Developing interactive web-based facilities for medium-sized museums

Colin Beardon [*], *Judy Mills and Martin Wright* [#]

[*] Exeter School of Arts & Design, University of Plymouth, UK
E-mail: cbeardon@plym.ac.uk
[#] Corinium Museum, Cotswold District Council, UK
E-mail: Judy.Mills@cotsworld.gov.uk Martin.Wright@cotswold.gov.uk

ABSTRACT
The project aims to explore the potential of certain new Internet technologies for small and medium sized museums. It is based on a particular project at a museum in the UK. In particular it attempts to address questions of social context and multiple narratives in relation to the museum's collection. Particular care was taken to ensure the resulting web site is accessible to a wide range of users. A prototype website has been developed which illustrates some approaches and raises important issues about the distribution of tasks between client and server, and the relationship of 2D to 3D representations.

KEYWORDS: dramatic representation, Javascript, museums, social history, VRML

INTRODUCTION

For many people, the World Wide Web appears as if it were a gigantic book. You may see it now as a directory of services which you can inspect, select and purchase from; now as an encyclopaedia where you can follow trails of information; now as an art catalogue in which you can view images and find out more about them — but its form, and thereby the expectations that people have of it, is the same mixture of text and images that we are familiar with from the print media.

Of course, we also have interactivity through 'buttons' that we can click upon and thereby be taken to other 'pages', but we must not forget that we also have interactivity with books. I can have many books on my desk, some open and some closed, and I can insert 'bookmarks' in the form of little slips of paper to mark pages. I can even annotate these bookmarks to indicate which paragraph or line I am referring to and add some personal comment. I can also use the tables of contents and indexes. Yes, we have buttons on web pages but, *Plus ça change...*

Yet, every now and again, we attend presentations that clearly go beyond this. Demonstrations of objects whirling in space, pages transforming themselves before our eyes, or complex processing going on behind the scenes to deliver to us some amazing result. Some of us see many such demonstrations: usually they are demonstrated by the person who wrote them; usually they are run on machines bought and adapted specially for the project — sometimes they are very difficult to find later.

The present collaboration between the Exeter School of Arts and Design (part of the University of Plymouth) and the Corinium Museum (part of Cotswold

District Council) in the UK, is aimed at determining the extent to which emerging Internet technologies can be of assistance to medium-sized museums in fulfilling their aim to make knowledge about their collection available to the widest possible public.

In this paper we will explain about the museum and the context within which it operates; we will discuss the particular technologies that we are concerned with in this project and talk about the design approaches taken; we will describe the processes of research and development undertaken so far, leading to the prototype web site; and we will draw some conclusion from the work that, hopefully, will be applicable to other museums, to other web designers and, even, to designers of the Internet itself.

THE CORINIUM MUSEUM

The present day town of Cirencester lays about 50 Km west of Oxford, in a region of the UK known as The Cotswolds. It is located on the site of Corinium, which was the major Roman administrative centre for south-western Britain. It was the second largest town in Roman Britain, only marginally smaller than London. Co-existent with its political importance, Corinium was of outstanding importance as an artistic and cultural centre. It was home to one of the finest schools of provincial sculpture in Roman Britain as well as containing the largest mosaic workshop [5, 8].

Cirencester is one of the country's most fully excavated towns. It has one of the most complete archaeological archives for the Roman period, including the largest excavation and study of a fourth century cemetery site in Western Europe [9]. The latter has provided invaluable demographic information about the age, sex and health of the local population in the fourth century. The town has also yielded the largest provenanced coin collection in Roman Britain. This collection is a unique source of information not only about the economic life of the town but also changes in occupation.

Within Cirencester, one of the sites which has been most fully excavated is the Beeches Road Town House, which we believe was constructed in the mid to late fourth century. Excavations between 1970 and 1973 revealed the full outline of the building and a number of spectacular mosaics, including the Hare Mosaic (see Figure 1) which has now been relocated to the Museum [10]. The site is of particular interest because it does not fit easily into accepted knowledge concerning that kind of building.

