Utilising 3D Realistic Models in Serious Games for Cultural Heritage

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ABSTRACT

In the cultural heritage field, many Serious Games applications have been developed whose goal is to educate players and users not particularly specialized or familiar with this field. On the other hand, 3D models of cultural heritage objects created with precise 3D modelling methods can be a very useful asset for these applications. In this paper a composite Serious Game for the Stoa of Attalos, a prominent monument in the Ancient Athens Agora, is developed and presented. 3D models are used, which were produced mainly with automated image based modelling techniques. The creation of the 3D models is described and presented along with the development of the application, which offers three options for the player. These options are: a quiz game, a 3D visual quiz and a virtual museum. The user interaction is described and, based on an evaluation questionnaire, the application is assessed by a group of people in the Cultural Heritage field.

KEYWORDS

3D Models, Cultural Heritage, Image-Based Modelling, Serious Games, Stoa of Attalos

1. INTRODUCTION

Nowadays, there are techniques available to create realistic 3D models of practically any object, among which are also cultural heritage assets. These 3D models can actually represent reality in extremely vivid ways. This can be very useful in many virtual reality applications. Realistic textured 3D models can be created using different methods. When based on 3D digitization, these methods may include laser scanning, digital imaging or a combination. In the cultural heritage domain, a 3D model can represent a whole building but also smaller objects, such as exhibits in museums, decorative elements, etc. They are very important media in serious games applications for cultural heritage, because they can help people that are not specialized in this scientific domain, such as tourists, school children, college students, museum visitors and others, to gain experience, expand their knowledge and stimulate their interest. The basic goal of this paper is to demonstrate and evaluate the usage of
realistic 3D models created with 3D reconstruction techniques (mainly image-based) in a serious game developed for the Stoa of Attalos monument, in Athens Greece. The rest of the paper is organized as follows: in the next section an overview of the most important implementations of serious games in the cultural heritage domain is presented; then some basic thoughts concerning geomatics and 3D modelling are presented; in section 5 the creation of the 3D models of the objects used for the development of the “Discovering the Stoa of Attalos” application is presented and explained; next the development of the application is described in detail, highlighting the various decisions taken; furthermore, the evaluation of the application is presented, and finally, some concluding remarks and the future perspectives of the project are introduced.

2. SERIOUS GAMES IN CULTURAL HERITAGE

During the last decade, many serious games applications have been developed in the cultural heritage field. The most representative ones have been selected and are briefly presented. The Roma Nova (Rome Reborn) project, whose main goal is the production of a high-resolution version of the city of Rome in 320 A.D. using procedural modelling techniques was developed a few years ago (Vourvopoulos, Liarokapis & Petrdis, 2012). In the Ancient Pompeii (Maim et al., 2007) application the player tries to simulate a crowd of virtual Romans who exhibit realistic behavior in a specific district of Pompeii. Another interesting serious game application is the virtual reality reconstruction of Otranto, an Italian city during the middle ages (De Paolis, Aloisio Maria, Celentano, Oliva & Vecchio, 2011). Virtual Egyptian temple (Jacobson, Holden, Studios &Toronto, 2005; Troche & Jacobson, 2010) is a game about a hypothetical temple that does not exist in reality. The temple is a typical representation of the New Kingdom era and is divided into four areas, each one housing an instance of the High Priest. Also, each area represents a different feature from the architecture of the era of the representation. Gate of Horus (Jacobson, Handron & Holden, 2009) is an application based on an ancient Egyptian temple, in which students can learn through a virtual priest who challenges them to demonstrate knowledge. The Foundation of the Hellenic World (FHW) has developed the Ancient Olympic Games project, which includes a number of gaming applications related to the Olympic Games in Ancient Greece (Gaitatzes, Christopoulos & Papaioannou, 2004). A treasure hunt scenario for medieval objects located in and around the remains of Coventry’s original Benedictine monastery, demolished by Henry VIII, is the theme of the Priory Undercroft game (Doulamis, Liarokapis, Petrdis & Miaoulis, 2012). A game that uses storytelling techniques and principles of modern videogames is the Battle of Thermopylae (Christopoulos, Mavridis, Andreadis & Karigiannis, 2011). In this game, the player learns many things about the battle and the associated legends. THIATRO (Froschauer, Arends, Goldfarb & Merkl, 2012; Froschauer, Merkl, Arends & Goldfarb, 2013) is a history of art serious game, in which the player can assume the role of a museum curator. The Via Appia application is an indirect augmented reality system, in which 1km of Via Appia Antica has been reconstructed in three different time periods and the user can explore the notion of narrative movements and travel across space and time in a cultural heritage context. Furthermore, it includes a quiz game with questions related to the information provided by the game (Liestol, 2014). A game, in which teenagers are able to construct the south portal of the Gothic cathedral of Amiens in France, is Your Stone to the Building (Leclet-Groux, Caron, Mouaddib & Anghour, 2013). ICURA is an application for intangible cultural heritage and especially for the Japanese culture and etiquette (Froschauer, Seidel, Gartner, Berger & Merkl, 2010). MuseUs is an attempt for developing an application to be used in museums that also runs as a smartphone application, in which the player is invited to create his/her own exhibition during a visit to a museum (Coenen, Mostmans & Naessens, 2013) for which it is available. MyMuseum is a serious game application, in which the players are able to experience and learn about the museum objects by creating their own virtual gallery space on Facebook (Goins, 2010). The PLAYHIST experiment is an attempt to develop a serious game, which will allow players to act and interact by posing as a historical character in a 3D environment,
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