CHIMERA - Cultural Heritage Interactive Media Evironment for Reality Augmentation

Veirum, Niels Einar; Christensen, Mogens Fiil; Meyerhofer, Mikkel; Lovén, Bjørn

Publication date:
2005

Document Version
Publisher's PDF, also known as Version of record

The 6th International Symposium on Virtual Reality, Archaeology and Cultural Heritage VAST (2005), pp.
Short Presentations

Cultural Heritage Interactive Media Environment for Reality Augmentation (CHIMERA)

N. E. Veirum, M. Mayerhofer, M. F. Christensen, B. Lovén
Aalborg University, Denmark / Zea Harbour Project, Greece

Abstract
This paper describes the initial concepts and ideas of the CHIMERA project. We first present the historical site, then describe the communication challenge in relation to a projected popular audience.
To meet this communication challenge, we explore promising matured technologies, present an overview of our preliminary findings, then describe our vision for an interactive and engaging museum based on an augmented reality network. In the conclusion, we list our immediate initiative and the scientific goals of the project.

Categories and Subject Descriptors (according to ACM CCS): J.5 [Computer applications]: ARTS AND HUMANITIES - Architecture

1 Introduction

In February 2005 the research project "Cultural Heritage Interactive Media Environment for Reality Augmentation" (CHIMERA) was initiated as a cooperative effort between the Department of Architecture and Design, Aalborg University, Denmark and the combined land and underwater archaeological Zea Harbour Project, under the Greek Ministry of Culture and the Danish Institute at Athens.

In Greek Mythology, the CHIMERA is a monstrous creature made of the parts of multiple animals, but the term is also used metaphorically to describe things that have combined attributes from different sources. And it can be used for an unreal ambition, a fanciful scheme, or even a castle in the air [Wiki05].

Our ambition is to present the overall concept for such "a castle in the air", a virtual museum based on hybrid digital and analogue technologies and situated at the historical site. Before turning to the "monstrous creature," we will first present the historical site, the communication challenge, and the application of promising technology.

2 Visualising Cultural Heritage

Our historical scene is set in Athens and the Piraeus harbour about 2,500 years ago in the classical period (5th and 4th centuries BC), more precisely a few years before and during the Persian War, unquestionable one of the most important chapters in the history of western civilisation.

Themistokles, the leading Athenian statesman of the time, was convinced that the future of Athens lay at sea, and in 492 BC, the construction of the fortifications and harbour installations in the Piraeus was begun on his advice. In 483 BC, Themistokles convinced the Athenian citizens to finance the construction of 200 triremes, the state-of-the-art, fast and manoeuvrable, three-tiered oared warship. It was these ships that narrowly allowed the victory at Salamis that decisively reversed the fortunes of the Persian invasion of Greece in 480 BC, eventually leading to its final defeat in 479 BC.

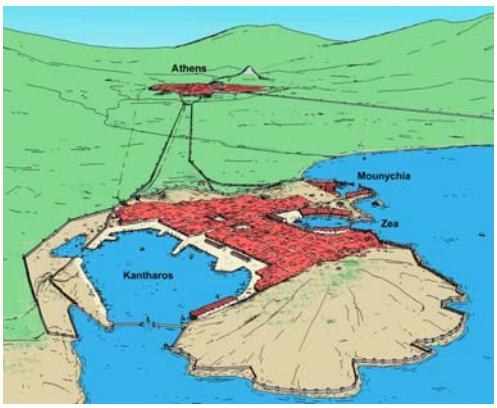

Figure 1: Ancient Athens and Piraeus with the three harbours Kantharos, Zea and Mounychia.

By the late 330s BC, Zea Harbour had a capacity of 196 warships, and it was Athens' most important naval harbour, as well as, one of the largest building complexes of the classical period.

The two other harbours in the Piraeus, Kantharos, which was a combined naval and commercial harbour in antiquity, and the naval harbour, Mounychia, housed 94 and 82 warships respectively. The ship sheds in the Piraeus covered now more than 110,000 m^2, which is about 15 football fields. More than 50,000 men were required to man the Athenian fleet.

Figure 2: Trireme reconstruction *Olympias*. ©Trireme Trust.

No shipwrecks of ancient warships have been found to date. Therefore, the Olympias, a reconstruction of a 2,400 year-old trireme, was based on various ancient sources: pictures of triremes on vase paintings, images carved in stone and ancient literary sources. More reliably, the inescapable rules of naval architecture had to be applied plus the overall dimensions of the Zea ship sheds, as they were then understood, served as a guide for the overall length and width of the experimental vessel.

