The NetConnect-Project – New Access to Ancient Sites

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Abstract

This paper illustrates the aims and the current state of the EU-NetConnect project. The project develops ICT solutions for three prominent Cultural Heritage sites in Europe in order to demonstrate inter-local cultural connections. The project is engaged in the development of an IT infrastructure capable of providing the public with a wide range of experiences, ranging from interaction with on-site mobile applications to georeferenced real-time visualization systems. Moreover the system shall enable researchers and Cultural Heritage operators to update and edit multimedia-content by an authoring tool. The aim is to promote an entertaining and effective educational access to Cultural Heritage that approaches both the virtual user and the "real" visitor on the site.

Key words: *Virtual Reality, mobile guide, authoring tool, GIS*

1 PROJECT

Most organizations whose missions include communication and promotion of cultural information are seriously aware of the value of digital applications. Digital technologies are winning over more and more cultural organizations. Especially in the field of attracting future stakeholders and interested parties they play an important role. Prevalently there is a gap between applied computer science in Cultural Heritage (CH) and the concerns and requirements of archaeologists regarding Information Technologies (ICT). Poor application of digital graphics can prevent optimal results and conceal the potential of the integration of these disciplines.

The NetConnect Project funded by the European Union intends to intensify interdisciplinary communication. It brings into dialog archaeological professionals and technologists to achieve a true integration of disciplines. Seven partners from five European Countries are involved.

Content and concepts are provided by the Archaeological Institute of Warsaw University, the Roman-Germanic Commission of the German Archaeological Institute (Frankfurt) and the Evolutionary System Group of the University of Calabria (Cosenza).

Technical support is provided by the Fraunhofer Institute for Computer Graphics, Darmstadt (GIS-implementation, authoring tool), the Center for Advanced Computer Graphics Technologies GRAPHITECH, Trento (Virtual Reality, game engine implementation), the Digital Design Studio of the Glasgow School of Arts (digital construction), and the Institute for Visual Computer Technologies, San Sebastian (mobile technologies).

Three cultural heritage Sites in different European countries will be equipped with integrative tools that allow easy upgrade of content and promote the sites by means of different digital media. The aims are digital publication of the sites in form of a mobile guide, a web-based virtual reality and mapping of the sites in a geo-browser.

The selected sites are Biskupin in Poland, Glauberg in Germany and Lokroi in Italy (see fig. 1). They are characterized as regional central places in the Early Iron Age. The sites have been intensely researched in the recent years.

Figure 1. Location of the three Cultural Heritage Sites Biskupin (Poland), Glauberg (Germany) and Lokroi (Italy)

Biskupin is famous for its wood preservation. On a boggy peninsula in Lake Biskupin, a well defended fortification was erected in the 8th century B.C. Nowadays an internationally known open air museum provides information about the remains of the Lusatian Culture here.

The Glauberg has long been recognized as an early Iron Age hillfort. It became the object of closer attention after the discovery of richly furnished burials in close vicinity to the impressive hillfort. A life-size sandstone statue of a Celtic warrior was a further highlight of the excavations (Glauberg 2008.). The site is currently being developed as a protected site with a museum.

The city of Lokroi was an early Greek colony in Italy – Magna Graecia – established in the 8th to 7th century B.C. It was founded by citizens of the Greek city of Lokris, to which the colony held strong contacts. It was involved in Mediterranean trade.

2 TARGETS

Expanding growth in tourism is raising new challenges within CH protection and increasing the need for accessible information in the tourism and leisure sectors. Even conservative estimates forecast a potential growth of visits to CH sites. 563 million visitors were counted in 1995 worldwide, and the number is expected to increase to 1.6 billion in 2020 (Bandarin 2007). These forecasts enhance the need to focus on the control of the physical impact of tourism on heritage sites. They pose new and growing acute problems for those charged with the multiple tasks of exploiting and conserving CH. Heritage operators are now looking to new technologies as a possible solution to these needs.

