Chapter 4
Multi-Dimensional Acquisition, Representation, and Interaction of Cultural Heritage Tangible Assets: An Insight on Tourism Applications

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ABSTRACT

The acquisition, digital representation and interaction of cultural heritage (CH) assets is of high interest for an accurate documentation of our cultural legacy. Detailed studies demand more information on the assets apart from the mere visual appearance or even shape of objects. In this regards, some research works can be found that combine shape with other kind of data, such as radiometric (e.g., IR, thermal radiation, etc.) or semantic information, leading to multi-Dimensional (mD) virtual objects. In this chapter, we review the state of the art of different techniques to deal with mD acquisition of CH tangible assets. We also discuss some representation (e.g., visual, sonic, etc.) and interaction approaches to enhance the value of CH by means of the technologies of virtual reality (VR) and augmented reality (AR), considering also the application of these techniques to tourism. Finally, we also point out some current needs and technological barriers that need to be tackled by the research community regarding the acquisition and dissemination of heritage.

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INTRODUCTION

Cultural Heritage (CH) is a fundamental expression of the richness and diversity of our culture and therefore, its conservation, documentation and dissemination is considered of the utmost importance. Beyond the well-established methods that have been traditionally employed in the field of CH up to the present moment, technological tools have become increasingly popular for the heritage enhancement, tourism experience development and dissemination. This is because they have the ability to engender fascination far beyond a tourist brochure or any other printed material.

The digital documentation and dissemination of CH tangible assets through current technologies usually involves several steps, such as the visual appearance and shape (or three-dimensional, 3D) acquisition of the assets, their virtual reconstruction, storage (e.g. repositories), digital representation or reproduction (mainly visual), and interaction techniques, among others. This chapter focuses on the acquisition, representation and interaction techniques with emphasis in multi-Dimensional (mD) data.

The acquisition step is fundamental, as it deals directly with digitizing the real characteristics of the assets. Thus, it plays an important role in the accurate documentation and safeguard of our cultural legacy. However, not all the acquisition technologies have been exploited in depth so far for the CH sector. In this regards, some research works can be found that combine shape with other kind of data, such as radiometric (e.g. IR, thermal radiation, etc.) or semantic information, leading to the mD virtual objects and opening the avenues for new dissemination and understanding of heritage. One of the aims of this chapter is to provide a review of these acquisition technologies, in order to point out the benefits that they might have for CH and to discuss current needs, technological barriers and/or new trends that might be of interest for the sector.

Additionally, this chapter also aims to give a review on the current representation (not only visual, but also sonic, haptic, etc.) and interaction solutions related to touristic applications, focusing on the technologies of virtual and augmented reality that are increasingly being used in museums, exhibitions, heritage sites, etc., being a vehicle for the access and dissemination of CH to a number of stakeholders and the wide public. Indeed, the dissemination of CH is essential to promote its conservation, so communicating the values and the significance of our heritage, especially to the general public, is a key issue for rising awareness. The thematic interpretation is the main tool to achieve proactive behaviours in general public towards conservation, and it is based upon the following sequence: “Through interpretation, understanding; through understanding, appreciation; through appreciation, protection” (Tilden, 1957, p. 38). The scientific literature regarding the role of new technologies in the dissemination of heritage is extensive. However, there is nothing from the methodological point of view in relation to the specific techniques analysed in this work. Therefore, to evidence this type of applications linked to the dissemination of heritage, various examples developed by the authors are provided through the chapter.

This chapter is organized as follows. In a first section, a review on the state of the art of different available techniques and the related methodologies to deal with mD acquisition for the virtual reconstruction of CH tangible assets are presented and discussed through different examples. In the next section, a review on various visualization and interaction approaches (based on virtual and augmented reality) to enhance the value of CH by means of these virtually reconstructed objects is given. Finally, the discussion section points out some current needs and technological barriers that need to be tackled by the research community in order to further advance on the given topic, which might be relevant for the CH sector, as argumented in the previous sections.
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