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MULTIMEDIA TECHNOLOGY AND 3D ENVIRONMENTS USED IN THE PRESERVATION AND DISSEMINATION OF PORTUGUESE CULTURAL HERITAGE

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Cultural heritage is an extremely valuable set of materiality, traditions and knowledge from the Past that should be used to better understand the Past itself. However, even nowadays there are still some difficulties to manage, preserve and disseminate cultural heritage sites. The usage of multimedia technology and 3D environments in cultural heritage has reduced these difficulties; nonetheless, there are still some remaining problems.

In the last years, some multimedia technology and 3D environments have been applied to the cultural heritage in Portugal. A few of them are used for scientific research purposes and others are used for dissemination purposes.

In this article, the authors will refer to some representative Portuguese case studies using Virtual Environments to maintain, preserve and promote Cultural Heritage. A critical reading of these projects will be made in order to stress out their success and to point out their weaknesses and limitations.

1 Introduction

Cultural heritage is an extremely valuable set of materiality, traditions and knowledge from the Past that should be used to better understand the Past itself. However, even nowadays there are still some difficulties to manage, preserve and disseminate cultural heritage sites. The usage of multimedia technology and 3D environments in cultural heritage has reduced these difficulties; nonetheless, there are still some remaining problems [1] [14].

In the last years, some multimedia technology and 3D environments have been applied to the cultural heritage in Portugal. A few of them are used for scientific research purposes and others are used for dissemination purposes [4] [10] [11]. Nevertheless, the important growth of cultural tourism forces the Portuguese authorities to perform significant maintenance and conservation work in several cultural heritage sites, particularly in the architectonic and archaeological heritage sites. This work is crucial to improve the divulgation of Portuguese cultural heritage. The general understanding is that virtual environments technologies will have an important role in this process. However, there are still some important constrains.

During the last years, 3D-oriented Virtual Environments, built up with high expressive visual elements, textures, sound and color, allowing various forms of immersive navigation throughout virtual worlds, have become quite common all over Europe. A great number of these projects have been launched and are supported by national founding in order to maintain and preserve historical, artistic, architectural, archaeological or natural heritage. Interfaces with high intuitive interaction forms are crucial to guide end-users (common citizens) through the immense content repositories that are available, helping them to appreciate the richness of the European Cultural Heritage [9].

The evolution occurring on the Virtual Reality devices has passed from the equipment size of a whole building to the virtual table [7], such as Barco Baron Table that nowadays moves to the mobile end-user.

In this article, the authors will refer to some representative Portuguese case studies using Multimedia and Virtual Environments, projects developed during all over the last 8 years by the institutions where the authors come from, aiming to maintain, preserve and promote Cultural Heritage. A critical reading of these

projects will be made in order to stress out their success and to point out their weaknesses and limitations. Based on this analysis a final discussion and conclusions will be exposed.

2 Technology Overview

2.1 Multimedia

According to [8] and [13] it is not an easy task to define Multimedia. The conceptual evolution of Multimedia is evident in their work, but when they try to define Multimedia, both are reluctant to do it in a unique way. However, there are some essential elements that should be present in a multimedia system: immersion, interdisciplinarity, hypermedia, interactivity and narrativity.

Actually, multimedia is not a concept of the sixties, but it was already present in places like the Palaeolithic caves of *Lascaux* (southern France) [2]. Just imagine a gathering or an event where the inhabitants of the cave are immersed in an environment that comprises image, sounds, symbols and even odours. So, in some sense one can say that multimedia is one of the oldest communication forms.

Nevertheless, some computer science researchers think that multimedia is a concept, which identifies a high specific research area. This research area, within the new information technologies, is concerned with the processing, management, distribution and dissemination of composite information, available in different media [5]. This means that people should use their different senses, like the hearing, the vision and the sense of feeling, to apprehend information. Furthermore, the apprehended information has to be presented using different media such as image, sound, text, animation and video. All these media have to work together in diverse dimensions as for example spatial, temporal and logical.

