A guide for multimedia museum exhibits: 1,000 years of the Olympic Games

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Despite the ongoing debate on the strengths and weaknesses of digitally reconstructed archaeological models, the virtual reconstruction of Olympia, and the website for the exhibition 1,000 Years of the Olympic Games: Treasures of Ancient Greece *www.phm.gov.au./ ancient greek olympics/ have demonstrated not only the unlimited potential of this medium, but also the viability of the Internet to supplement and extend materials offered locally in museums. The author is project manager/creative producer of special projects at the Powerhouse Museum, Sydney, where she developed the Olympia visualization and multimedia project. Traditionally a maritime archaeologist and museum curator, Sarah Kenderdine has researched and excavated shipwrecks throughout Australia and the Indian Ocean region and has written a number of books on the subject. After completing an M.A. degree on virtual museums in 1995, with a research thesis on design, she carried out web projects for the Western Australian Maritime Museum from 1994 to 1995, the Smithsonian Institution, and for the Museum Archives and Informatics. For two years from 1998, Ms Kenderdine was the information architect and creative producer for the portal web Australian Museums On-Line (amol.org.au). She has recently completed working with the Museum of New Zealand Te Papa Tongarewa to examine redesign options for the portal web New Zealand Museums Online.*

Introduction

This article draws from a recently completed multimedia project which complemented the exhibition *1,000 Years of the Olympic Games: Treasures of Ancient Greece,* held at the Powerhouse Museum, Sydney, from 10 July to 18 November 2000. Organized and lent by the Greek Ministry of Culture, Athens, it was Greece's contribution to the celebration of the Sydney 2000 Olympic and Paralympic Games. With varying emphasis, this article has been reproduced for other forums, including: *WWW10* in Hong Kong, May, 2001;[1] *Museums and the Web*, Seattle, March 2001;[2] and *Virtual Systems and Multimedia Conference*, Gifu, October 2000.[3]

The exhibition offered an opportunity to supplement the traditional visitor experience with the introduction of 'virtual reality' components. These works included a 3D digital reconstruction of the site of Olympia in 200 B.C.; the laser scan of the famous statue of Zeus from the archaeological museum in Athens; and the construction of a large-scale website which delivers the exhibition components together with a host of supplementary interpretive material.

We begin this article by highlighting the visions and cautionary perspectives in undertaking the process of archaelogical reconstruction using digital tools. Recognizing the potentials and difficulties of digital reconstruction, we discuss some of the curatorial and technical aspects of creating the information complex, and continue with the archaeological and historical data considerations that were the basis for creating the 3D visualization.[4] We then proceed with the presentation of the complex of requirements that are the basis for any large-scale exhibition-based

website, and a statistical analysis of the website usage since its launch.

Theory in digital archaeological visualizations

In theory, digital reconstructions represent a paramount tool of inquiry for archaeologists. As Forte notes: 'Through the collection of multiple forms of data otherwise lost, that become homogeneous after calculation, a model of the event can be constructed. This allows for the step-by-step visualization of all phases, providing humanity with extraordinary predictive power, since each level is the necessary condition for the next one.'[5]

In archaeological inquiries the richness of the medium for teaching and theory testing in the form of alternate visualizations is potentially unlimited. Furthermore, to situate digital visualizations of archaeological and historical sites into museums and to translate them for the Internet, represents a powerful form of interpretation. It allows for complex datasets to be drawn together forming products that are multi-sensory and easily accessible. Colonna presents his view of the flexible nature of digitally reconstructed environments (as discussed by Barceló).

> A virtual world should be, then a *model*, a set of concepts, laws, tested hypotheses and hypotheses waiting for testing. If in standard theories, concepts are expressed linguistically or mathematically, in virtual environments, theories are expressed computationally, by using images and rendering effects. Nothing should be wrong or 'imaginary' in a virtual reconstruction, but should follow what we know, be dynamical, and be interactively modifiable. A virtual

experience is then a way of studying a geometrical model – a scientific theory expressed with a geometric language – instead of studying empirical reality. As such it should be related with work on the empirical reality (excavation, laboratory analysis). As a result we can act virtually with inaccessible artefacts, buildings and landscapes through their models.[6]

For the Olympia project the empirical reality was based on numerous excavation reports, historical and scholastic sources and in aerial and geological ground-survey data. A considerable component of the project was the acquisition and analysis of source information, especially as a high degree of veracity and verisimilitude was required. The digital reconstruction process attempted to create an archaeologically correct interpretation of the research materials available.

Caution in reconstruction

Increasingly, archaeological reconstructions are used in cinematographic-digital formats or 3D interactive environments. These virtual models are criticized for their ability to portray scientific speculation as 'truth'. In general 'the more advanced the level of technology used in the reconstruction and for display, the greater the belief in its authenticity'.[7] This mechanism is also reinforced when reconstructions are displayed in the context of museums with the inherent authority these institutions confer to the works.