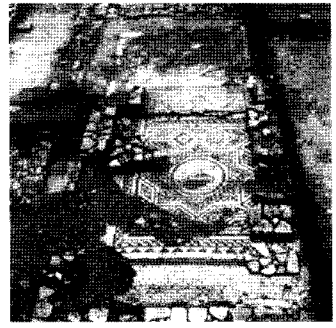

Figure 1 Part of the excavation of the Beeches Road site, showing the hare mosaic.

Cirencester is not a large town and it is situated today within a largely rural community, within which interest in history and archaeology is relatively high. There is also a focus upon the period of Roman occupation within the UK school curriculum at Key Stage 2 (ages 7–11) and this gives added

importance to its work. As a result, the Corinium Museum is very active within its locality, with links to local schools and colleges, historical and archaeological societies, and other civic bodies, thus addressing some of the current issues with museum education [6]. Alongside more traditional way of working — visits, meetings, publications, theatre, etc. — the Museum is keen to explore innovative ways to use the Internet in order that more people can find out about the artefacts it holds, as well as develop their enthusiasm and knowledge about what the objects might mean.

A particular problem that museums such as this one face is that, to the untrained eye, their raw materials can be relatively unexciting — often no more than some stones in the ground. The challenge is to utilise such visually unexciting material to disseminate two types of knowledge. The first is knowledge about the living context within which the objects may have been used. The second is knowledge about the processes of archaeology and history, combining insight and imagination with the disciplined search for knowledge

The MaRSH (Multimedia and Roman Social History) project aims to explore the potential of emerging Internet technologies to support a museum such as the Corinium Museum in helping it explain its artefacts in terms of the social conditions in which they may have been used. To do this we have focussed upon the Beeches Road site and tried to develop some creative understandings of what life might have been like there 1600 years ago.

THE TECHNOLOGIES AND THEIR DESIGN

In preparation for the project we conducted a survey of web sites, and we discovered two things. Firstly, we had seen far more demonstrations of 'clever' sites at conferences, etc. than we could find accessible on the web. Many URLs we had collected were no longer active, some required a seemingly infinite amount of time to download, while others seemed to require hardware that was beyond what we had on the desktop. If there were public sites that used these technologies they seemed well-hidden. Whatever the truth, the interested member of the public did not seem to have ready access to this level of Internet technology when it came to matters of archaeology and history.

Secondly, those examples we had seen (at conferences, on-line or on the television) showed a strong bias in their content in favour of modelling the physical aspects of things. We saw many physical reconstructions of buildings and sites, and several of pots and other artefacts, but very few models or reconstructions that had any people present, or any other evidence of human life and its relationship with the environment. This is not to denigrate those sites, or to underestimate the considerable effort that went into building them, or their usefulness in explaining all sorts of aspects of the past. Rather, it is to point to what is infrequently done (to our knowledge) and that is to tackle those aspects of archaeology and history that are less clear cut. Two examples struck us as important: anything to do with social conventions and relations, and anything that had no single dominant narrative (i.e. artefacts that raised many questions).

Influenced by these experiences, we set about defining our project in terms of the technologies that we would explore, and the methods we would employ in developing and evaluating the site.

The technologies

There is a bewildering array of new digital technologies available and any project of this nature needs to be focussed on a particular class of them if it is to deliver any tangible results. The technologies we decided to concentrate upon in the first phase of the project are defined as meeting all of the following four criteria.

1. They conform to Internet standards and are therefore (theoretically) platform independent. Apart from standard HTML and graphics standards such as JPEG, GIF and PNG, this includes the three-dimensional (3D) modelling language, VRML 2.0, scripting languages (e.g. Javascript) and applet languages (e.g. Java). (It thereby excludes platform-specific formats, such as the 3D modelling language 'Superscape' which runs on PCs only.)
2. In addition to text, graphics and formatting, these standards provide added functional (or processing) capability. There are two basic ways of achieving this: relatively small packets of code are typically sent within HTML pages using, for example, Javascript, while large or regularly used sections of code, such as those that will display VRML, are available as downloadable plug-ins for www browsers.
3. They are all client-side technologies, which means that they result only in code that is run on the user's machine (rather than the server). This has some advantages and some disadvantages. One advantage is that the resulting web pages can be used off-line (e.g. from a CD-ROM) without loss of functionality. One disadvantage is that responding to user profiles, beyond an elementary level, becomes difficult.
4. They are usable on the type and age of computer that most of the community is likely to have. (This is in contrast, for example, with the 'Virtual Smithsonian' site — http://2k.si.edu. — which specifically does not restrict itself to utilising current common network capacities.) We can express this in terms of typical access times: say, that users should not normally have to wait more than one minute to download a complex example. If we assume access via telephone lines in the UK, then an access rate of 4K bits/sec is typical. This would mean that pages should be no larger than 240K, including all invoked files.