Having in mind that cultural heritage itself has a spatial, a temporal and a logical dimension; it seems that multimedia technology is ideal to register multi-sensorial information that can be used for the preservation and dissemination of a cultural heritage site. The Internet is, naturally, a new and powerful communication medium, closely associated to multimedia. This communication platform is therefore a privileged dissemination medium for cultural heritage.

2.2 Virtual, Augmented and Mixed Reality

We can say the last decade *multimedia* advent has occurred when the “media” became easy to treat in *digital* form, within normal PC's. The media streams could be randomly accessed and easily “fused” and, consequently, new ways of perception and *interaction* with them have arisen.

In respect to the interactive and immersive 3D models (Synthetic Environments), know as *Virtual Reality* (VR), if we include into the multimedia subject all that elements which make it expressive (textures, sound, color, etc.), we can also say that, in consequence, multimedia brought to the Virtual Environments the realism needed to make them highly expressive. The ultimate goal of VR is to create such an environment that seems real to the user, not only in respect to its visual appearance, which nowadays is possible due to the mature field of Computer Graphics, but also considering its intrinsic dynamics (natural feedback), as well as the extrinsic ones (responsive feedback).

However, in many cases a complete immersion of the user into the synthetic environment is not necessary and sometimes not even desirable. It is possible to superimpose or compose virtual objects upon the users view of the real word. This augmentation of scenes with additional information, in real time and correctly registered in 3D, is what defines *Augmented Reality* (AR) [3]. The ultimate goal is now the creation of such a system that the user cannot tell the difference between the real world and the virtual augmentation of it.

It is possible to point out some variants of these technologies, mainly in respect to their applications. In order to find a consistent definition, [12] established the so-called Reality/Virtuality Continuum: by one hand we have the real world, and by the other hand we have the artificial one. The mixture of real and virtual objects is called *Mixed Reality*, in which one distinguishes Augmented Reality and Augmented Virtuality by the amount of real or artificial objects.

3 Case Studies

3.1 Virtual Santa Clara

A very interesting application field for virtual environments is archaeology. Through virtual environment techniques it is possible to recover heritage that might be badly preserved or has completely disappeared.

The Gothic Monastery of Santa Clara-a-Velha was founded in Coimbra, Portugal, in the 13th century, on the left bank of the Modego River. Half a century later, the river started to swallow the building until it was completely abandoned in the 17th century.

The aim of the Virtual Santa Clara project was to construct a complete three-dimensional digital model of the monastery throughout the various stages of its history. This included the representation of several elements of the church and of the cloister in their correct historical location using the highest level of realism in the texturing and coloring. The 3D model was usually presented using the virtual table (Barco Baron Table) in stereoscopy passive projection.

The Virtual Santa Clara project was developed for the IPPAR – a Portuguese public institute devoted to the preservation and restoration of architectural and archaeological treasures. The project was concluded in September 1999.

Virtual Santa Clara was one of the first projects ever realized in Portugal in the area of Virtual Reality for Cultural Heritage. The project itself served to demonstrate the limits of the technology and to foster the next steps in the area. It was a very expensive project both in terms of labor-intensive 3D modeling and visualization devices required (for more details see [15]).

3.2 Virtual Tour to Bracara Augusta

Bracara Augusta was one of the three urban foundations controlled by Emperor Augustus in the NW of Iberia at the end of the Cantabrian wars (19 BC). During the first century the town became an important administrative and economic centre, which was served by a network of roads, since it was a key access point to the NW from the South of the country.

