

Cultural computing: exploiting interactive digital media

James Devine and Ray Welland

The Web site of the Hunterian Museum and Art Gallery at the University of Glasgow had to respond to a number of imperatives. First and foremost, it was to make the collections available to schools in the most remote areas of Scotland as a complement to their curriculum. It then had to highlight an extremely diverse collection ranging from archaeology to zoology, with side trips including the voyages of Captain Cook and the house of world-famous architect and designer Charles Rennie Mackintosh. The solution was found by using a mix of interactive technologies in an innovative and imaginative way. James Devine is head of Education and Digital Media Resources at the Hunterian Museum and Art Gallery. He has spearheaded a wide variety of innovative multimedia projects focused around the Hunterian collections, including an award-winning Web site, and, with colleagues in the Computing Science Department, has developed new applications for leading-edge technologies. More recently, he led field expeditions to Knossos in Crete to create Quick Time Virtual Reality tours of the Minoan palace complex on behalf of the British School of Archaeology in Athens and the Greek Ministry of Culture. Ray Welland is head of the Department of Computing Science at the University of Glasgow. His main research interest is in software engineering and, more particularly, in its application to the creation of large, multi-authored Web sites.

The advent of interactive digital technologies has provided cultural heritage organizations with an opportunity to present their cultural resources in new and increasingly innovative ways. At the University of Glasgow, the Hunterian Museum and Art Gallery, in collaboration with the Department of Computing Science (DCS), has embraced this exciting new challenge and has established a firm bridgehead as a pioneer at the leading edge of computer-based cultural heritage information delivery.

The World Wide Web (WWW) gives museums and art galleries a unique opportunity to display their contents to a global audience. Not only can the exhibits on display in the galleries be made available to a wider audience but also material which is in store can be shown. This means that objects which are, for example, too fragile for permanent exhibition can be photographed and displayed. The material collected for a temporary exhibition can also be recorded, allowing people to see the exhibition long after the material has been dispersed back to its original owners. We can effectively build a 'virtual museum' which extends the physical museum both by allowing remote worldwide access to our exhibits and by building special displays which have no physical existence.

This ability to present information electronically can also be used to bring together museum artefacts and the sites and monuments from which they originally came, thus digitally placing the objects in their archaeological contexts. Under the auspices of Glasgow University's REVELATION project, a major SHEFC (Scottish Higher Education Founding Council) grant-assisted project (£665,000) to explore the potential of high-resolution/high-fidelity data transfer

over networks, the first Hunterian/Department of Computing Science field expedition team travelled to Knossos, Crete, in 1998 where the entire archaeological site and related nearby locations were digitally photographed and processed in Quick-Time Virtual Reality to create a 'virtual tour' of the palace of the legendary King Minos. This article will examine the academic, pedagogical, and technical issues raised in the undertaking of such major digitization projects, and will assess the value of the resulting digital resources to a wide range of end-users with varied expectations and aspirations.

The Hunterian Museum and Art Gallery at the University of Glasgow houses important collections of art, archaeology, ethnography, numismatics, geology, zoology, anatomy and scientific instruments. These collections are accessed for research by scholars from all over the world, but they are also made available to the general public and visiting school parties. Indeed the Hunterian is the oldest public museum in Scotland, having opened its doors in 1807. There has been a philosophy of access and outreach which has steadily grown over the years but which took an exponential curve with the new possibilities offered by the advent of the World Wide Web and the increasing quality available for digital image capture, compression, and presentation in recent years.

The nature of Scotland's geography is such that the greatest population density is in the central belt of the country on a line running between the two largest cities, Glasgow in the west and Edinburgh in the east. The west coast in particular is very sparsely populated, with the Western Isles separated from the mainland and accessible only by air or ferry. It was this situation which first encouraged us to

look at digital communications as a means of providing resources to schools in these remote areas. The schools in the central belt were taking full advantage of the resources and activities being made available at the museum; however, it seemed rather unfortunate that we were not able to do very much for the schools trying to deliver the same curriculum on the Isles of Barra or Lewis or indeed anywhere beyond the central belt. The Web seemed to offer at least a next best scenario to an actual museum visit, so with this as our goal we formed a collaboration with colleagues in the University's Department of Computing Science to bring their technical expertise together with our domain expertise to provide digital resources based on the Hunterian's collections and targeted in the first instance towards school students and their teachers.