Non-experts usually perceive archaeological sites as fragmented, partial, difficult to interpret and out of the contemporary context. 2D-media and on-site 1:1 reconstructions have been shown to be not completely satisfactory.

During the last decades a great number of projects related to innovative technologies and CH have been applied. 3D digitalization and scanning techniques have been used for the reconstruction of historical objects, Virtual and Augmented Reality technologies allow new ways of interaction for users and experts, mobile technologies and multimodal interfaces provide intuitive and personalized access to scientific information at museums and CH sites.

Although these applications have improved the dissemination of CH, most of the projects have not been implemented in concrete scenarios. In order to convert fruitful technologies into successful applications for experts and laymen the focus should shift from mere a technological point of view to an integrated process for the generation and management of content.

The project chose the topic of Early Iron Age central places in order to provide an integrative context as background for the three prototype sites. The sites provide a contextual comparison of the degree of “urbanization” and the development of central places of regional importance. It also illuminates the different ways of contending with environmental challenges. Trade and exchange are also touched on. The applications allow us to go into detail on-site – virtually and in reality. They help to arrive at an estimate of different developments and concepts in different parts of Europe in the Early Iron Age, introducing their user to early domestic life, the trade of goods and skills in different parts of Europe – which are all itemized in the project.

3 COMPONENTS

Archaeological specialists were not only interested in the representation of the sites using state-of-the-art technology, they also demanded special requirements such as the possibility of simple authoring and modification of content, as well as the visualization of uncertain features and (re-)constructions. Moreover, the special conditions at the different sites demanded individual solutions for mobile device technology.

The concept behind the system architecture is a GIS-based POI-server (see fig. 2). Geo-data, geometry, semantic and metadata are stored on this central server. File-based information is provided by geographical information and 3D-objects. Client oriented web-services are a geo-data server, internet based access for mobile application, web-based VR and an admin-tool that enables archaeologists to release new information to the public easily.

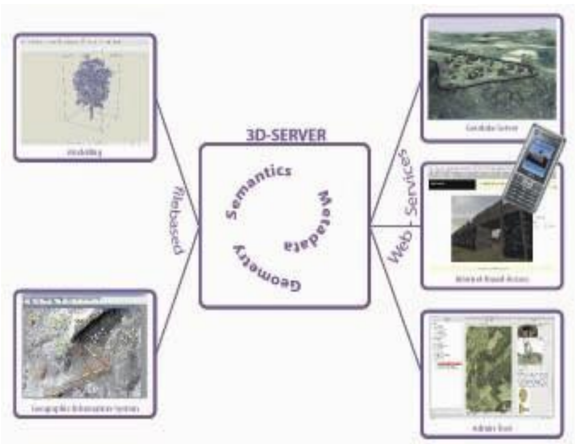

Figure 2. Organization-chart of technological components

The chosen structure for the components was an interacting system of applications which all extract parts of their data from the central GIS-Server. It stores and makes available multimedia objects such as text, 2D-images and 3D objects. Texts and images are simple to edit, but the editing of 3D objects to date is too difficult and still has to be conducted by experts. Information on the server is indexed, stored, managed, retrieved and associated to specified geographical positional data.

4 AUTHORING TOOL AND SERVER TECHNIQUES

A central element of archaeological finds and features is their spatial information. Therefore a basic part of the project was the setting up of a GIS-server capable of the task of managing and providing spatial data. The Points of Interests (POI)-server, configured and initialized by Fraunhofer IGD, stores multimedia-data linked to their spatial references. The data can also be integrated into various GI-Systems, Google Earth or location based services on mobile phones.

An authoring tool administers the data input (fig. 3). It also allows the upload of geo-referenced maps as a basis for mapping new POIs. After the POI-setup multimedia data can be added. The three-fold user interface of the tool can be individualized by the user and thus is simple to understand and to operate.

