Chapter 5
Exploiting Cross–Reality Technologies for Cultural Heritage Dissemination

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ABSTRACT

One of the most challenging tasks in cross reality environment simulations is the generation of realistic and attractive worlds. The continuous evolution of computer game industry has a dramatic effect on such tasks as younger generations have higher expectations and demands in terms of realism. Virtual, Augmented, and mixed reality-based museums allow the efficient dissemination of cultural heritage thesaurus and are considered a popular application domain for cross reality environments due to their broad appeal. One of their primary scopes is to enrich user experience by introducing intuitive means of interaction with artefacts while offering knowledge in a more pleasant way than most of the traditional approaches. This chapter focuses on the development aspects of realistic simulations of cross reality environments for cultural heritage applications. It covers aspects related to modern 3D graphics and game engines, 3D digitization, and modelling. It discusses on the combination of these technologies in order to produce realistic, pleasant, and educative environments.

INTRODUCTION

Realistic simulation has a prominent role in Cultural Heritage (CH) dissemination (Kiourt, Pavlidis, Koutsoudis, & Kalles, 2017). Virtual museums are environments that host *synthetic* exhibitions created to tell the stories of real artefacts in a similar to a real museum visit but in with richer context and a wider range of interaction capabilities. In the context of a real museum, this is achieved by combining exhibits and information in a well-designed layout and presentation style (Lepouras & Vassilakis, 2004). The development of virtual museums is based on contemporary technologies such as real-time 3D computer graphics, spatial sound and Cross Reality that are used to deliver enriched virtual presence combined with a more vivid and enjoyable experience. Although each one of the previously mentioned technologies aim towards discrete goals, *realism* and *response time* are considered common. In addition, the continuous development of Web services and computer infrastructures complemented by the increasing availability of computer game development platforms (also known as *game engines*), contribute towards a continuous release of serious games in diverse fields including entertainment, cultural heritage, education, artificial intelligence, sociology, military and health systems (Breuer & Bente, 2010). In a sense, serious games can be considered as an efficient approach for blending domain specific activities, like in cultural heritage and education, with gaming. By utilizing contemporary visualization and simulation technologies, serious games enhance the user's experience through photorealistic interactive environments (Van Eck, 2006). This form of stimulation is considered to be one of the primary factors for a successful user engagement, in which playing, assumes the role of the driving force that promotes concentration in the activity process and user encouragement for further self-improvement. Stimulation is largely considered by the scientific community as an appropriate mechanism to achieve the desired results (Rogers, 1996).

Jacobson & Gillam (2012) define Virtual Heritage (VH) as "*the use of electronic media to recreate culture and cultural artifacts as they might have been or interpret them as they are today*". While Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) technologies, are frequently adopted in the field of Virtual Heritage, their capabilities are much more dynamic and powerful, such as blending 3D visual reconstructed CH elements with the real environment (Desai, 2018) (Kolivand, El Rhalibi, Tajdini, Abdulazeez, & Praiwattana, 2018). VR/AR/MR technologies allows archaeologists and experts to study directly on site and gives the opportunity to the general public to explore immersively and interactively points of interest (Haydar, Roussel, Otmane, & Mallem, 2011) without coming into contact with the real exhibits (Van Krevelen & Poelman, 2010). This is considered to be one of the most important steps towards the dynamic dissemination of CH elements in a safe way and without time, financial and geographical restrictions. Cross Reality (XR) technologies can capture a visitor's attention by enhancing their satisfaction from the produced experience and by deepening his/her understanding for an exhibit (by revealing hidden unknown stories). This key point creates a positive active learning experience for the user (Dieck & Jung, 2017). Canciani et al (2016), report that AR is applied in CH domain for the last two decades. Its first appearance in the Archeoguide application (Vlahakis, et al., 2001), installed at Greece's Olympia archaeological site, simulating ancient life and reconstructing ruined elements. Since then, AR/MR technology has been applied in various CH derived case studies with promising results (Higgett, Chen, & Tatham, 2015) (Střelák, Škola, & Liarokapis, 2016) (Martínez, Casas-Yrurzum, Vidal-González, Vera, & García-Pereira, 2018) (Boboc, et al., 2019).

This chapter introduces and presents some of the most important factors that should be taken into account when building realistic simulations of CH with XR technologies for dissemination approaches that apply to all ages (children, adults and seniors). The chapter covers the following subjects: a) Primary

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