David Laidlaw	(CS Assistant Professor)

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

Definitions (1/2)

- GIS: Geographical Information System

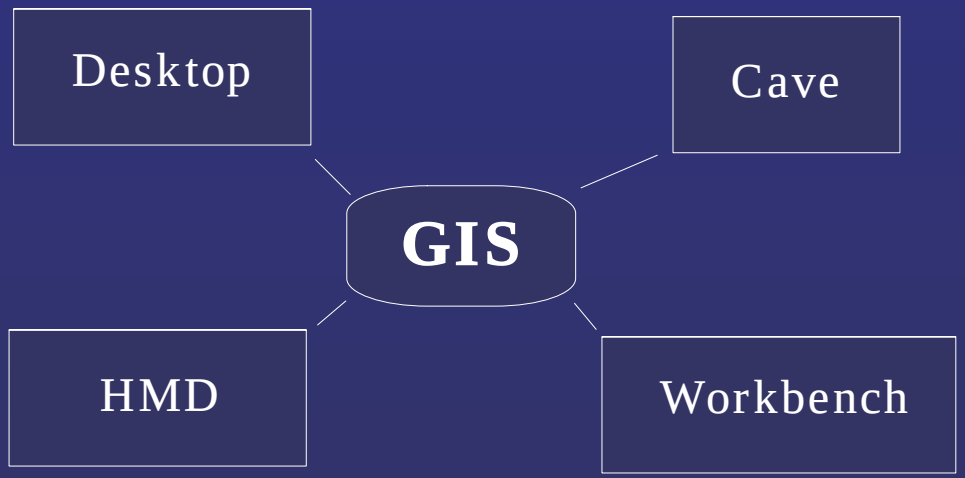
" A set of tools for collecting, storing, retrieving and displaying spatial data for a particular set of purposes. " (Burrough P.A., 1986)

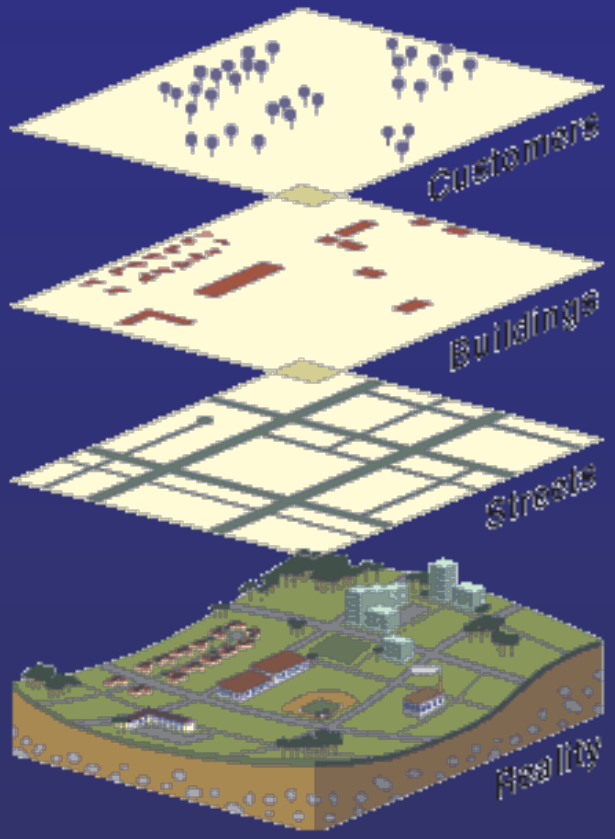


1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

Definitions (2/2)

- Why 3D GIS ?
- VR Interface:





1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

Archaeological Practice Today

Archaeologists must make important judgments about the object to record, characteristics of those objects and their relationship to the site and the culture they came from.

A dig system is established to record the information needed for analysis.

After information is recorded, it is analyzed using various databases, statistical analyses, laboratory procedures.