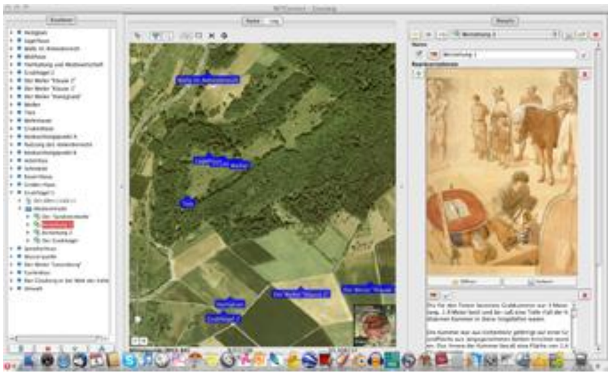

Figure 3. User Interface of the NetConnect authoring tool

The left hand column displays the POIs created and allows the creation of media folders, deletion of content and POIs, as well as changes in structure.
The central part displays geo-referenced maps and individual maps (e.g. excavation plans). Official spatial data services (e.g. Google Earth, Windows Life Search) can be integrated. A zoom function allows pinpoint initiation of POIs. When creating new POIs the user can revert to a simple point tool or a polygon tool marking large areas.

The left column of the display structures and organizes the data-input, geo-information can be modified and multimedia content can be uploaded.
The interface enables even only partly trained users to create and manage POIs in the virtual space. This way we hope that the integration of new content can be carried out easily.

5 3D Modelling of 3 Sites

3-dimensional models had to be created to form the basis of all further ICT developments. Detailed virtual models of the three settlements have been constructed by the partners from the Glasgow School of Art. Based on excavation drawings, architectural plans, photographs and extended discussions between archaeological and technological partners, the fragmented archaeological record could be transcribed to graphic constructions that might give an impression of what the sites could have looked like more than 2500 years ago.

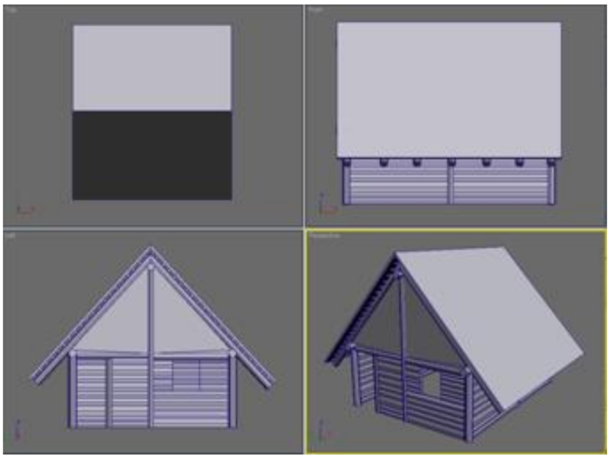

Figure 4. Model of a log house from the early Celtic settlement at Hünfeld-Mackenzell

Especially at the Glauberg the construction of the settlements (fig. 4) was a real challenge because here although there are some archaeological remains in the hinterland, no features of the Early Iron Age were preserved inside the hill-fort itself. All traces were erased by later settlements and only tons of Iron Age finds from within later occupation layers indicate intense earlier settlement activity.
Here the dilemma was that not representing any settlement inside the hill-fort would probably have been more misleading then adopting examples from comparable sites (fig. 5) – nevertheless a debatable interpretation. The effort taken and the arrangement of the virtual Glauberg settlement demonstrate that this responsibility was carried out carefully. The educational aspect here was more relevant, because only the settlement setting enabled us to provide an insight into living conditions, social arrangements, crafts and trade of that period.

Figure 5. 1:1 Model for the Glauberg - reconstruction of an Early Iron Age House in Hünfeld-Mackenzell, Hesse

6 Mobile Technologies

Given current technology trends, mobile guides are increasingly useful for visitors on site, as they are capable of providing large amounts of information about Points of Interest. The contribution of VicomTech to the project is the application of mobile technologies to enhance the visit to the sites.