Design approach

Clearly, the potential of these Internet technologies is not unrelated to the quality of the design and its ability to exploit them in ways relevant to the aims of the project. In this project, we tried to ensure the highest quality of design by learning from previous projects, by establishing clear goals and concerns, by constantly prototyping and discussing ideas in relation to the developing product, and by continually consulting the intended user group [3]. The design approach has been strongly influenced by graphic and performing arts and has adopted design approaches from these disciplines, rather than from traditional HCI.

The project learnt from two previous projects undertaken by one of the authors. The Virtual Curator project started in 1992, when the concept of a 'virtual museum' first began to appear, and sought to question whether virtual museums need to reconstruct the features of existing museums. In particular, it questioned the necessity of casting the user in the role of museum visitor, and suggested instead that they may be assigned the role of curator [1].

The Visual Assistant project began in 1996 and involved the development of purpose-built software for the visualisation of dramatic scenes. These visualisations may help develop set designs, or they may simply enable the 'sketching' of visual and spatial ideas about some aspect of a performance, typically so that it may be shared with others [2]. The project has an extensive web site and the Visual Assistant software is freely downloadable from www.adr.plym.ac.uk/va.

There were four main contributions of these projects to the current project.

1. We would have to work solely with representations of objects and these would employ many different media, and be of varying qualities. We should not assume that a photo-geometric representation of the museum or gallery was best, but should also explore the potential of other forms of representation (for example, collage).
2. As a general multimedia design principle, we should be concerned primarily with activities, rather than objects [7]. (At one time, this translated to the aphorism, "Implement the verbs, not the nouns.") A different kind of application emerges if you decide to try to model the processes that curators, archaeologists, historians, or others follow than if you concentrate upon the artefacts they use or produce.
3. We should not see software design and the professional discipline of the user group as two discrete fields of work with little or no theoretical interchange. There is a need for software designers to become engaged in the theoretical issues within the discipline (once described as producing 'software with attitude') — just as there is also a need for those within the disciplines to become aware of some of the key theoretical issues within software design.
4. It is necessary to make software small, easy to use and reliable. This sounds obvious, and it is, but it is not easy to achieve when the development method involves a lot of prototyping, which will involve a great deal of re-arrangement, deletions and the introduction of much seemingly extraneous material which serve only to disrupt any attempts to achieve simplicity and elegance.

The project

The project's long term aim is to complete a practical, but seminal, web-site and to carry out evaluation of its effectiveness in meeting the stated aims. Phase I was concerned with defining and developing a prototype web site. Phase II involves its evaluation and the specification of the final product. Phase III will lead to the implementation of the complete site and final evaluation.

Phase I ran from October 2000 until February 2001 with the aid of a grant from the UK Arts and Humanities

Research Board and the support of the two institutions. It principally involved the three authors and it is estimated that the total cost of this phase was around £30,000, including staff time. We are currently commencing Phase II and are seeking funds to complete Phase III. We estimate that it would cost around £100,000 to complete the project.

Phase I involved developing a deeper understanding of the technologies we had selected, defining some more specific aims from the museum's perspective, developing a number of prototypes of parts of the website, seeking the opinions of other museum staff and the user community, and bringing these together into a single unified prototype. We have also carried out some evaluation of this unified prototype through presentations and feedback.

THE UNIFIED PROTOTYPE

The resulting website can be found at www.adr.plym.ac.uk/MaRSH/ It represents about 15% of the complete site, but illustrates most of the features that we would expect to be present on the final site.

The site can be described in several ways. By seeing the site as operating under several different metaphors, we are able to provide a richer environment which combines factual information relating to the collection of artefacts, with a series of meaningful activities that put them in context, and with a creative and dramatic fiction that brings them to life.