At present, there are no definite answers as to where and when the trireme was invented. But the fact that the trireme served as a warship for almost 1,000 years is a testament to its successful design. By the early 5th century BC, this ship was one of the most sophisticated architectural structures built by man.

Figure 3: Reconstruction of the ship sheds. Y. Nakas © ZHP 2005

Ship sheds were huge, hangar-like buildings designed to store ancient warships. The buildings were crucial for keeping the Athenian triremes operational and consisted basically of a ramp sheltered by a roof that was supported by two colonnades. The ramp supported and guided the keel of the ship during slipping and hauling operations, and was built on an inclination to ensure that the ship was hauled completely out of the water.

It was essential to store these fast and rather fragile vessels out of the water for two reasons. First, their slender softwood timbers were subject to attack by wood-eating marine worms. These shipworms were a principal problem of all ancient navies, because a worm infested ship required major repairs before it could be made seaworthy again. Second, triremes were kept under a roof because of the effects of sun and rain. Rainwater inside the ship would soak the timbers, swelling them and allowing fungal decay to attack them. On the other hand, the fierce Mediterranean summer sun would thoroughly dry and shrink the timbers of an uncovered warship, rendering the ship hopelessly leaky and thus unseaworthy.

3 Why use interactive media technology in archaeological excavations?

Classical archaeology has traditionally had difficulties engaging the interest of ordinary people. And Cultural Heritage institutions like museums and collections have to meet new challenges from the global knowledge and experiences of their respective societies. The traditional model for these institutions has been collection, cataloguing and display of artefacts based primarily on chronology and character. These models and methods, however, are now challenged by the users' expectation and experiences, which are framed by interactive media and the technological focus on individualized searching and profiling of knowledge and experience.

There are already a variety of museums, libraries and other cultural institutions that are looking into digitisation of their different collections [CIG03] [OBP04b]. The Internet will slowly take over the different tasks of communication of knowledge for these institutions for several reasons:
1. Easier to reach out to a wider set of spectators.
2. Service already in demand.
3. Easier data sharing.
4. Easy to access and preserve data.

An important role of IT is to help the cultural heritage institutions handling various sets of data. Just as important, however, is the issue of communication of knowledge. How can WWW, databases, VR and AR help the cultural heritage institutions communicate and present knowledge to stakeholders and outsiders alike? Such technologies have been thoroughly tested and are thus no longer of an experimental character. In particular, the equipment for 3D-animation and projection is more easily accessible today, not least in terms of costs. Hence many more museums are capable of investing in the equipment.

3D reconstruction of archaeological remains will give the visitor (in museums, at the dig-site or on WWW) a feeling of space and dimension, which traditionally is very hard to create, unless the ruins are reconstructed physically.

How to present the past using 3D-animation:
• In a museum cinema that projects movies of 3D-animations and/or an interactive museum information post.
• On WWW through small streamed movies that convey a sense of interactivity.
• Using a Head-Mounted Display showing 3D-reconstructions on top of the archaeological ruins, allowing full interactivity for the visitor at the site.

A matrix strategy is used to optimize CHIMERA for the cross-referencing of archaeological findings across excavation sites. As an example, a column-base is registered at several levels: three-dimensional laser survey data, three-dimensional geo-localisation, 2D/3D photo and video registration etc. These data entities can be queried,

