

VIRTUAL HERITAGE

Is There a Future for the Past?

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Abstract

This paper attempts an overview of the contribution which emerging information technologies - viz CAD, Multimedia, Virtual Reality and the Internet - can make to the presentation, understanding and preservation of the rich architectural heritage which exists in almost every cultural context.

Introduction

This paper is a celebration of the union of emerging high technology with issues of culture and history which are clearly of social importance.

Europe is hugely rich in architectural and archaeological heritage which is commanding increasing interest not only of Europeans but of visitors from all over the world.

As interest intensifies, the environmental threat to some sites accelerates. Venice is under touristic siege, Stonehenge is a battleground between conservationists and "new-age" Druids and the cave paintings of Lascaux can no longer be seen by any but the privileged few.

Virtual Reality (- an overly used but ill-defined term -) is, the authors believe, an information technology which can provide a convincing, and enhanced, experience of environments which:

- i) exist, but are too remote, costly or hazardous, to visit.
- ii) don't yet exist but are planned, such as architectural designs or urban plans.
- iii) never will exist, other than in the imagination.
- iv) existed in the past and are now threatened or already lost.

This paper has its focus on the latter category, i.e. what is now becoming known as Virtual Heritage (VH), but it puts VH in the context of the broader spectrum of simulated experiences of past, present and future environments of cultural significance.

The paper draws largely on the work of ABACUS, the Architecture and Building Aids Computer Unit, Strathclyde. The examples of the application of IT to VH include:

- i) a virtual reality experience of Historic Scotland's premier historical site: Skara Brae, the most complete Neolithic settlement in Northern Europe.
- ii) a computer based archive of rare and normally inaccessible 17C and 18C drawings of Scottish buildings from four seminal sources.
- iii) a multimedia CD-ROM featuring some 50 of the most wonderful interiors of Glasgow's architectural treasures.
- iv) a massive 3-D model of Glasgow (some 10,000 buildings located on the hilly terrain of the city), which is now accessible on the Internet.

The paper concludes with conjectures, based on the examples given, of how emerging information technologies can help secure a future for the past.

Archaeological Sites

Historic Scotland is custodian of some 300 heritage sites throughout Scotland, one of which is Skara Brae, situated on the Bay of Scales in the Orkney Islands, off the Northernmost coast of mainland Scotland. It is Northern Europe's most extensive Neolithic Village - an extraordinary complex of seven houses, revealed for the first time in 1850 as a result of a massive (and

fortuitous) storm. The completeness of the houses - with stone furniture - offers an extraordinary, if incomplete, insight into the life of Scots some 5000 years ago.

The objective of this project was to assess the suitability of new media in offering an alternative to the traditional presentation formats. The site itself exhibits most if not all of the problems associated with heritage sites. It is remote, Orkney being a small island in the extreme north of Scotland, conservation is a key issue, as access is already restricted to some areas of the site, and there is also a need for explanation and interpretation as much of the original building fabric has disappeared through time.

ABACUS has developed a virtual experience of one of the seven houses, using Macromedia Director and QTVR. Through the virtual environment spectators are able to see: an object, which may be picked up and viewed from all angles, and a 360 degree panoramic image that allows the user to pan and zoom. Different panoramas are also linked together to create an entire scene. The conjunction of these media elements allows the recreation of a virtual version of the site which the visitor can then explore at will.

In addition to providing a virtual experience of the site as it currently exists, use has been made of "augmented reality" by combining the existing imagery with computer generated images. This allows, for example, hypotheses regarding the door opening/closing mechanism and will, in the future, allow alternative conjectures to be evaluated regarding how the houses were roofed.

From the centres of population in Scotland (primarily Glasgow and Edinburgh) it is a 12 hour journey by car and boat to the Skara Brae site on the island of Orkney. On arrival, visitors can view the site only from above - entry to the houses and passageways is forbidden and of course all of the magnificent artefacts found on site have been removed to museums in Edinburgh.

The "virtual experience" of Skara Brae provides a hitherto unobtainable experience of what is, and what might have been 5000 years ago [1].

Architectural Archives

Uniquely, in Scotland, a scheme [SCRAN, 2] exists to provide money from lottery funds, to capture and caption images of Scotland's cultural assets. Some \$20 million is being invested to ensure that schools and scholars have free access to electronic records of the country's cultural heritage.

ABACUS is engaged on a number of contracts funded by SCRAN including one which seeks to gather together, from a number of relatively inaccessible sources in libraries throughout Scotland, the key 500 17th and 18th century drawings, captioned and cross-referenced, within an interactive multimedia document available on CD-Rom and the Internet.