The site as information

The site is based upon fairly conventional web pages which describe discrete artefacts from the museum's collection. These artefacts have been carefully selected in that they are all believed to come from the 4th Century AD and are associated with aspects of personal adornment. They illustrate a range of materials, styles and uses. On the page they are shown graphically, by a photograph or drawing. As well as being described simply in text (for 7-8 year olds) and in a more complex manner (for age 9-11), a third text field provides some 'tangential' information on such topics as the materials used, or where they were found.

The site as activities

The site provides a number of 'project pages' where the user is expected to undertake a simulated process, thus placing the project firmly within the constructivist tradition of museum-based learning [4]. For example, the archaeology pages (called 'Exploring'), begin with a page in which you simply have to find various 'buried' objects, which you can then explore by using the information pages described above. You then move on to a visual identification project in which you are presented with a number of visually interesting objects and a question, such as "Which of these objects do you think was worn in 4th century Britain?". There are no textual clues, only visual ones — later we will have VRML models of all the objects in this section so they can be fully examined.

The main project pages are concerned with the social agenda selected for the project. There are pages with activities about dress (including style and colour), hair (including style and dyes), shopping for jewellery and wearing it, etc. There are also pages for pottery and housing. These involve a great deal of 3D modelling: the pottery page, for example, simulates a potting wheel (introduced into Britain during this

period) and the user can attempt to reconstruct a known style of pot, complete with its decoration.

Figure 2. Julia goes shopping for jewellery

The site as creative fiction

The site contains a dramatic narrative. In order to enter the site, you need to adopt the persona of one of a set of characters. There is Marcus, the owner of a fine villa (in Beeches Road) and a wool merchant, and his wife Julia. As well as other members of his family, there is the artesan, Sulinus, and a slave girl. Each character is represented by a 2D graphic image and each has a story to tell. When the user accesses the project pages, it is in the context of the persona they have adopted. So, for example, if they are entering the 'Dress' pages, they may do so as Marcus and the context may be that he is dressing to meet an important government official, or that he is dressing to relax with his family.

Figure 3. An introduction to Marcus

The site as a virtual world

The site can also be seen as an imaginary world, rather like a film that is set in 4th century. This aspect relies heavily on five 3D models: the two Beeches Road villas, the town of Corinium, the surrounding countryside and an imaginary farmstead located about 4 Km away. We are currently investigating the relative benefits of the various characters being represented by a predefined 2D graphic image, as opposed to a full 3D model. The technology is also capable of making the characters dress according to the user's choices on the various project pages. It would also be possible to implement all of the 'Activities' (see above) within the 3D world, rather than as separate animated 2D pages, but we are not yet decided as to whether this is the best way to go. There would be some advantages in well-integrated 2D and 3D representations, a point we will come back to later.

Figure 4. Julia and Marcus welcome you to their villa (VRML 2.0 model with sound and animation)

FINDINGS

Though the site is yet to be completed, several interesting things have emerged from the project thus far. The project aims to explore the potential of emerging Internet technologies to support a museum such as the Corinium Museum. As such there will be both

positive and negative findings, and some pointers as to the way ahead.

Positive findings

The prototype site has been shown to various user groups (Gloucestershire Archaeological Society, Cirencester Archaeological and Historical Society, Cirencester Civic Society, Lechlade Primary School, Cotswold District Council staff, Corinium Museum Committee). All groups indicated strong support for the project and expressed the view that they thought that this approach had much to offer the museum in its attempt to reach its public. In particular, they found that the project pages were an imaginative way of raising central issues, especially for younger children, and would provide a good basis upon which teachers, parents, or museum staff could develop further non-computer-based activities. They also found that the characterisation helped to bring the topic to life.

The three-dimensional models were considered by many to be 'spectacular', and the page that always attracted the greatest interest (and desire to use) was the pottery page, which combined a high degree of purposeful interactivity, with three-dimensional modelling.

The groups generally accepted the need to keep the project to a small set of issues, but also expressed a strong interest in developing other topics such as 'social and political life in the town' and 'aspects of life at different times of the day'.