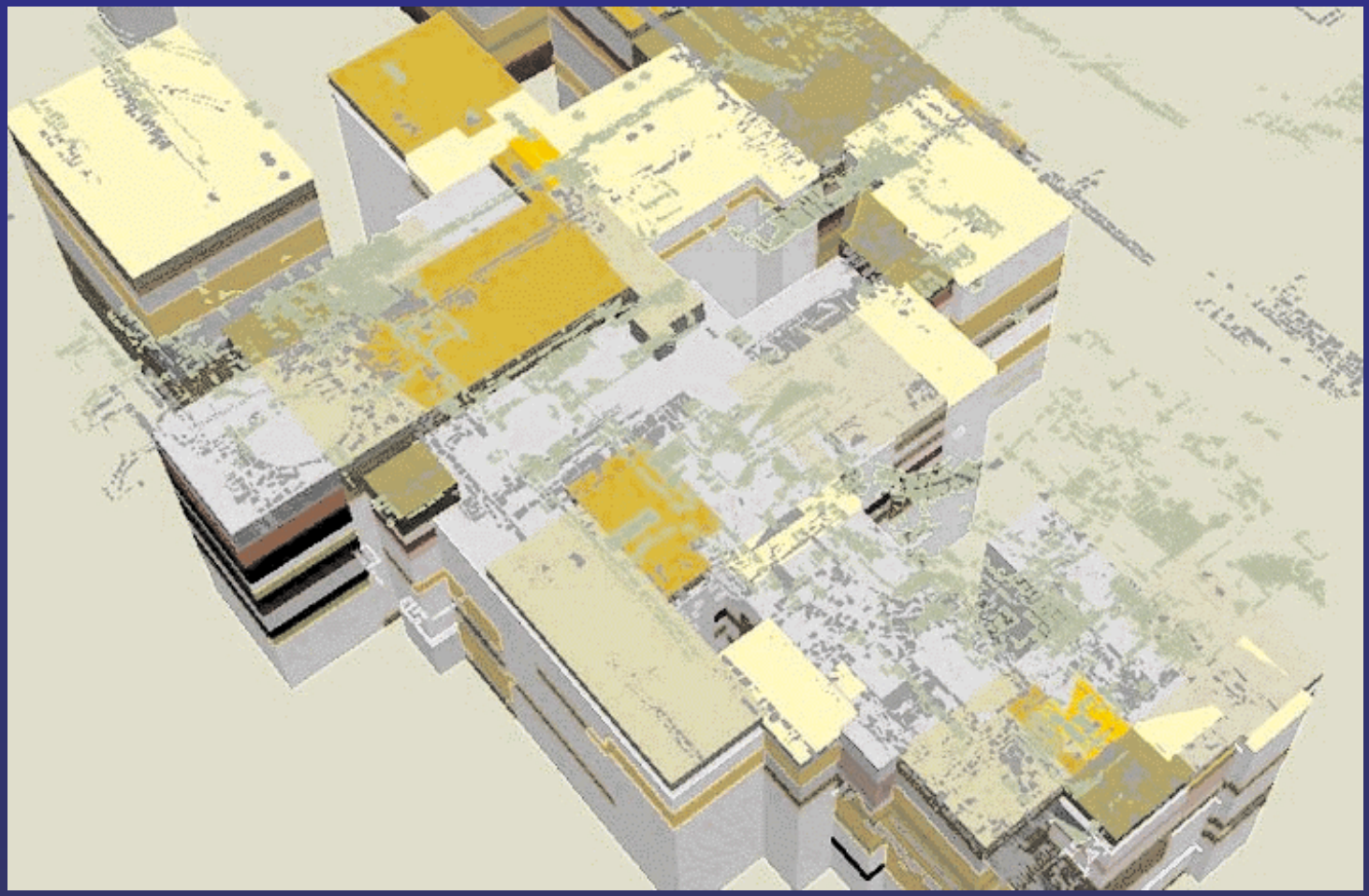
1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

The Problem ...

- Large 3D dataset.
- Difficulty of a direct analysis of tabular data.
- Researchers need to be able to extract conclusions and relations.
- Limited type of queries because of visualization issues.

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

The Problem ...



