

The Norwich Virtual City Project

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Abstract

This paper describes the early work on implementing a visitor attraction based on the heritage of the Norwich area. The project has been in planning for about three years, but has only just been funded and is due to open in 2001. The paper reviews the background to the project and the city, and considers the expected benefits of the venture. The range of data sources are then reviewed and areas are highlighted where computer science research needs to progress to maximise benefits. The paper then reviews progress to date on the project.

Keywords: Virtual Heritage, Urban Modelling, Visitor Attractions, Norwich Virtual City

1. Introduction

A consortium from the City of Norwich and the County of Norfolk have been awarded a major project by the UK Millennium Commission. The Commission was established to consider bids and decide on support for community projects designed in celebration of the Millennium. This project will provide a new and greatly enhanced County Library to replace one destroyed by fire in 1994, but also includes a heritage visitor centre to be based on the city and its environs. The Norwich Virtual City Project is an informal independent consortium led by Televirtual, a prominent UK VR company based in Norwich. The Virtual City Project is contributing to the heritage visitor centre. The budget for the Millennium Project is ~£60M with ~10% of this allocated to the visitor centre. The Norwich Virtual City Project is expected to seek funding from a range of sources including Fifth Framework. Part of successful project completion will be to integrate the needs of a wide range of sponsors.

2. A brief historic background

Since the 11th Century Norwich has been the historic commercial, civic and religious centre of the East Anglian region, chartered by King Richard I who allowed the city to be governed by elected citizens in 1194¹. The City walls, completed in 1334, extend for over 5Km and by 1348 (figure 1)

there were 52 churches inside them including the Norman Cathedral, which celebrated its 900th anniversary in 1996. The Norman Castle is also a prominent feature of the Norwich skyline.



Figure 1: Norwich in 1348 (after¹)

From the point of view of tourist entertainment, the City has its fair share of dramatic incidents from rebellion, war, pestilence and fire:

- Bubonic plague (where in some cases almost half the population died)
- Fire amongst the timber-framed buildings (the worst being the destruction of 1,718 houses in four days in April 1507)
- Rebellion (most notable being Kett's rebellion when the city was stormed by 20,000 people) and
- war (Norwich was subjected to the "Baedeker" air-raids in the Second World War).

There are also many stable factors like the market place which has been on the same site for around a thousand years. The essential physical characteristics of the Virtual City project are therefore that the area to be modelled involves a reasonably large city (about 9 square kilometres for the central area), with several hundred buildings of historic interest still standing inside the remains of the city walls. There are good records of the history of the city.

3. Potential Benefits: Why Develop "Virtual Heritage"?

Virtual heritage will become increasingly important for tourism as leisure time increases. Tourism is a growth industry in many areas where traditional industries have struggled to remain competitive. Virtual tourism and other outlets for realistic models (e.g. education and video games) will add to the commercial viability of Virtual Heritage. On the world stage Europe has significant advantages in terms of surviving heritage sites and documented historic interest. VR offers new opportunities for future generations to appreciate the past, and the present, by allowing:

- software and data archive as a new medium of preservation
- controlled access to, and minimum interference with, original historic artefacts
- education and appreciation of heritage
- new sources of finance for continuing historical research and research into preservation techniques
- construction of tools that are less labour intensive for reconstruction

General appreciation of heritage can also be expected to generate more public support for heritage projects. These goals are not necessarily mutually compatible. The objectives of archive would be to preserve artefacts at whatever level of detail was possible in case future users need access to any part of the original. Education is likely to be more selective and pre-determine "features of importance". At the other end of the spectrum pure entertainment may only require adequate virtual sets and convincing virtual actors. At times the original facts appear to need re-writing to support the entertainment value. In the Norwich Virtual City project the principal drivers are for a visitor experience, which is commercially successful and entertaining. We believe the educational message about the region will come through if we can achieve something based on fact but genuinely entertaining (cf ²). The advantages of using VR include access

to sites which no longer exist in the original format and the ability to re-enact scenes in historic settings which are still lively parts of today's city, without interfering with the life of the community.