Student participation

We have been building a Web site for the Hunterian Museum and Art Gallery at the University of Glasgow for several years now (<http://www.hunterian.gla.ac.uk>). Much of the work has been carried out by teams of students from the Department of Computing Science who have experimented with a wide range of multimedia presentation techniques. The students have benefited greatly from dealing with real customers; attending lectures about requirements and the problems of interacting with customers is no substitute for actually doing it! However, it is necessary to compromise between the customers' product expectations and the academic objectives of project work. In each case, there have been interesting technical challenges in using existing software and major design issues but these have to be balanced against the museum's desire to capture large quantities of data. The



Photo by courtesy of the authors

compromise is to regard the student project as providing a framework for the final product which can be expanded by paying somebody to carry out the data capture required to fill in all the details. Typically this has been done by employing the students on a paid basis over the vacation periods to take projects to completion.

The initial projects were concerned with fairly basic Web site construction: designing an attractive overall style for the museum's site, providing a consistent framework for future development and evaluating the results using museum visitors, both locally and remotely. Building on this basic structure, there have been projects adding video clips to animate some of the material on Roman armour, using image maps to illustrate Captain Cook's voyages of exploration, adding audio for Latin inscriptions and more recently for aiding blind and partially sighted visitors to the museum. We have used QTVR (Quick Time Virtual Reality) to provide panoramas of the Mackintosh House and to display small objects from the museum in 3-D. This led directly to the major field project undertaken at Knossos (<http://www.bsa.gla.ac.uk>) as a collaborative venture between the Hunterian/DCS, the British School at Athens, and the Greek Archaeological Service.

The simplest way of presenting the museum is as a hypertext, effectively like

The virtual tour in production at the Temple Tomb, Knossos, with author James Devine in the foreground.



A composite image taken from a QuickTime Virtual Reality morphing movie, part of the museum's Hominid Evolution project.

an illustrated book with active links between the pages. So one could start from the home page, select a subject (e.g. the Romans in Scotland) and be presented with a series of pages of mixed text and illustrations about the chosen topic. Typically, navigational buttons allow the user to jump to the next topic, to return to the home page or to jump to other connected pages; thus the site can be explored in a structured way or in a haphazard fashion following links which look interesting.

A Web site can be made more interesting by enlivening the presentation with video clips, audio fragments or rotating objects ('movies'). We have integrated all of these approaches into our Hunterian site. To illustrate the construction of Roman armour we have included some short video clips of people dressing in facsimile armour which simulates the hands-on experience which school parties get when visiting the museum. Most schools no longer teach Latin and so children have no idea what the inscriptions on the Roman distance markers would sound like if spoken. Therefore, we have attached audio fragments to the inscriptions which can be played by pressing a button on the page. Many objects benefit from being shown in 3-D, so we can display the static picture of an object and then add the facility for rotating it to see different perspectives; we have done this with Asante

gold weights and are currently working on the display of hominid skulls.

An important use of multimedia technology is to provide more structured ways of navigating through the site, providing different recommended routes rather than simply allowing the user to wander at will. Our first attempt was to provide a 'guided tour' of the museum so that access to the site follows the logical order in which the exhibits are arranged. Users are presented with a plan of the museum, showing the present position of objects within the rooms and exhibition cases. They can then progress to the next exhibit or jump to another room simply by clicking on it. In this way the visits to the museum are structured, but users also have the freedom to explore at will.

The Hunterian Museum has a large collection of artefacts connected with Captain Cook's voyages and we wanted to find an interesting way of presenting this material. The user is presented with an image map showing the routes of Captain Cook's three voyages and can click on the map to inspect pictures of the relevant places and the artefacts found there. An image map is a map where various areas are active and can be used as links to other pages. The main problem with the Captain Cook maps was keeping them simple enough to be readable on a small screen and dealing with the problem of creating usable selectable areas. It is quite easy to select Australia but rather more difficult to hit Tahiti if the map is strictly to scale.