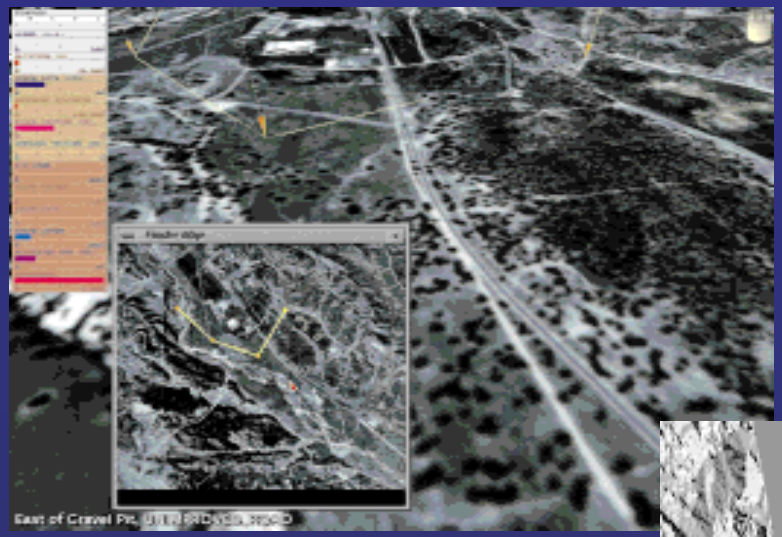
1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

A Proposed Solution ...

- **Use VR.**
- VR+GIS ..... obvious combination.
- Helps in understanding the context of the data.
- Freedom of movement through the dataset.
- Immersion in the " 3D dataset virtual world ".
- Eventually...
  - More complex queries.
  - From "data-viewer" to advanced GIS functionality.
  - Alternative to more complex data-mining strategies.

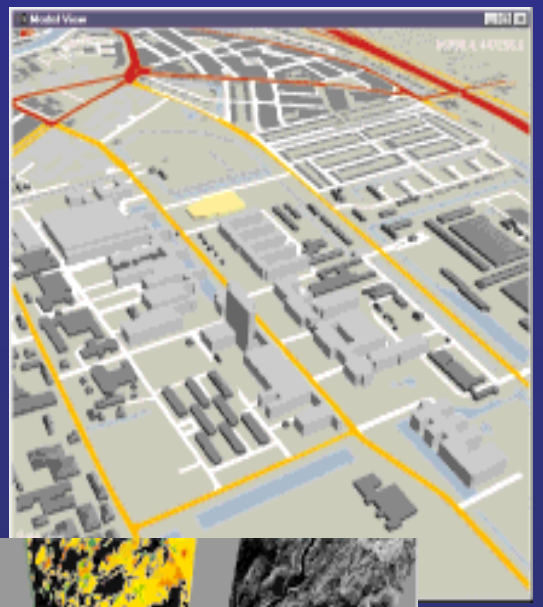
1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

Background

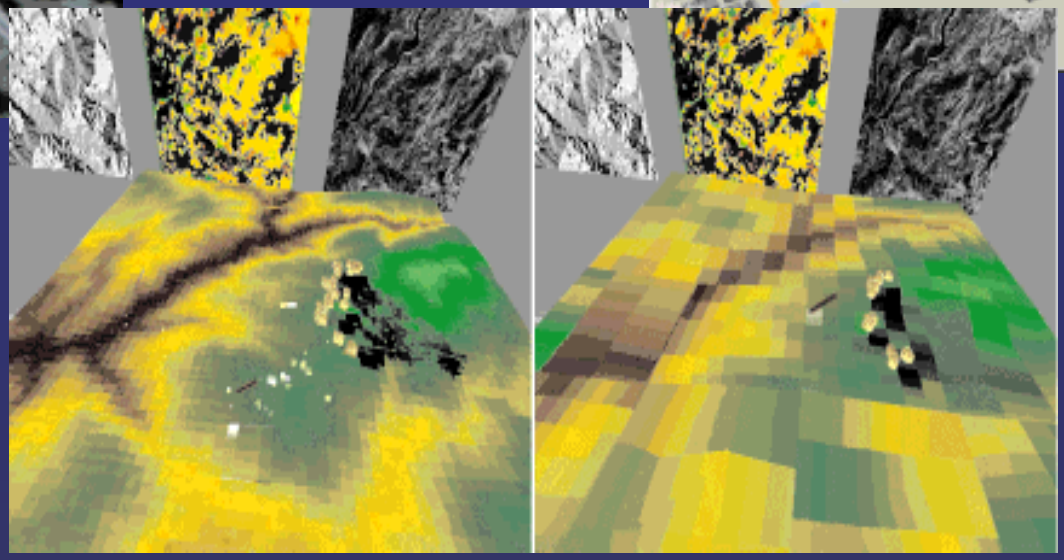


VGIS

KarmaVI



Virtual GIS Room



1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

Project Hypothesis

A Virtual Reality interface to a GIS application will allow archaeologists to easily identify and successfully analyze more complex interrelationships from the field-data.

