

DigiArt: Exploring the Scladina cave

Eleftherios Anastasovitis^{*1}, Dimitrios Ververidis¹, Spiros Nikolopoulos¹, Ioannis Kompatsiaris¹, Gregory Abrams², Kevin di Modica², Dominique Bonjean², Isabelle De Groote³, Frederic Bezombes³, and Christoph Strecha⁴

¹Centre for Research and Technology Hellas

²Belgium Scladina Cave Archaeological Center

³Liverpool John Moores University

⁴Pix4d photogrammetry company

Abstract

DigiArt is an interdisciplinary research project with focus on developing new methods and tools for automated 3D modeling and analysis of physical cultural resources and assets such as Cultural Heritage (CH) and archaeological sites, monuments, sculptures, beyond simple digital reconstruction. In this demonstration, the case of Scladina cave is being presented. More specifically, the design and development of a Serious Game (SG) that gamifies a cave of palaeolithic era, is the subject of our contribution, using Virtual Reality (VR) technologies.

Keywords: Virtual reality, serious games, cultural heritage, game development, virtual environment.

1. Introduction

The use of VR in museums and CH settings, offers new opportunities for archaeological, art-historical, and also for public education and interpretation activities, which can be impressive and entertaining [1]. The demonstration of "Exploring the Scladina cave" is the first case study of DigiArt's h2020 European Union project [2]. The scenario and the storyboard of Scladina cave SG was designed and developed by the Scladina Cave Archaeological Center (SCAC). The game-design allows the player to explore the virtual world in both linear and non-linear way. The first scene is a menu where the user can be transferred to various spots in the second or third scene, where the second scene is the area of Scladina cave and the third scene is the cave alone.

2. Development of Scladina cave serious game

2.1 The 3D models

The reconstruction of Scladina's cave 3D model has been achieved through photogrammetry, i.e. photos have been taken from the ground or by airborne drones, and subsequently the photos have been fed to a photogrammetry program such as Pix4D¹ that processed them and derived the 3D model. Manual interventions on the 3D model were necessary in order to fill holes generated by missing spots in the photos (occlusions). Artificial 3D models, textures and materials were inserted to represent scientific equipment and structural assets such as the bridge of the cave for increasing the sense of presence and immersion of the player. A huge number of artifacts such as human/animals skeletons as well as flints that served as prehistoric tools have been discovered into the Scladina cave and some of them have been scanned by the Scladina Cave Archaeological Center and they are available in the game for inspection.

2.2 Virtual tour design

The virtual tour is a game that has been designed and developed with the most recent software packages for 3D-graphics and game-engines, such as the Oculus Rift headset [3], and the Unity3D game engine [4]. The Oculus

* Corresponding author: anastasovitis@iti.gr

¹ <http://pix4d.com>

Rift with Xbox controller increases significantly the immersion into the virtual environment, and the Unity3D game engine provides the tools for rapid development of the game in a high quality level, as it can be seen in a screenshot of the game shown in Figure 1(a).

In the Scladina virtual cave, the user has the opportunity to interact with specified Points of Interest (PoIs). When the player reaches specified areas, the game has to provide some extra information. These areas are defined by the use of 3D marker. As the player reaches a PoI, there are three types of displaying information such as text, images, and video.

The user can also interact with the artifacts in a “3D viewer mode”. In this mode, the artifact is isolated from the environment of the cave. The virtual visitor of the cave can translate, rotate and zoom in/out the selected artifact. On the right section of the screen, the user can read some information for the artifact and instructions for its manipulation. The player can zoom in to the object to reveal a great amount of detail, a feature useful mostly for the scientific community, as the models were inserted at the highest texture level (8192x8192 pixels), maintaining also the original vertices.

During the exploration in Scladina cave, user has the opportunity to trigger some immersive 3D animations. The objective of these animations is to represent some useful information about the cave, in an entertaining way. The test-pit animation is triggered in the entrance of the cave Figure 1(b), while the evolution of the cave is in last level of the SG.



Figure 1. The Scladina cave (a) main view, (b) test pit.

3. Conclusions and future work

In this demonstration, we presented an SG based on 3D graphics and VR technologies, for communicating an archaeological site to virtual visitors. Users interact in an immersive virtual world and learn through the execution of the designed scenarios. This SG can also act as an additional tool for the scientists of the Scladina site, offering new perspectives of the history and the evolution of the cave. As for future work, we are planning to evaluate the SG for its educational results and the influence of VR technologies in CH communication.

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