The prime sources of the images are:

- i) Vitruvius Scoticus, 1830
- ii) Theatrum Scotiae, 1693
- iii) Baronial and Ecclesiastical Antiquities of Scotland, 1848 - 52
- iv) Examples of Scottish Architecture from 12th to 17th Century, 1921

In the case of Theatrum Scotiae which dates from 1693, the library holding the volume would not permit it to be scanned; arrangements were made for the library staff to photograph the plates and from the negatives a Photo CD was made.

This electronic resource is ubiquitously available to primary and secondary schools, scholars and the general public. This represents a significant change in the way people can access formerly obscure visual material.

Virtual Open Doors

Throughout Europe it has become increasingly popular to organise, during one weekend in September, limited physical access to buildings not normally open to the public. In Glasgow alone in 1998, around 90,000 people visited 70 properties over three days, despite large queues and inclement weather.



Figure 1. Multimedia Document on Skara Brae



Figure 2. Image from Vitruvius Scoticus

ABACUS, with funding from SCRAN, and in the context of the celebration of Glasgow as the UK City of Architecture in 1999 [3], has created the concept of Virtual Open Doors - a CD-Rom on which text and graphics relating to the interiors of some 50 of Glasgow's most important buildings can be explored, virtually, using Micromedia Director and QTVR.

Glasgow is extremely rich in architectural quality and the most difficult task was making a choice of just 50 interiors from around 200 candidate buildings. The authors sought to include:

- i) buildings of different types, e.g. churches, museums and galleries, buildings for leisure and entertainment, domestic architecture, etc.
- ii) examples of buildings by architects of renown e.g. Charles Rennie Mackintosh, Alexander "Greek" Thomson.
- iii) buildings which are wholly unique to Glasgow, and
- iv) buildings which had undergone dramatic change of use, e.g. a church which has become a nightclub.

The CD will be issued by SCRAN to over 2000 primary and secondary schools throughout Scotland and will be on sale to the general public in the Lighthouse [4], the completely refurbished building designed in 1893 by C R Mackintosh as a newspaper office, which is the showcase for Glasgow 1999 and which provides a unique centre for architecture and design in Glasgow.

Glasgow Directory On-Line

As far back as 1986, ABACUS began the construction of a 3D model of the city of Glasgow. This initiative was stimulated by a request from a Government Department to evaluate a new generation of colour graphics workstations (the IRIS from Silicon Graphics) which featured for the first time embedded geometry engines. To test the workstation capability, the Unit deployed a team of students over a summer vacation to construct a model of the topography of some 25 square kilometres of the city centre and the (approx) 10,000 buildings which were located there [5].

Despite being a remarkable feat at the time, little practical use was made of the model. Although the geometry was relatively crude - more a 3D map than a realistic representation of the built environment - it proved much too large for real-time animated "fly-throughs". Other than the geometry there was no information relating to individual buildings or streets. The fact that it existed on specialist hardware and used specialist software developed by ABACUS made it virtually inaccessible to anyone other than the R+D team.

Thirteen years later, with the emergence of multimedia technologies, the Internet and, more specifically, the Virtual Reality Modelling Language (VRML), the Glasgow model has been recast as the centrepiece of the electronic content of the Lighthouse [6].

The Glasgow Directory On-Line allows users to explore the 'virtual city', search under a range of headings for items of interest, and discover some of Glasgow's finest architecture.

It achieves this by linking to a number of information sources, accessible through conventional Internet components such as lists, tables and search engines, as well as in-directly through the VRML. Unlike many Internet systems, there is no pre-set route to follow, or list of 'useful links'. Information is accessed through intuitive exploration of the site, and therefore varies depending on both the user, and the chosen route. In this manner, the user becomes familiar with the virtual city, in much the same way as they would become familiar with the physical city. He or she may identify particular areas of interest, which can be revisited using familiar routes, or accessed via browsing.



Figure 3. Extract from Virtual Open Doors CD



Figure 4. Frame from Glasgow Directory On-Line

Current information sources include:

- **Multimedia database of General Tourist Information.**
This includes entertainment venues, shopping centres and transport facilities. Each item in the database contains a photograph, an address, and further information.
- **Multimedia database of Glasgow Architecture.**
A selection of Glasgow's finest buildings are archived with a photograph, address, architect, date and further detailed information. In many cases a Quicktime VR interior is included.
- **Alphanumeric database of property addresses and street names.**
- **External Web-sites.**
The system can take advantage of the many Glasgow based web sites that exist on the Internet such as those offering local news and weather.