+ Classical approach.
+ Workstation.
+ Workbench.
+ Cave.

The use of different working environments will allow us to compare the different user interfaces and evaluate the success of the project.

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

System components

- GIS end.
- Connection VR-GIS.
- VR end.

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

GIS application

"GROSSO MODO"

- ESRI's ArcView.
- EarthLab.

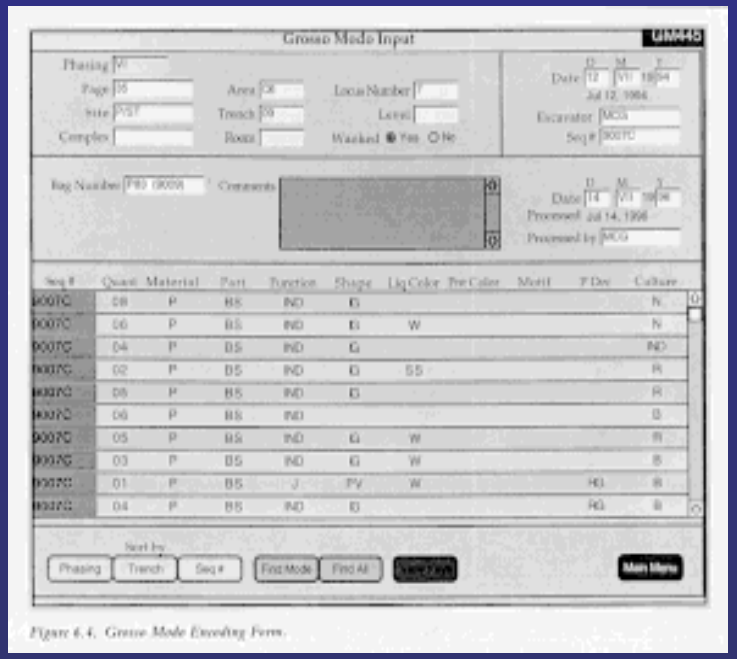
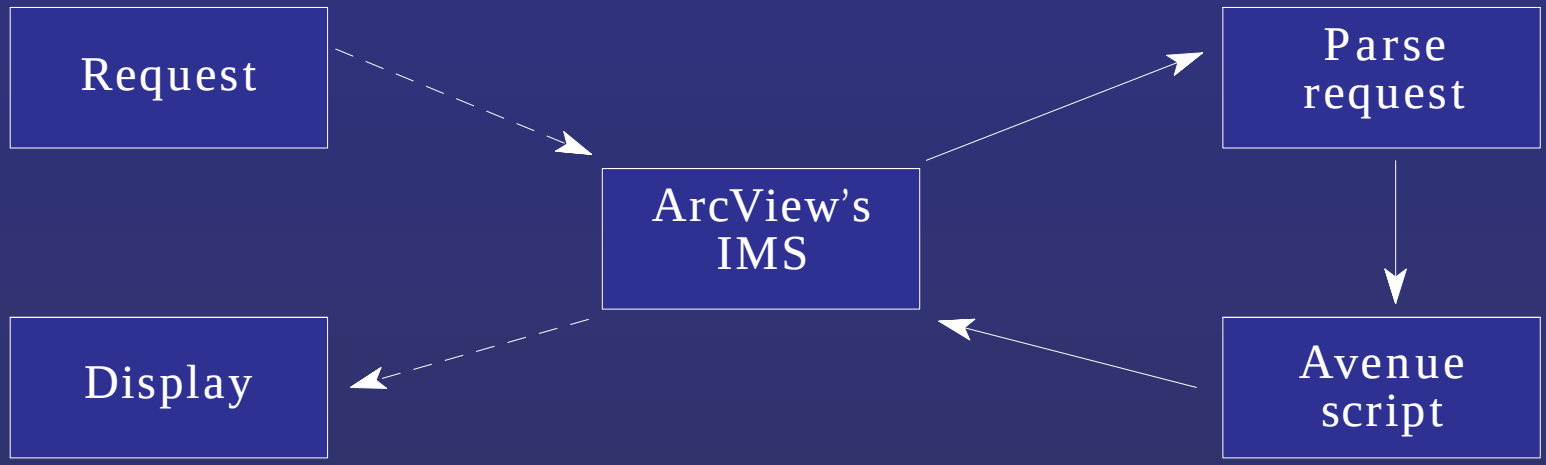


Figure 6.4. Grosso Modo Encoding Form.