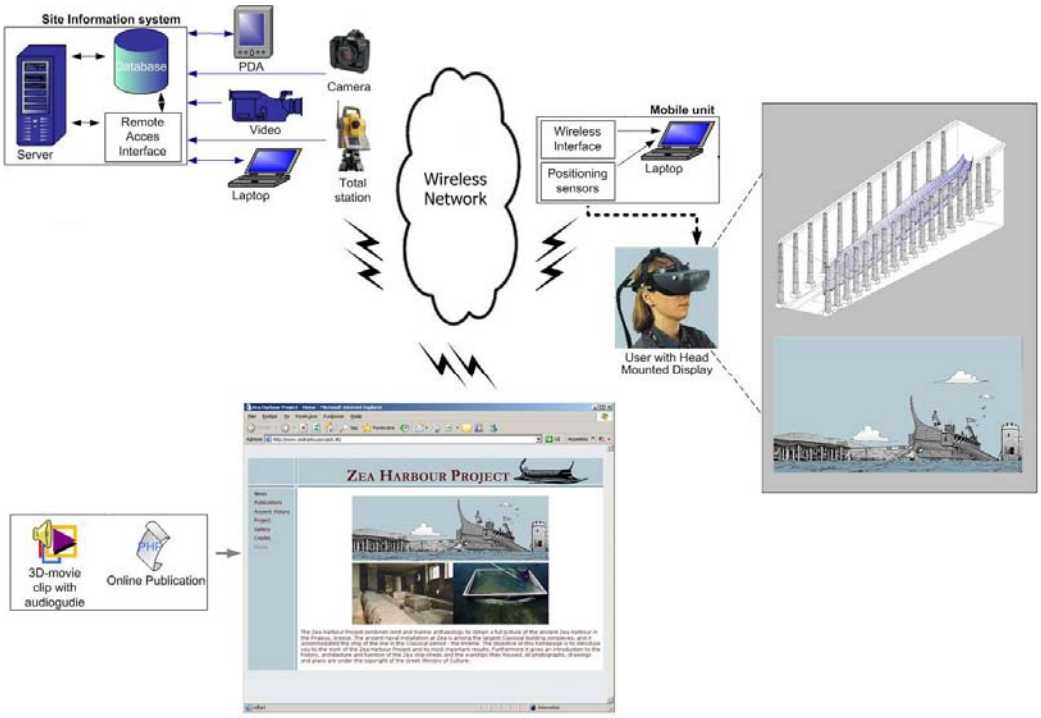

Figure 4: Reality Augmentation

4 The Castle in The Air

The Zea Harbour Project is used as a case study in which the user's experience and engagement is investigated and prototype solutions are demonstrated.

We envision the Cultural Heritage Interactive Media Environment for Reality Augmentation (CHIMERA) based on the following concepts:

4.1 The concept of the integrated digital/analogue museum

The platform for several initiatives includes an overall strategy for the integration of analogue and digital data from the very beginning of the archaeological excavations in the Zea Harbour Project. The special characteristics of the project, with large parts of the findings still in their original position over and under water, allow the museum to be an integrated part of contemporary city life. Only very few artefacts have been moved from the site to storerooms in museums and other places.

combined and optimized for several purposes. For a public display, for example, only a subset of the data would be relevant, but these data would be readably available in an optimized resolution and data format.

4.2 The concept of the Multi-Medial Museum.

The implementation of the CHIMERA environment supports a robust, multimedia museum concept. All media assets are prepared for simultaneous use in several media, such as virtual museum web site, stationary and mobile exhibitions, on-site PDA and Head Mounted Display solutions [VDBI04].

4.3 The Concept of the Interactive and Engaging Museum

The CHIMERA matrix is the platform for design and integration of interactive experience and learning modules. The goal is to make the users active participants in the ZEA Project by interactive exploration of preferred parts of the project and by experiencing different 're-living history' [GCP04] installations that combine physical and digital artefacts to optimize multi-sensory learning and reasoning.

Figure 5 is a short example of a conceptual storyboard for the design of a user experience at the historical sites in Piraeus' ancient harbours. The visitor experience is distributed in the contemporary cityscape [OBP04a] rather than isolated in traditional cultural heritage institutions.

The workshops are hybrid physical and digital installations using fragments of physical tools as specialized interfaces to game-like digital learning modules. Again, visitors have the choice to leave the tour or return to the starting point.