Another challenge was to provide a realistic presentation of the Mackintosh House; this consists of a re-creation of several rooms from Charles Rennie Mackintosh's house including the original furnishings. To display this on the Web

site we used a linked set of QTVR panoramas. Users can select a room which allows them to 'stand' in the centre and scan through 360 degrees. At any point in the panorama it is possible to zoom in on specific objects. Because the panoramas are linked it is possible to 'walk' from one room into one of the adjoining rooms and simulate a complete visit to the house, starting from the entrance hall and walking right round.

We believe that the exploitation of the full range of multimedia facilities within the Web provides great opportunities for providing wide-ranging access to the wealth of educational material in our museums. This includes many objects which are not even available to visitors to the museum. Our site for the Hunterian Museum and Art Gallery demonstrates some of the possibilities for using this technology. These projects are critically dependent on the collaborative efforts of the museum and DCS staff who have proved extremely enthusiastic and supportive. Any project with real customers obviously depends on their willingness to participate, but one of the additional problems of this group of museum projects has been that many of the objects which the students have been working with are extremely valuable and often fragile and irreplaceable. The curatorial and technical staff of the museum have been very helpful in overcoming a wide variety of problems.

By the very nature of the medium all useful Web sites are constantly 'under construction'. We believe that the potential for 'cultural computing' in this field is enormous, bound only by our own imagination. We envisage a scenario, early in the new millennium, where our museum visitors will be able to experience our cultural past in a fully interactive and immersive fashion. The past may well be a

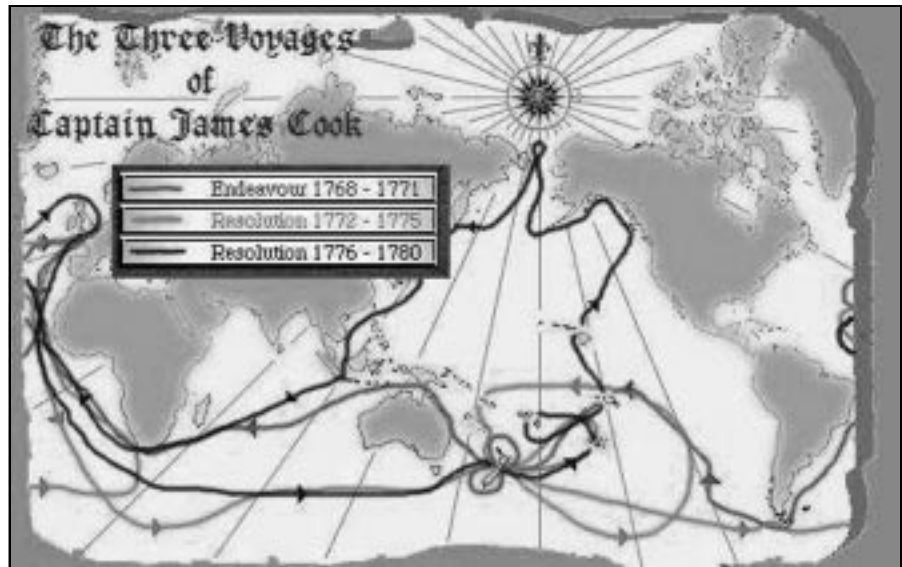


Photo by courtesy of the authors

foreign country, but the potential of digital technologies in cultural contexts is bringing that country ever closer. Join us in the journey! ■

Interactive map which allows Web visitors to travel on a 'virtual voyage' with Captain Cook, viewing artefacts in the collection along the way.

Acknowledgements. We would like to acknowledge the work of the many computing science students who have contributed to the development of the Hunterian Web site and also the contribution of staff of the Museum and Art Gallery, the Department of Computing Science, and the REVELATION project which have provided input, production facilities, critical observation, and project supervision. We are also grateful for the continued financial and advisory support which we have received for our projects from SCRAN (Scottish Cultural Resources Access Network), a Millennium Commission Project. Last but by no means least, we are very grateful for the valued peer reviewing which much of our material has received from Carl Hansen and his colleagues at the Office for Scientific Imaging and Photography at the Smithsonian Institution, National Museum of Natural History, Washington, D.C.