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

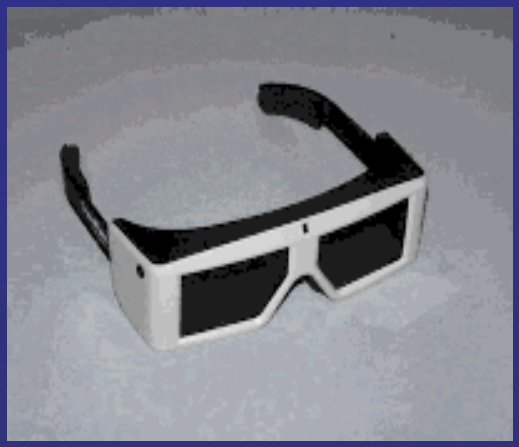
VR-GIS Connection

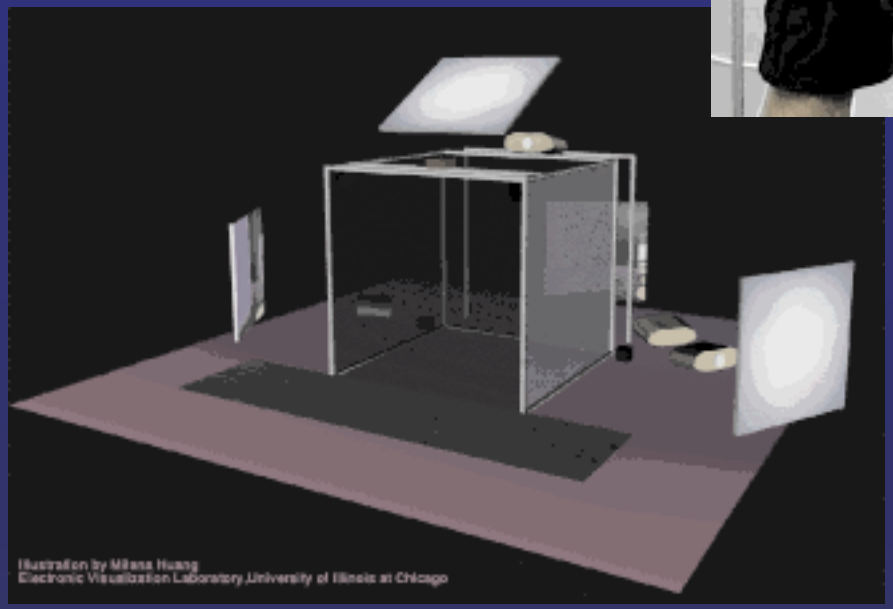
- ArcView's Internet Map Server.
- Web client.
- ArcView's Avenue™.