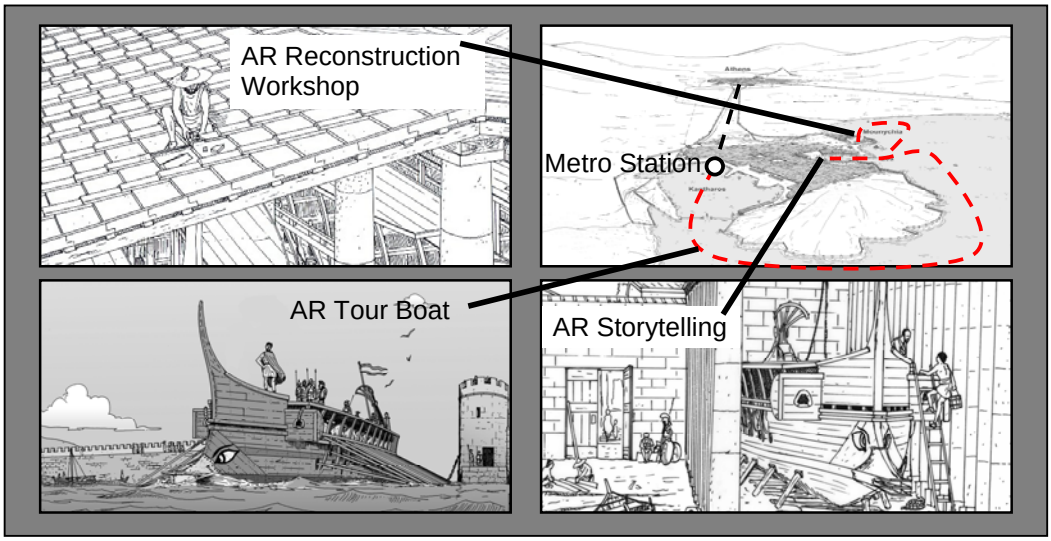

Figure 5: User experience storyboard

Whether arriving to Piraeus from Athens, the Greek Islands or the outside world, the Metro Station harbour area is the main entrance point and the archaeological experience will start here by entering the AR Tour Boat. The boat is equipped as a VR Panorama and the first part of the route to the Zea harbour includes an introduction to the historical situation in the classical period.

A visualization of the Battle of Salamis (480 BC) puts visitors in the role of the triumphant trireme crew returning after the victory. As the boat enters the Zea harbour, visitors mount a specialized HMD perhaps in the form of an ancient helmet. The presentation then changes to Mixed Reality mode [VDBI04], with the modern physical site overlaid by a reconstruction of the ship sheds and accompanying triremes and crews.

On the harbour front, visitors have several possibilities to learn more about the archaeological findings. As they move around, geo-coded material will offer stories and experiences situated at the exact location of original events.

The user decides when to leave the tour or board the AR Tour Boat and return to the Metro Station or continue to the small harbour of Mounychia. Again, the sailing time is used for a linear presentation. At Mounychia are located the AR Reconstruction Workshops, which are the most interactive installations. In the workshops visitors are given the possibility to engage in several learning sessions involving multiple senses.

5 Conclusion

Traditionally archaeology has a tendency to document and analyse buildings and other architectural structures from plans and sections.

Instead we document the architectural structures in 3D using a Leica total station and the direct CAD (MicroStation) surveying system developed by Nigel R. Fradgley of English Heritage. The system records the results directly in the form of a 3D MicroStation 'wire frame' CAD model in the field, the empirical foundations of the 3D VR reconstructions.

What is the scientific goal of the project? We could mention:
1. Explore the 3D dimensional interior a highly functional building designed specifically to store one of the most advanced architectural structures of its time, the trireme. For example, exploring the 'space' available for the hauling and maintenance crews between the hull of the warships, the colonnades and the side-passages (the floor area between the ramp and the colonnades).
2. Explore the 'light' inside the ship shed, and the kind of work that could have been carried out inside the buildings.
3. Create a physical space integrating the physical laws that will allow us to explore different slipping and launching theories - basically how the 40 m+ warships were pulled into and out of the ship sheds.

These attempts to 'recreate' the past should hopefully result in more focus on the field of archaeology. The general idea is that the intermediary

will benefit from new ways of creative learning in relation to the acquisition of knowledge concerning cultural heritage and archaeological remains.

6 References

[Wiki05] Wikipedia, the free encyclopedia. http://en.wikipedia.org/wiki/Chimera, august 2005.

[CIG03] J. Cosmas, T. Itegaki, D. Green et. al: *Providing Multimedia Tools for Recording, Reconstruction, Visualisation and Database Storage/Access of Archaeological Excavations*. (VAST 03)

[GCP04] A. Gaitatzes, D. Christopoulos and G. Papaioannou: *The Ancient Olympic Games: Being Part of the Experience*. (VAST04)

[OBP04a] Ruth Owen, Dimitrios Buhalis, and Daniël Pletinckx: *Developing the Tourism Aspects of a Cultural Route* (VAST04)

[OBP04b] Ruth Owen, Dimitrios Buhalis, and Daniël Pletinckx: *Identifying technologies used in Cultural Heritage*. (VAST04)

[VDBI04] V. Vlahakis, A. Demiris, E. Bounos, N. Ioannidis: *A Novel Approach to Context-Sensitive Guided e-Tours in Cultural Sites: "Light" Augmented Reality on PDAs*. (VAST04)