Moreover, virtual archaeology has been accused of being more an artistic task than an inferential process. Uncritical acceptance of the product has led to a point where 'fundamental questions relating to issues such as what we actually mean by virtual reality, and what our expensively assembled models truly represent have been left largely unexplored.'[8] Both perspectives introduced above were to act as much as inspiring horizons as cautionary notes to the Olympia visualisation project.

Against the potential of a digitally reconstructed archaeological model the project was constrained in many ways with regard to the final product. Resource restrictions, that is, time and computing power, meant that it was necessary to fix an approximate date in the history of Olympia rather than use the model to examine the changes at Olympia over time.

Interactivity was also restricted to force users to complete a tour of the site, with choices along the way, in twenty minutes, rather than allowing free interaction. Juxtaposition between the reconstruction and the archaeological site was introduced by the use of panoramas from the Olympia site as it was photographed in March 2000. This offered a temporal and spatial link between the site as it appeared in 200 B.C. and the extant ruins that exist today.

Data acquisition

The site of Olympia is situated in fertile countryside adjacent to Mount Kronos between the elbow of two rivers – the Alpheios and the Kladeos. Archaeological and historical records show that little has changed at this site over the past few millennia.

In the prehistoric period its verdant topography inspired the worship of nature gods, and set it on a course for greatness as one of the glories of ancient

Aerial view of the digital reconstruction of Olympia 3D model.

Greece. This isolated glade was to spend 1,000 years as one of the most important religious sanctuaries in Greece, with its Olympic Games a fundamental component of worship to the supreme deity in the ancient Greek pantheon: Zeus.[9]

A team comprised of a curator, archaeologist, surveyors and photographers travelled from Australia to Greece early in 2000 to capture the datasets in high resolution using laser scanning and digital photography. Most of the archaeological remains at Olympia are scattered across the site, the result of two earthquakes in the sixth century A.D. and numerous floods. Those foundations that survived date back to different periods, from Archaic, Classical, Hellenistic and Roman times.

The bibliography on Olympia runs to hundreds of items, although those dealing strictly with the archaeology of the site can be counted in the mere dozens. The reader may retrieve a comprehensive discussion of the bibliography from the website.[10]

The project team decided to attempt to reconstruct Olympia, as it had been around 200 B.C. This choice was expedient, as it is impossible to pick a single year to reconstruct an ancient site, given

the relative coarseness of archaeological chronology. At a site like Olympia, used without interruption for over 1,000 years, almost certainly with frequent refurbishment of quite old buildings, it is only possible to establish a rough idea of when a building was erected. Whether a building was undergoing renovation in a particular year cannot be stated. The length of time it took to complete buildings is also another issue.

The choice of 200 B.C. was therefore made mainly for practical reasons: the later the date in the site's history, the more buildings there would be, and the more interesting a virtual tour would be for modern visitors and would more closely correspond with the extant ruins. It was an Olympic year; and it was just before the beginning of the Roman annexation of Greece.[11]

One of the most significant sculptures in the National Archaeological Museum in Athens is the statue of Zeus from Artemision (Artemesium), also considered to be possibly a statue of Poseidon. This bronze sculpture is slightly larger than life size, and was found in 1926 in the sea off Cape Artemision. It is one of the few surviving examples of Early Classical statuary. The laser scan of the Zeus allowed this object to travel, in a virtual

sense, from Athens to Sydney. This offered audiences in Australia a new point of access to examine this rare object.[12]

The website

Despite the great opportunity to produce these abovementioned interactive exhibition materials, the sponsors of the project, the Intel Corporation, and the museums' main interest involved the production of a state-of-the-art website. This website was intended to complement the exhibition, and to demonstrate the viability of the Internet to supplement and extend materials offered locally in the museum. This medium has not only provided access to this material to wide audiences but has also outlived the exhibition. Other options are its abilities to archive the website in the long term and possibly to repurpose the content.

The Greek Ministry of Culture gave the museum extensive access to the archaeological site of Olympia, and to the pedimental sculptures and metopes from the Temple of Zeus, currently housed in the Museum at Olympia. These materials, in addition to extensive archaeological and historical research, and education and programming material associated with the exhibition itself, formed the basis for the website.

In response to the sponsors' expectations, the website was constructed to demonstrate the use of advanced technologies for the delivery of rich cultural content. From the museums' perspective the opportunity to design a product with a high degree of sophistication outweighed the concerns over download times and minimum browser specifications, though these concerns were also addressed in the design. The website, ultimately intended for academic, school and researcher markets, was also translated into Japanese, Korean and Mandarin for the Asia-Pacific markets.