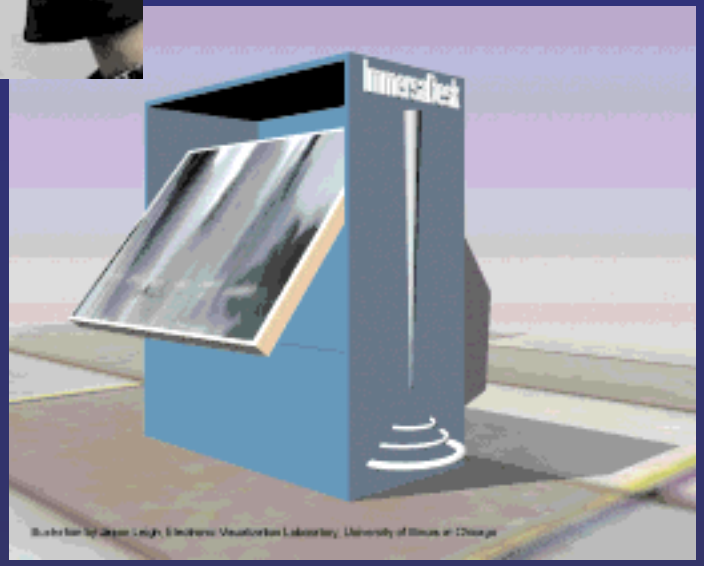


1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

VR environment





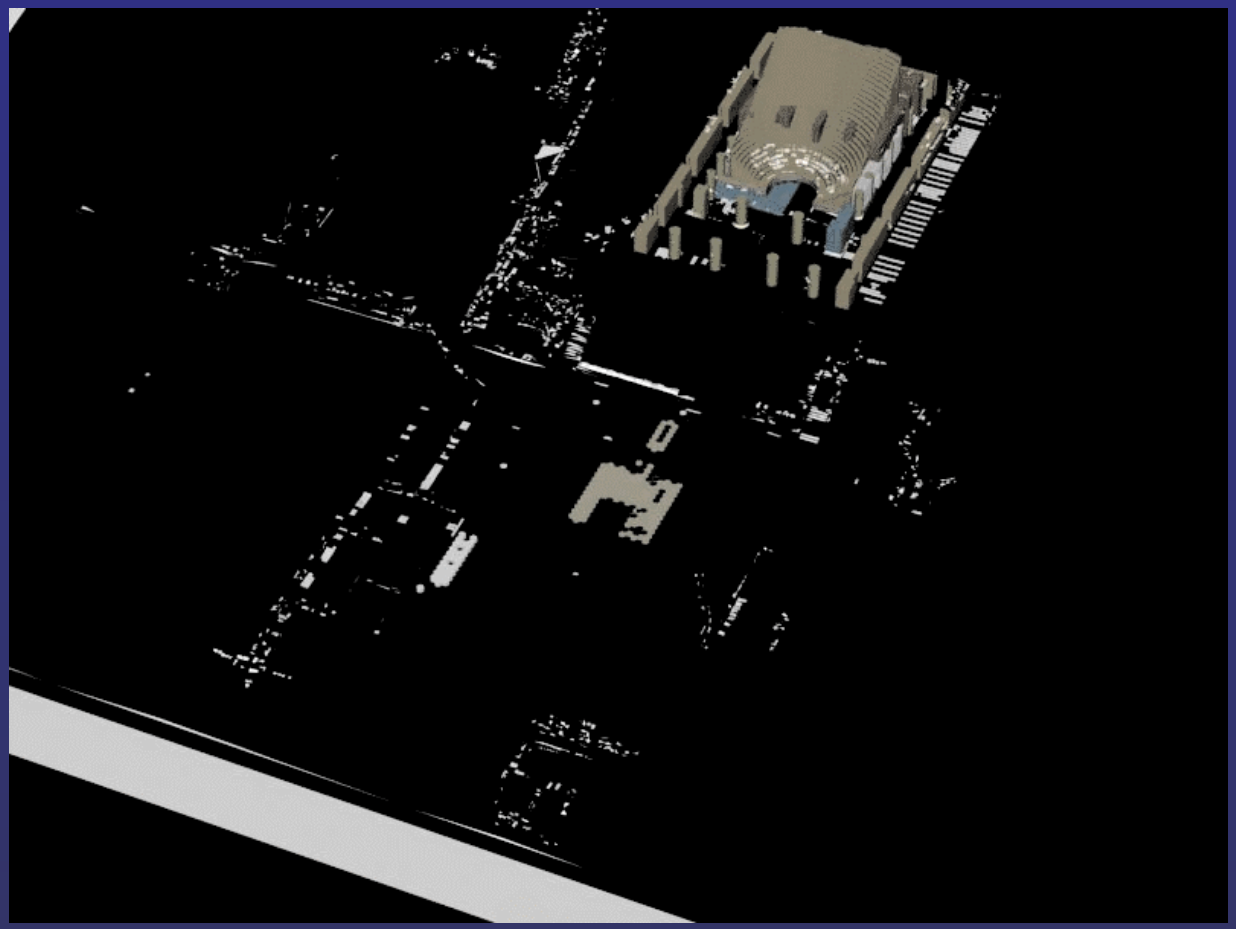


ARCHAVE: A Virtual Reality Interface for Archaeological 3D GIS

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

User's Scenario (1/2)