A special feature within the system allows architects and designers to download appropriate sections of the 3D model for use in proposed developments. Future additions to the system will permit design proposals to be integrated into the system allowing the audience to explore a number of possible urban design alternatives.

Recognition of the virtual city is aided by the use of certain key 'Lynchian Elements'. As with the physical location, landmarks, streets, edges and nodes play an important part in comprehending the virtual environment.

- Extra detail is given to buildings in the model when they are perceived to be landmarks.
- The streets can be easily identified by clicking on them.
- Each model segment is terminated at a distinct edge such as the river or a main street.
- Specified viewpoints (nodes) at junctions etc., help users understand their location in the virtual city.
- The subtle use of basic colours - blue for river, green for parks etc., enhance the urban fabric.

Recognition of individual buildings is achieved through the use of 'layered' data. Since the model of the building itself may be nothing more than a basic block within the city context, the facade is expressed as a photograph displayed in another frame. This frame also displays some introductory text about the building, as well as linking to more detailed information such as QTVR interiors. In this way, the user can recognise the building by collating all the relevant information that is automatically displayed on screen as the building is accessed within the VRML model.

Throughout its design stages, ABACUS has welcomed evaluation from the general public as to the development of the Glasgow Directory. This has been achieved through posting 'Requests for Comments' (RFC's) on many appropriate Internet Newsgroups, asking users to 'test-drive' the project and return their ideas and recommendations by way of a simple on-line 'Feedback' form. To date, over 100 forms have been returned, with users offering from the simple "congratulations on the project", to a complete list of suggested improvements and samples of programming code.

Feedback is analysed, evaluated, and where appropriate put into practice. This process will play a critical role in the future evolution of the system.

Other Initiatives

ABACUS is currently engaged on a number of research and development projects which could be classed as Virtual Heritage. These include:

- i) a major project to document the remarkable architectural and social history of New Lanark - the utopian concept of the visionary Robert Owen (1771-1858)
- ii) a taxonomy of the Scottish house type, known as the "tenement".

In addition, a significant financial investment has been made in the creation of a Virtual Environment Laboratory [7]. This visually immersive facility is powered by advanced Silicon Graphic computer technology and makes use of advanced projection systems. The laboratory seats around 15 people and the 160 degree curved screen fills the viewers' cone of vision, thus giving them the impression of being immersed within the projected environment. The processing power of the Onxy2 Silicon Graphics machine allows interactive manipulation of large computer models, thus enabling real-time navigation of detailed building interiors or urban landscapes with relative ease.

This facility enables two aspects of virtual reality to be addressed, namely interaction and immersion. Development in these areas in the past has been hampered because of a lack of computer processing power. However the graphics processor at the heart of the VEL can interactively display the Glasgow City model which not only represents around 10,000 properties, but also the appropriate topographical data covering an area of 25 square kilometres. Currently the machine displays this model at up to 25 frames a second, compared with one frame every few minutes 10 years ago, and a rate of processing equivalent to a frame every day or two 20 years ago.

Visual immersion is achieved as a result not only of the screen size, but also due to its curvature. It therefore feeds the viewers peripheral vision with the correct visual clues and thus invokes the sensation of being surrounded by the projected environment, city scene or architecture. So although it is a 2D moving image that is being projected onto the curved screen, viewers report the feeling of being immersed within a 3D environment.



Figure 5. The Virtual Environment Laboratory

In Conclusion

The responses of both the general public and heritage specialists (archaeologists, architects, conservationists etc) to the concept of Virtual Heritage has been overwhelmingly positive and we can anticipate rapid progress in the development of the technology and its effective uptake.

Particularly pleasing to the authors is the conjunction of advanced information technology and issues of cultural significance. In this regard, architecture is a pioneer.

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References

1. Virtual Experiences of Cultural Heritage. P M Grant, **Europa Nostra**, No 1, 1999.
2. **Scottish Cultural Resource Access Network (SCRAN)**
<http://www.scran.ac.uk>
3. **Glasgow: UK City of Architecture and Design, 1999**
<http://www.glasgow1999.co.uk>
4. **The Lighthouse**
<http://www.thelighthouse.co.uk>
5. Flying the City with Geometry Engines. T W Maver
Computer Aided Design, Vol 19, No 4, May 1987
6. **Glasgow Directory**
<http://iris.abacus.strath.ac.uk/glasgow/>
7. **Virtual Environment Laboratory**
<http://www.strath.ac.uk/VEL>