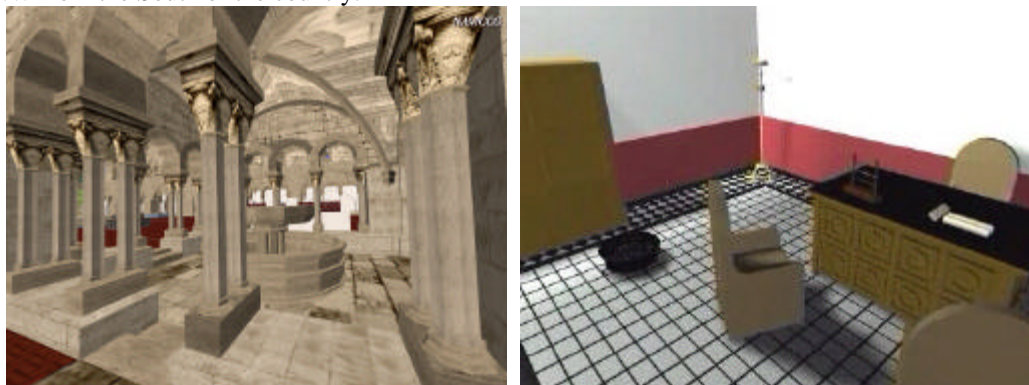


Figure.1. Left: aspect of Virtual Santa-Clara; Right: inside of a roman house at Bracara Augusta.

In spite of an increasingly growing public interest in the past, non-specialists still have some difficulties on understanding archaeological records. The Project “A Virtual Tour to *Bracara Augusta*” provided an interactive Multimedia Information System that facilitates access by common users to scientific data analysis and archaeological interpretations concerning the old roman city, *Bracara Augusta*. The support platforms for the system are the so-called Multimedia Kiosks that may be visited in Braga and represent a kind of Information Window into the past, and are specially conceived to be operated by people without a technological background [11].

The system has been based on a structure tree divided into four main subjects, being the “Virtual Reconstruction of *Bracara Augusta*” the most important one in terms of information provided as well because it integrates many of the complex and impressive Multimedia elements provided. An example of a private Roman House (the house of Carvalheiras), a public Roman building (the Roman Baths) and a first

essay into the entire virtual reconstruction of Bracara Augusta is presented and can be visited in detail. The other subjects are the research history, the excavated places and the artefacts that have been recovered.

This project was only possible due to a multi-disciplinary approach that joined together Archaeologists, Architects, Computer Scientists and Multimedia Designers.

3.3 ARK project

ARK – augmented reality kiosk - is a set-up based in the prototypes developed in the European project Virtual Showcases [6] where direct interaction has been added. A normal monitor and a half-silvered mirror constitute the usual set-up of the kiosk (see fig. 2).

The image displayed on the monitor is reflected by the half-silvered mirror, thus creating the illusion that the image space is behind the mirror. Because of this, real objects can be inserted behind the mirror, thereby creating the AR illusion. This is the Virtual Showcases concept.

Additionally, it enables the user to directly interact inside this image space, by placing the hand beneath the mirror. The input device used in the prototype is a data glove which allows the user to manipulate both the real and the virtual objects, creating greater realism.

ARK is being used to display archeological artifacts in collaboration with the Museum D. Diogo de Sousa in Braga, Portugal. It represents one of the next steps on the application of the technologies on cultural heritage, since it surpasses the constraints of costs and solution complexity, by encompassing a low-cost set-up and adopts a simple interface and interaction metaphor targeting the large group of the museum visitants.



Figure.2. Left: Virtual Showcase concept; Right: Aspect of the ARK system.

4 Discussion and Conclusions

Nowadays we are assisting to a very fast growing in 3D visualization, display and interaction technologies. Computer-generated augmentations of the physical world will be a reality with applications in almost all the environments we are used to. Moreover, as it has been presented in this paper, the traditional Multimedia has still its place, i.e., it complements the systems with more accurate contents in the form of high-quality images, sound, texts and animation.

On the other hand, the evolution occurring on the VR devices has passed from the equipment size of a whole room to mobile end-user devices of today. This makes AR the alternative solution for many applications.

In any case, a crucial point in X-Reality is the quality of the experience. The "reality" must react coherently to the user actions, making that experience consistent.

The image composition in AR is more sophisticated compared with the well-known techniques used on television or movie effects, like the chroma keying, because the supplementation of the real world have to take in account depth information and all the interaction must be performed in real-time. Because AR

permits improved forms of mixing the reality with virtuality (simulation) together with more user-friendly devices it will become more and more the key-technology (with several variants) in the area of cultural heritage. AR allows the users to ultimately live *in* the world we are simulating while he/she does not break the link with reality.

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