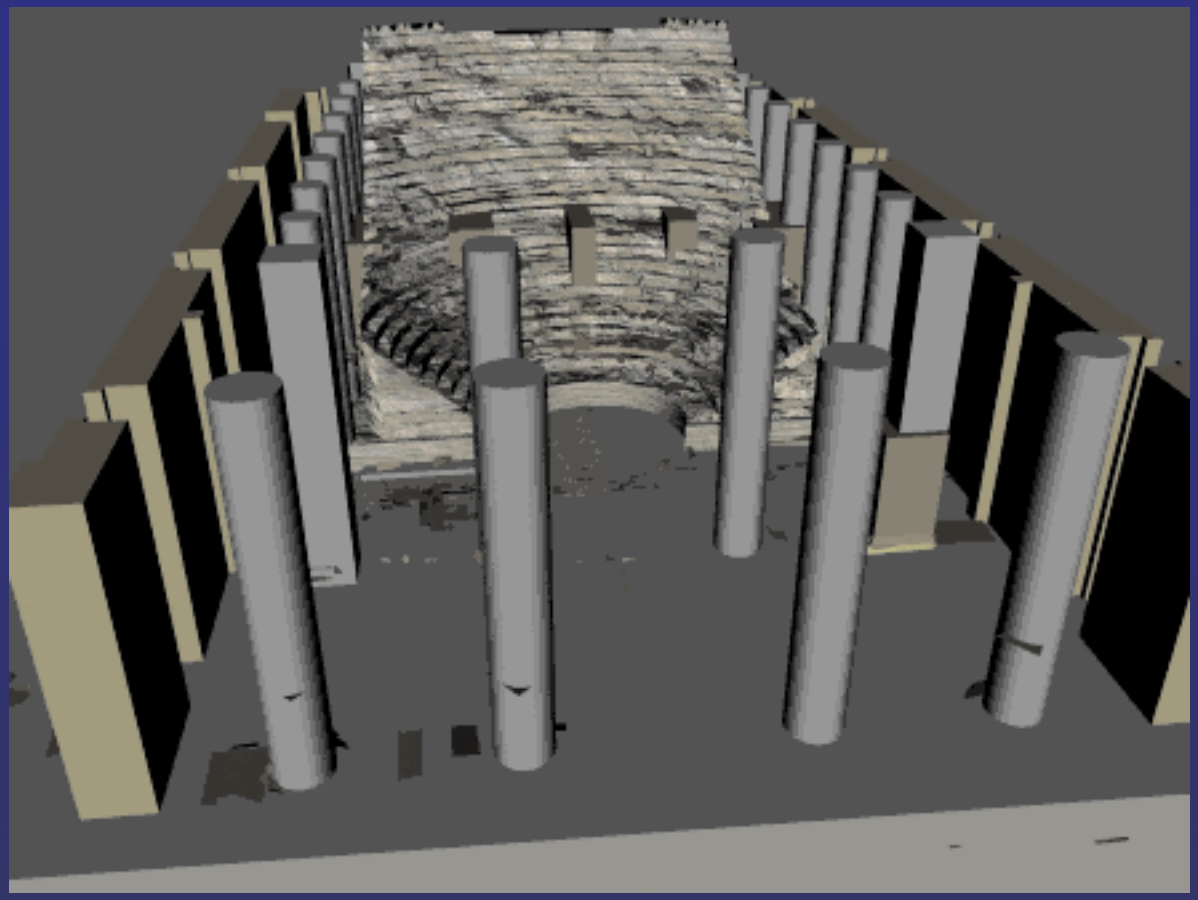
- Become familiar with the site.
- See the trenches.



1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

User's Scenario (2/2)

- See the loci.
- See artifact information.



1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

Evaluation

- Tests and user study.
- Tests for:
  - Environment navigation
  - GIS operations
- Pilot studies and User study:
  - Experienced archaeologists.
  - Three different interfaces.
  - General impressions and specific timed tasks.

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

Schedule

- February ..... Web client, model of the Temple, topographical data.
- March ..... Walking interface using the Wand.
- April ..... Avenue scripts and first VR-GIS interface.
- May ..... Data visualization models.
- June ..... Intra-theme visualization models. Pilot study I.
- July ..... LOD implementation. Flight interface.
- August ..... Advanced GIS queries. Pilot study II.
- September ..... User study and final presentation.

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

Contributions

- The first VRGIS application for archaeology research.
- User study across 3 different working environments.
- New interfaces for GIS applications.
- Navigation and LOD techniques.

1.- Motivation and definitions.
2.- Problem to be solved.
3.- Hypothesis.
4.- System description.
5.- Testing.
6.- Timeline.
7.- Contributions.

"Impact"

- Complete system to investigate new GIS interfaces.
- Integration of this system with artifact and architecture reconstruction software.
- Intra and inter-site collaboration.