Apart from the standard plugin, Adobe Acrobat Reader, the main plugin is the Zoom Viewer by MGISoft. The latter has two main utilities: it allows the high-resolution images to be stored on the server and streamed to users on demand, thereby reducing bandwidth requirements; and it prevents users from saving the materials on to their hard drives. This last feature is of extreme importance to the Greek Ministry of Culture and the museum who wish to protect copyright. As noted, none of the exhibition objects displayed in the exhibition and on the website, had been displayed outside Greece before. With a history of contentious international relations over Greek antiquities it was very important to all those involved that every measure was made to prevent unwanted use of the digital materials. The website is constructed in six sections. These are as follows.

The exhibition

A series of zoomable panoramas of the exhibition at the Powerhouse Museum (photographed in high resolution using a D1 Nikon camera and stitched together using Live Picture from Reality Studio™) augmented by 3D object movies and high resolution zoomable images of objects, and supplemented with object information as text.

Virtual Olympia

This section contains a rich collection of materials separated into four subsections including:

- Archaeological and geographic maps of Olympia.
- A panoramic tour of the digital reconstruction of Olympia presented as 360-degree zoomable panoramas, viewable at full screen and accompanied with audio files. The option to download individual buildings to complement scholarly research is also available. Essays are available as PDF files.
- Twenty-nine zoomable 360-degree panoramas of the archaeological site at Olympia taken in March 2000. Essays are available as PDF files.
- The statues from the Temple of Zeus shown as a 360-degree panorama of the main room at the Museum of Olympia, and a series of zoomable object movies. The metopes are further supplemented by reconstructed line drawings and colour interpretations using archaeological and historical records as the sources for reconstruction.

Foreground of the Temple of Zeus showing the Nike statute, from the reconstruction of Olympia 3D model.

- Fourteen researched PDF articles (with links to an html glossary page).
- Education programmes.
- A glossary of terms as a stand-alone page or linked from the PDF articles.
- A nodal genealogy of the gods (using Macromedia Flash).
- A supplementary programme of events to compliment the exhibition at the Powerhouse Museum.
- All audio files are listed.

3D Zeus

The 3D Zeus was presented in a web version of the laser scan of the Zeus of Artemision (using the Zoom Viewer plugin), with the option to view as a 3D anaglyph through downloadable anaglyph glasses. The Zeus data was very dense to start with and was finally reduced to 2 million-odd polygons. This model was stitched in 3D Studio Max and an animation was produced. Live Picture was used to make the animation an 'object'. The analglyph version was made by composting the red and blue images.

Image archive

Due to the extensive visual components in the website, this section offers a quick entry to all the individual panoramas, zoomable images, object movies and jpegs. Selected buildings from the digital reconstruction of Olympia are available here, for research purposes, to download and print.

Resources

This section intended for researchers, and as part of school studies includes:

Timeline

A timeline of events at Olympia over a 1,000-year period is organized into:

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Sarah Kenderdine

Inside the Temple of Zeus, from the reconstruction of Olympia 3D model.

- Events specific to the Games at Olympia (events added after 200 B.C. not included).
- Events relevant to Olympia itself (the building programme until the end of Hellenistic period only).
- Events, political, around the Mediterranean world. After 200 B.C. only events that were directly relevant to Greece or Olympia, for example, politics, arts and sciences.

The website also contains extensive project information, help information, and plugin downloads page.

Analysis of website usage

Statistical data derived from website traffic has been analysed for the four-month period of the exhibition – from the beginning of August 2000 until the end of November 2000. The author acknowledges the restricted nature of basic statistics to determine true use of the web, however, general statistics are presented here to demonstrate several observable trends.

The average number of hits per day over this period totalled 18,500. Other broad general-level statistics include: the average number of visitor sessions of 52,582, and the average visitor length of twelve minutes. The majority of visitors were from outside Australia (international at 55 per cent and unknown at 29 per cent).

A more thorough examination of the period shows a predictable variation in the data display. The most active day of use was during the Olympic Games period – 16 September 2000 with 92,352 hits. Weekdays rather than weekends showed a larger number of hits though it was after-hours that numbers were marginally higher. This contradicts our initial expectations that the high bandwidth required to access the site would preclude extensive home use.

What is potentially of more interest is the length of stay by each visitor, 45 per cent of visitors accessed just the first two pages of the website. There was a corresponding drop off as the number of pages increased. However, 8 per cent of the visitors stayed over twenty minutes to access 43 per cent of the total page views. This last statistic would suggest that those visitors who were interested in the site found rich and rewarding content. At one point in the four-month period over 18 per cent of the visitors were staying over twenty minutes. In web language this has been referred to web 'stickiness', where

content is rich and has sufficient depth to sustain user interest.