4. Evaluation of data sources

There are a wide variety of sources of information about the layout and physical appearance of the City of Norwich. These include: i) Existing digital data including GIS data from the regional planning and from the UK Ordnance Survey, and CAAD data from major development projects ii) Collections of still photographs including postcard collections and aerial photography collections iii) Collections of historic cine film and video (principally the material in the East Anglian Film Archive) iv) Text based records (e.g. Thomson business directories, official records and local history collections) The two themes which recur in assessing the data are firstly that existing computational methods are inadequate for extracting the richness of the data and secondly that obtaining best coverage for any building may involve sources in very different formats. In the first theme we see the need to develop better techniques for extracting from the noisy historic sources (see ³ for a review of the problems here). Included here is the ability to extract scenes from cine films shot on hand held moving cameras (cf ^{4,5}), but there are also needs to resolve the incompatibilities between digital formats acquired for different purposes (e.g. CAAD and GIS systems - see ⁶). In the second theme we see the need for considerable historical research to establish the combinations of sources. Note that improved indexing, based on feature extraction from digital image archives, might help with source identification - but unfortunately most historic sources are not even available in digital format.

5. Progress to date

5.1. The Proof of Concept Project

In December 1998 Televirtual as leaders of the Norwich Virtual City Project were tasked with providing an initial segment of the model, with a degree of interactivity so that the potential could be assessed. Initial work has concentrated on the area around the Norman castle as an obvious icon of the project. Figure 2 and 3 show two views from the proof of concept work. (Reproduced by permission, ©Televirtual, 1999)

Figure 2 shows a 3D-model of the Norwich Castle, implemented in VRML and incorporating different levels of detail, gates which open etc. Figure 3 shows a street near the cathedral, and demonstrates the use of avatars within the model. An important part of ensuring successful entertainment will be to script activities of convincing virtual humans. We envisage a number of different levels of avatar capability. At the lowest level this will consist of moving around, following some sort of script with simple motion control rules ("don't



Figure 2: *Castle entrance*



Figure 3: *London St.*

walk through walls", for example (cf ⁷). At the next level avatars will have goals, and the ability to interact with other avatars in a scripted performance where the outcomes are not fully prescribed and may depend upon the audience interaction (cf ⁸). At the top level of performance capability, we are also envisaging some use of "interactors" - real actors who can see both the display and the person piloting the audience. The real actor then controls the movement of an avatar in the virtual environment.

5.2. Distributed Virtual Environments

We envisage two distinct circumstances which generate a need for distribution of models. The first is an internal need within the visitor centre using high bandwidth. This is particularly important for entertainment where several visitors interact with each other in a virtual environment, with each visitor having their own display and interaction devices. The second distribution is for communicating models to external users. The range of possibilities here is enormous, but obvious uses are for publicity - communicating pre-programmed sequences efficiently, at internet speeds, for replay on different hardware. Another use might be in education where more complete models need to be shipped in a form which is usable over internal school networks by groups of students. Work on the description of urban models for networked architectures has begun ⁹ and is based on the use of param-

eterised, generic building types for less interesting areas of the model. The approach is really object space compression as opposed to image space compression

5.3. Rapid Model Prototyping

Even a rapid guesstimation will reveal that in the city as a whole the majority of the model will be of buildings of little historic interest which act as a back drop to the important centre pieces of city architecture. Visitors however should be allowed to wander and the model should allow this over a reasonable area. In 1900 about 80,000 people lived within the medieval walled area. This implies a huge volume of relatively uninteresting and infrequently visited buildings, which in many cases we know little about. Therefore one piece of work has been looking at the rapid prototyping of "fill-in" areas ¹¹. Using a palette of generic building types and parameterisations of those types individual buildings may be quickly defined and mapped according to the constraints of known building sites in the old city. Thus if a Georgian double fronted, town house with particular roof-style and materials was known to occupy a particular footprint then the building type can be rapidly selected and parameterised and then inserted into the model. Approximations of large areas can be generated, in reproducible ways, very rapidly and this format, by exploiting application specific knowledge, appears very efficient for network distribution.

6. Conclusions

Visitor attractions such as that envisaged here will be opened - the only questions are how quickly and with what level of excitement and commercial success? Heritage is a real attraction (as the popularity of costume drama shows). In this respect Europe has a major advantage over Hollywood and should seek to preserve that advantage. The Fifth Framework Programme appears to have places where the sorts of developments envisaged here are encouraged. However, as with many applications of Virtual Environments, it is extremely easy to envisage applications which cannot yet be delivered and where delivery will take some time. In the meantime the projects present real challenges to current computing capabilities and solving the research questions they pose will inform many branches of computing science. There is considerable opportunity within Fifth Framework for the effort of solving these research questions to be spread between multiple heritage projects. These opportunities should be taken.

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