Figure 6. Installation of the Glauberg guide on a mobile phone

The multimedia guide follows a tree-like structure, each of the branches represents a single page that is displayed on the mobile device. Pages can be of various types, displaying different formats of content.
The location of the user is automatically detected by satellite-based positioning systems and displayed on a 2D map which is dynamically adjusted to the position of the user. Devices without GPS navigate the POIs exclusively via the 2D map. The system simplifies accessing and retrieving information about the closest POI, filtering the contents on the basis of location data provided by GPS techniques.

7 VIRTUAL REALITY

Another component of NetConnect is the creation of virtual environments capable of delivering an enriching experience on the site. Users can navigate virtual reconstructions and access images videos, audios etc. in a fully interactive manner. The work has focused on educational aspects and is suitable for use by a wide and heterogeneous public, such as families, elderly people and students. For this reason the partner responsible, Graphitech, has paid specific attention to the design of a user-friendly and universal interface which can be used during the visit (fig. 7). As a result they decided to adopt a 'serious game' approach, trying to deliver an experience close to the simplified interaction of common video games. We hope in this way the user is less wary of such applications and encouraged to approach and use them. Here the game engine, the Unity-3D game development tool, is initiated. This powerful low cost application supports a wide range of platforms and is highly compatible.

The Virtual Glauberg, for example, represents a digitally modeled area of nearly two hectares. The basic terrain model is derived from a 3D airborne high resolution scan. Not only are the hill-fort and the nearby sanctuary integrated, but also the hinterland settlements on fertile soil close to the Glauberg. In the West the river Nidder forms a natural border to the settlement cluster, while other borders are defined by relevant archaeological features. Moreover, the diversity of the landscape should be demonstrated in the clip. At the Glauberg in particular archaeobotanical and palynological research provides a differentiated impression of the archaic environment.

Figure 7. Visual menu for the Glauberg hinterland

The display of this diversity was a further

challenge. The user can explore the whole area by foot or he can choose POIs from a menu as well as from a map. In the area of the hinterland settlements where archaeological features are available, the POI information concentrates on the excavations (fig. 8) and the individual research results.

Figure 8. View towards the hinterland settlement Linsenberg

Most POIs are concentrated on the hill top. Here concrete features are missing and educational aspects come to the fore: different crafts as well as living conditions will be demonstrated in this area. Not only the exterior landscape but also interiors have been furnished (fig. 9).

Figure 9. Interior of the weaving house

Audios and films are provided to the user at each POI. Additionally detailed texts and 2D material is provided. POIs can either be selected from a menu or they can be “walked by” in the real-time environment. Unity 3D also supports navigating the VR with Wii Remote™., Nunchuk™., and Classic Controller™. This will be a further feature of the VR application appealing to younger target groups.

8 Current State/Conclusions

It took some time and intellectual endeavor to establish a common language between the archaeological and technical partners of the consortium. Many forms and guidelines have been established, while meetings and interim video conferences were needed to overcome major and minor technical problems.

Currently technical effort is being spent on the display of the models in Google Earth as well as on the improvement of the interface between server and virtual reality. The reported outcome is of value not only for the NetConnect consortium but more widely for future endeavors in the reconstruction and display of CH.

Up to now the project has achieved many of its goals. Yet some of the targets could not be fulfilled sufficiently in the short period of time. A specific example here is the interface between the authoring tool and virtual reality. Currently the authoring tool works best with Google Earth and not with our own developments.
Moreover, research in the project poses further tasks and questions to be executed and answered. Displaying the fourth dimension as well as an adequate solution for the presentation of uncertainties in archaeological interpretation would be some of the demands of future research.

Understanding the technological needs of CH sites, and more specifically of archaeology, has significant relevance to the future of knowledge and education delivery. Moreover, it supports the development of shared technology services to enhance digital graphics for CH in current and future research.

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