A future for the model

The virtual reconstruction of Olympia was intended for general-public consumption with limited interactivity, and was not specifically designed as a teaching tool. However, the underlying dataset of the model does allow for scientific use. Two areas for investigation include modelling the sun in relation to the temples and the earthquake effect on the Temple of Zeus. The model also allows for further research on sanctuary usage and liturgical practice.

Conclusion

Any project of this nature is concerned with balancing realism with reality. The decisions made in the creation of the digital reconstruction were further constrained by the goals of the project, the intended audience, the desired product, the quality of archaeological information and technological capabilities.

In the construction of the website further constraints on design decisions included the use of state-of-the-art technologies, which must demonstrate impressive content development and display for a sophisticated web-user demographic. This questioned the museum's role as a provider of 'access for all', but at the same allowed for the museum to push limits in Internet design and technology using rich cultural content.

The Olympia model and some of the content from the website have been re-purposed for a CD-ROM which will be distributed to schools in Australia and in limited numbers for other markets. The

The treasure houses near the stadium.

versatility of use for the Olympia and Zeus models, and the rich website content demonstrate that rigorous scholarship is a worthwhile investment (and potentially profitable), and can command a significant audience. The repurposing of the underlying content has enabled the works to be developed for different platforms and delivery mechanisms. The ability to have this flexibility rests on the application of appropriate metadata standards to digital materials and in the overall strategies for knowledge and content management which are part of the core business of museums today. Attention to the archival implications of 3D materials is an area in which work is just beginning. The ongoing challenge in relation to the creation of virtual models is to provide users with the ability to alter input data and test their own hypotheses. The development of VRML worlds on the Internet, which are robust in implementation, will hold much value for museum web developments.

Intel Corporation (www.intel.com.au). MGI Software Ltd (http://www.mgisoft. com) kindly supported the licence for the Zoom Server software. ∎

Notes

1. S. Kenderdine, *1,000 Years of the Olympic Games: Treasures of Ancient Greece. Digital Reconstruction at the Home of the Gods*, presented to WWW10 Conference, Hong Kong, May 2001, Association for Computing Machinery (in press).

2. Idem., presented to Museums and the Web, Seattle, March 2001, CD-ROM, Pittsburg, Museum Archives and Informatics, 2001.

3. K. Da Costa, S. Kenderdine, C. Ogleby and J. Ristevski (2000), *The Digital Reconstruction of Olympia, 3D Zeus and Website*, presented to the sixth International Conference on Virtual Systems and Multimedia, Gifu, Japan. pp. 104–16, International Society of Virtual Systems and Multimedia.

4. Technical aspects of the construction of the model, the data acquisition process at the site of Olympia, the laser scan of the statue of Zeus, and presentation of the works in the exhibition are available on the website itself. *1,000 Years of the Olympic Games: Treasures of Ancient Greece*, website. Last accessed 15 January 2001 (www.phm.gov.au/ ancient_greek_olympics).

5. M. Forte, 'About Virtual Archaeology: Disorder, Interaction and Virtuality', *Virtual Reality in Archaeology*, pp. 247–59, CD-ROM, Oxford, Archaeopress, 2000 (BAR 5843).

6. J. F. Colonna, *Images du Virtuel*, Addison-Wesley, France, 1994. As discussed by A. Barceló, 'Visualizing What Might Be: An Introduction to Virtual Reality Techniques in Archaeology', *Virtual Reality in Archaeology*, op. cit.

7. M. Eleme, 'Archaeological Simulation between Linear Media and a Virtual Museum', European Institute of Cinema Karlsruhe website. (http://eikk.hfg-karlsruhe.de/Eng/ simulation.htm). Last accessed 31 August 2000 [No longer available – Ed.].

8. Forte, op cit.

9. P. Donnelly, Comments from the Curator, *1,000 Years of the Olympic Games: Treasures from Ancient Greece*, Sydney, Powerhouse Museum.

10. Sections of this paper have been included in the project information available on the website (http://www.phm.gov.au/greek/4/ pdf/Grecian2000weba.pdf). With regard to these documents the author would like to acknowledge co-authors Kate Da Costa, Cliff Ogleby and John Ristevski.

11. An extensive discussion on the archaeological basis for reconstruction is available from the project website (http:// www.phm.gov.au/greek/4/pdf/ archaeological_basis.pdf). For technical discussions on the creation of the digital model and 3D display of the work at the Powerhouse Museum (using rear projection from dual projectors and viewed through polarized glasses), please refer to Kenderdine, op. cit., and the project website (http:// www.phm.gov.au/greek/4/pdf/ Grecian2000weba.pdf).

12. For technical discussions on the scanning of the Zeus and the display of the 3D model at the Powerhouse Museum (using shutter glasses), please refer to Kenderdine, op. cit., and the project website (http:// www.phm.gov.au/greek/4/pdf/ Grecian2000weba.pdf).