From Wroxeter to the Web : The British Telecom Access to Archaeology Project

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The British Telecom Access to Archaeology project is seeking to produce computer-based, educational packages to present and place in context data collected and produced by the Wroxeter Hinterland Project, (White, 1998) a project which has studied the processes of romanisation within and around the Roman *Civitas Capital* at Wroxeter, Shropshire (UK). The Wroxeter Hinterland Project was co-ordinated by the Birmingham University Field Archaeology Unit, although a large number of organisations and individual academics have participated in data provision and analysis. The result of this collaborative work has been an enormous dataset, including results and interpretations of remote sensing surveys, photographic survey, conventional, ground based survey and archaeological excavation.

With only a small area of the archaeological remains (c.1%) exposed at Wroxeter, most of the town lies buried under pasture land and, thus, invisible to the visitor. Access to Archaeology aims to make the non-structural data available, in a coherent way, to as wide a range of interested parties as possible. The primary output will be a software product, that can be accessed over the internet and via CD, to educational organisations. The project is designed to allow users not only to explore the data, in ways that will give them insights into archaeological interpretations, but also to understand how data, leading to these conclusions, has been collected and analysed.

Access to Archaeology is using two main approaches to present this data. These are a virtual reality reconstruction of the city and an interactive, digital landscape, representing the Wroxeter Hinterland.

Our decision to present the data in this manner springs from the extent and nature of the original data, provided by the Wroxeter Hinterland Project. First, there is the vast collection of data, for the study area as a whole, and which comprises: regional and national archaeological databases, results of GIS analysis, field walking surveys, parish surveys, excavation, interpretation of aerial photography and the photographs, themselves. Currently this data exists as a collection of individual databases, database records, and images. We felt that this should be made available in ways, that are accessible and simple, but as unrestricted as possible.

This situation suggested that a software application, in the form of an interactive landscape, would allow users to display maps and plans for areas of the landscape around Wroxeter. Here they could query the Wroxeter Hinterland database and overlay positions of sites on to the backdrops, as well as being able to overlay linear data, such as roads and streams. The users can then display textual data about specific sites and images, including aerial photographs or remote sensing data. A data structure has been designed that treats the data as a multi-layered entity, allowing the user to look more closely at chosen areas, with a high density of data. This data structure also makes the application reusable for other data sets. As long as the data is formatted in the specified way, then the application can be used to display data for any area. The digital landscape application is being developed in Java, to allow internet delivery.

Apart from the wider landscape, there exists a massive dataset for the area within the city of Wroxeter itself, including one of the most extensive, remote-sensed surveys ever currently undertaken. (Gaffney, *et al.*, 1998) The data allows the most complete plan of a Roman city, currently available in Britain.

In deciding how to present this data to a larger audience, it seemed natural that one potential route was to present the data as a virtual reality reconstruction. This part of Access to Archaeology was always likely to have the most popular appeal, whilst retaining a strong educational value. In planning such a product, project staff began by investigating the opportunities presented in VRML, version 1 (version 2 had not yet been released, at that time) (VRML, 1998)(Gillings and Goodrick, 1996). The advantages of VRML seemed to be that it was web presentable, had several free plug-ins, existed that could be run on average spec PCs, and it represented a standard rise in popularity. Simple shapes were easy to create, and a wide range of authoring packages were emerging.

Despite these advantages, several factors lead us to reject VRML 1. The first was lack of interactivity. Worlds could be viewed and explored but it was very much a "look and don't touch" environment. We also found the fact that there was no way to stop the user from walking through objects (including walls) rather confusing. Another major factor was the fact that several of the free plug-ins, that we looked at made navigation through a world difficult. It should be noted that many of these issues have been addressed in version two of VRML.

Superscape's VRT was then assessed. Like VRML, the words developed can be web presentable using Superscape's Viscape plug-in; they can also be run on a standalone program, called Visualiser.

The package had several advantages over VRML 1. Much more interaction was possible, using VRT, and small programs could be written and added to objects, to control their movement and responses to actions, by users in the world. Larger amounts of code could be added as libraries of C programs, using the Superscape software development kit (SDK).

