Chapter X
The Role of Interactive Computer Graphics to Augment the Learning Experience of Cultural Heritage Within Museums and Expositions

Giuseppe Conti  
Fondazione Graphitech, Italy

Raffaele De Amicis  
Fondazione Graphitech, Italy

Gabrio Girardi  
Fondazione Graphitech, Italy

Michele Andreolli  
Fondazione Graphitech, Italy

Stefano Piffer  
Fondazione Graphitech, Italy

ABSTRACT

In the past years the adoption of computer graphics to improve learning experience has seen a rising success. The wide availability of dedicated graphics hardware at low cost, mostly fostered by the increasing popularity of videogames, has contributed to the widespread adoption of 3D graphics technologies specifically developed for the general public in the context of cultural heritage. This chapter illustrates the role that 3D graphics has played and still plays today in improving the learning experience and it does so from different perspectives through the results from three projects. The first project illustrates the use of high-tech virtual reality facilities as means to improve the learning experience in the context of an archaeological site. The second project describes the use of standard desktop as well as Web-based 3D game-based technologies to provide interactive access to cultural heritage content. Finally, the third project shows how the use of technologies borrowed from other domains, such as in the case of 3D Geobrowsers, can bring significant benefit if adopted in the context of cultural heritage.
INTRODUCTION

In the last few years technologies related to computer graphics have been playing an increasing role as new means to improve the learning experience. The interactive nature of 3D applications in fact provides an ideal support to the learning experience as it stimulates a two-ways process based on an interaction-feedback loop, engaging the user to a higher extent.

The use of 3D computer graphics can be beneficial in a variety of scenarios ranging from applications specifically designed for domain experts as well as for common people. The former can benefit of direct manipulations of precious artefacts (e.g. fragment of vase), through simulations showing the effects of restoration techniques or validating theories. Access to Digital Libraries (DL) containing 3D models of artefact can be a valuable help to experts, scholars as DLs allow storing, archiving, fast retrieval as well as remote access to pieces of art otherwise out of reach.

Common people can also benefit from a range of different applications using 3D computer graphics technologies to provide interactive access to multimedia data on cultural heritage. For instance, through a specific set-up located at a museum premises, visitors can virtually hold a precious piece of a collection, they can explore it freely or they can compose fragments of an ancient vase to build the original artefact. Through the use of 3D computer graphics a visitor of an archaeological site can also experience the visit to the site as it was in the past, through a virtual walk within the 3D reconstruction of a site. Visitors can benefit from 3D computer simulations to better understand archaeological sites characterised by complex layout or poor state of conservation.

The rapid diffusion of 3D web-based applications is contributing to reducing geographical constraints. Visitors can experience the collection of a museum, a walk through an archaeological site from a remote location, sitting comfortably at home. Benefits can be particularly significant for to those users, such as physically impaired or elderly people, with mobility constraints as well as for young visitors, such as pupils, children, traditionally very interested to computer-based technologies.

The aim of this chapter is to illustrate how the learning process can benefit from a range of computer graphics technologies ranging from hi-end visualisation facilities to solutions based on commodity hardware. This is done describing the results of three projects, sharing the goal of providing an improved learning experience, through the use of different technologies. Each section illustrates the details of the relevant project, it presents its advantages from a technical perspective and it highlights the limits that characterise the different approaches.

The first project presents the benefits of adopting high-end visualisation facilities within an archaeological museum. Visitors at the museum are immersed within a virtual reality environment that brings them through a virtual journey illustrating the history and the highlights of a particularly complex archaeological site, providing a very effective learning experience which greatly improves their comprehension of the real archaeological site.

The second project takes a different approach and it makes use of commodity off-the-shelf hardware set-ups, based on standard PCs, video projectors and gaming controllers, to deliver an equally engaging experience during the visits to a museum. This is done through a “serious game” metaphor where a game-like approach becomes the means for a more engaging learning experience. In other words visitors learn about cultural heritage by playing with a gaming environment that replicates the historical context of interest. This approach is particularly attractive for young people and it can help turning the learning process from a tedious chore to a playful experience. Additionally the same project illustrates how this approach can be extended more generally to web-based applications thus increasing their learning potential.