Chapter 7

Reconstructing the Past: Providing an Enhanced Perceptual Experience

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ABSTRACT

Accurate modeling/reconstruction and visualization of real environments, particularly archaeological sites, is both a major challenge and a crucial task. This work will address the entire process of the virtual reconstruction of archaeological sites, since the construction of the virtual model until its visualization. The chapter begins with an introduction to the process of virtual reconstruction of archaeological sites, where the several stages that should take place to obtain a faithful virtual representation of an archaeological site and its artifacts are identified. Moreover, each stage is characterized and its main methods and techniques are identified, in dedicated sections. The authors’ contribution for the state of the art will be highlighted in each stage. The chapter ends with the authors’ vision about future trends for this field and unveils what could be their contributions to this vision.

INTRODUCTION

Accurate modeling/reconstruction and visualization of real environments, particularly archaeological sites, is simultaneously a major challenge and a crucial task. It allows the digital preservation and the visualization of not only current cultural assets, but also of those who no longer exist, resulting in a true glimpse of the past. This enables experts to study and to interact with their objects of interest, while allowing the general public to visualize such virtual environments, fostering cultural, social and scientific participation. By using mobile devices, such as smartphones or tablets, virtual models can be visualized...
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in loco, giving the experts a better understanding of how objects of interest integrate in their original environment and providing the general public an enhanced perceptual experience.

Despite sometimes being used as synonyms, in the context of this chapter “modeling” and “reconstruction” are considered as similar concepts, but with different working objects. The modeling task aims to build a model of an existent object while the reconstruction task is concerned with building models of no longer existent objects or model (reconstruct) the original shape of damaged objects, based on some information.

Highly accurate modeling/reconstruction is a very complex and time consuming task. To achieve a faithful representation of the object of interest all stages of the reconstruction and visualization processes must be carefully executed. These stages include constructing the object’s virtual model, mimic the ancient original illumination conditions, to render and visualize the model, under the correct context.

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VIRTUAL RECONSTRUCTION PROCESS

The use of computers in Archaeology dates back to the late 1950s and early 1960s, essentially for the statistical treatment of information collected during excavations (Reilly & Rahtz, 1992). At that time, the use of computers was confined to a very limited set of archaeologists. In the early 1970s, a group of enthusiasts and experts in the use of computers in Archaeology joined in and started a cycle of international conferences designated as “Computer Applications in Archaeology”, which still takes place with the title “Computer Applications and Quantitative Methods in Archaeology”. In the following years, the use of computers in Archaeology has evolved to the use of computer aided design (CAD) systems, database management systems (DBMS) and geographic information systems (GIS). The first, besides allowing to digitally store the topographic survey carried out during the field work also enabled, based on the acquired data, some earlier works on the 3D reconstruction of both the terrain and the archaeological site’s existing structures. While both DBMS and GIS allowed storing data acquired during the excavation, GIS enabled storing, manipulating and visualizing data with a spatial nature. The term “Virtual Archaeology” as a reference to the use of Virtual Reality in Archaeology was first mentioned by Reilly (1990), but the creation of virtual reconstructions in the field of archaeology began in the 1980s.

Since then, the use of computers, particularly the virtual reconstruction as a support to research and promotion of cultural heritage, has gained an increasing interest. Presently there are several international conferences dedicated to this topic. In the last years there has been a significant increase in the number of projects involving some sort of historical reconstruction as well as its web promotion, which causes a greater impact and consequently affects more people. This increase can be related to two factors: (i) the technological development, which allows to obtain these reconstructions more easily; (ii) the increased