Negative findings

The issues of 'space' and 'logics' in relation to objects in museums is a very profound one [11] and this project provides a particular technological perspective on it. Though the technologies of 3D were considered by users to be 'spectacular', the integration of two and three dimensionality that is offered by the existing standards and browsers was found to be far from ideal. This is not surprising as there is a marked difference in the way that two and three dimensionality is handled by computer software packages and it is known that many humans have problems with three dimensional representation.

The present Internet philosophy is that it is equally possible to view HTML (i.e. 2D) and VRML (i.e. 3D) on their own within a browser window. However, when they need to be combined then the 2D format is the higher-order one. So it is possible to open a 3D window within a 2D page, but you cannot open a 2D window within a 3D page.

This is unfortunate and seems to follow from the development of 3D environments as being based solely on photo-geometry. All objects within 3D worlds are forced to be fully described within a 3D co-ordinate system (that is, they must be given precise locations and sizes, etc.). (The Visual Assistant, by contrast, allows you to relax that constraint a little by mixing 2D images and 3D space with less precision. This allows the user to pay more attention to global properties, such as lighting and colour.)

In this respect, it would be good to see a future Internet standard that provided better integration between 2D and 3D representations. From a creative user's point of view, we might consider dividing 3D space into meaningful regions (for example, close-up, foreground, middle-ground, and back-ground) with different operators, modelling techniques and level of detail

defined for each. This would enable the low-resource sketching of a background, while devoting extra resources when a user wants to inspect an objects in close-up.

Developments

The third defining characteristic of the technologies we have considered is that they are all client-side technologies. This has enabled us to place a practical limit of the project, but begs the question of whether this is a sensible constraint in real life. It means that we can produce platform-independent solutions and that they can be delivered via Internet, but we are thereby cutting ourselves off from developments which exploit the great potential of the Internet to support meaningful communication.

Server-side technologies would provide two main classes of advantage. Firstly, we would have greater ability to store information about each user. This would enable us to develop a more participatory narrative as the server can become ever more selective in the material that it offers and can personalise images for particular users (for example, putting a facial image on a model). It would enable to museum to track each user's journey through the site and to provide relevant information about the collection and access to exhibits in order to directly encourage users to visit the museum.

Secondly, we could extend the scope to include the server's ability to work with more than one user at a time through a multi-user environment (as, for example, Blaxxun's CyberTown). This would enable users from different locations to come together in our virtual 4th century environment and carry out various activities communally. They could, for example, attempt to build a villa or other housing within the town; or they could undertake the various projects (described above as 2D pages) within the 3D world; or they could try to undertake some of the various social and communal functions that we know citizens of the day were engaged in — shopping, paying taxes, receiving visitors, making a living. But they would be doing so in an environment in which the other characters were active through the actions of other users, in other parts of the country or other parts of the world.

CONCLUSION

The aim of this project is to determine whether the emerging Internet technologies are suitable for use by medium-sized museums within their traditional aims. Though there are not a lot of practical examples of their use in this context currently available, we hope to have shown that these technologies can be used in imaginative ways to create interest in and awareness of collections.

To do so requires not just access to the technologies and design skills in using them, however, but also a reappraisal of what it is that the software is to model. Interactive software is inherently better suited to modelling processes than modelling static information about objects. This, in turn, leads to the possibility of addressing more complex issues, such as the social aspects of history, and of dealing with more complicated historical periods and examples.

Though we have yet to complete this project, we believe that it has been sufficiently developed to show that these issues can now be addressed. We can optimistically look forward to a new kind of web-based service being offered

by museums — a service that is both respectful of the disciplined side of museum work, and acknowledges and exploits our imagination and creativity. After all, it is imagination and creativity that got most of us interested in the first place.

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ABOUT THE AUTHORS

Colin Beardon is Professor of Art & Design at the University of Plymouth, UK and Visiting Professor at Malmö University, Sweden. He specialises in the design of software to support creative practices.
E-mail: *c.beardon@plym.ac.uk*

Judy Mills is Collections Management Officer for Cotswold Museums Service.
E-mail: *judy.mills@cotswold.gov.uk*

Martin Wright is Museum Assistant for Cotswold Museums Service.
E-mail: *martin.wright@cotswold.gov.uk*