Within VRT users can click on objects, to cause text about an object to be displayed, as an HTML document in a separate frame. They can click on links, in the HTML document, to jump to another part of the world, or cause some action to be performed in the world. Fly-throughs can also be defined, following pre-set paths through the world. The user can be prevented from walking through walls, and can walk, fly or drive. Sound can also be played, from within the world. All in all, the world is much more an application than a 3d model, to be simply viewed. Together, these qualities recommended VRT as the development platform.

The VRT software consists of four editors, to create worlds. The first, a shape editor, allows you to build the basic building blocks. A world editor, then lets you put these together and add interactivity, movement, etc. The image editor allows the application of textures to objects, and a control editor lets you define user-interface elements, such as dialogue boxes and menus.

The virtual reality reconstruction, created using Superscape's VRT for Wroxeter, will allow users to explore our interpretation of Roman Wroxeter, during it's different phases. Users will be able to move around the fortress and the later city, unguided, or be taken on themed, guided tours. They will be able to enter buildings and learn about the history of Roman Wroxeter, life in Roman Britain, and find out about the reconstructions and what they are based on. Specific buildings and areas will have explanatory text attached to them, which will be presented at several levels of detail.

Given the overwhelming complexity of the evidence, work on the archaeological interpretation of the plan, developed from the geophysical surveys of Wroxeter, is still in progress. In the meantime, reconstruction of the military phase, that is, the fortress, has been taking place, a more straightforward task, given the general predictability of Roman fortress plans. Thus, despite the fact that we only have evidence for the defences and some of the roads and buildings within the fortress at Wroxeter, reconstruction is possible, using parallels from other Roman fortresses of similar period and size.

VRT Issues & Problems

Although VRT was adopted for development, there are still specific problems with the software, as a development tool. For a world to be displayed at a reasonable speed, the number of facets displayed, at any given time, must be kept fairly low. The maximum number depends on the specification of the PC, it is being run on, and also on limits within the VRT software. A balance must be struck, between the level of the detail, of objects in the world, and the need to allow the world to run at a reasonable speed. Speed is also determined by the amount of userdefined code, running at any given time. Of course, file size is also an important factor, if worlds are to be web deliverable.

When building worlds, positioning objects can sometimes be awkward, as collision detection fails, when groups of objects are rotated. Adjacent facets sometimes show cracks between them, even when objects are butted against each other. An important method, incorporated into the VRT software, and which can be used to restrict the number of viewed facets, is distancing. Distancing is the practice of replacing an object with a simpler version of itself, the further away from it you get. Although this is clearly critical in constructing efficient worlds, the method, used for calculating distancing in VRT, is rather unexpected. The distance from the viewpoint to an object is calculated, to the centre point of the object. This allows fast calculation and works well for objects, that are either small or symmetrical, about all three axes. However, for asymmetrical objects, such as fortress walls (that are much longer than they are tall and wide), this is a big problem. The viewpoint can be very close to the end of the wall, and the viewer should expect to see a detailed version of the wall. However, as the distance is calculated from the object's centre point, the software is misled, and a very simple version of the wall may be displayed.

This problem can be overcome in small world objects, simply by breaking objects into smaller chunks and distancing each chunk individually. For large worlds, this is not possible, as the limit of the number of facets, that VRT can display, will soon be exceeded.

To solve this problem, a library of functions has been developed, to calculate the distance of the viewpoint from the nearest point on the bounding box of an object, and then, to fake distancing, by making visible and invisible versions of the object, thus, bypassing VRT's own distancing function. This procedure takes the whole size of object into account.

Combined with other facet-reducing stratagems, this approach to distancing provides a good solution to some VRT problems. It has, for instance, also been possible to construct the insides and outsides of buildings, separately, making them visible and invisible, as the user enters and leaves a building. The contents of rooms are only visible when the user enters a room. For some large buildings, including the hospital, which has many similar wards off a central corridor, only a few rooms exist, and these are only positioned, when the user opens the door to a room. It is also possible to randomise which objects appear in a given room, to give the impression of being in different rooms, when only one room (and thus, only one set of facets) exists.

Despite this, the battle to balance speed, detail, and file size has still not been won.

Although individual buildings display well, the larger worlds (the fortress or city) still need more optimisation, before the program will run at a reasonable speed. One way may be to incorporate more of the code, running within the world, into the c library. Having said this, the work done, so far, has isolated and begun to resolve problems within VRT, itself, and this should allow us to build worlds, in ways that use the software most efficiently.

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List of Figures in CD-ROM.