Chapter 14
Three–Dimensional Modelling for Cultural Heritage

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ABSTRACT

The creation of 3D models of urban elements is extremely relevant for urbanists constituting digital archives and being especially useful for enriching maps and databases or reconstructing and analyzing objects/areas through time, building/recreating scenarios and implementing intuitive methods of interaction. The widespread data available online offer new opportunities to generate realistic 3D models without the need to go physically to the place. This chapter aims to demonstrate the potential 3D modeling and visualization/interaction of urban elements in the city for multiple purposes, and it is organized in four main topics: The first deals with the theoretical framework regarding the bases of the human perception of the spatial environment and the importance of 3D modelling. The second and third deal with technical procedures on terrestrial/aerial data acquisition and demonstrate alternatively data gathered online to generate 3D models for the visualization of urban elements of the city, and the fourth introduces 3D model visualization within an augmented reality environment.

INTRODUCTION

Recent technical-scientific research has tried do analyze, replicate, and develop technological structures and aptitudes analogous to the human brain. Several technological innovations and concepts have been introducing significant words, such as smart or intelligence, tied with the human brain and its capabilities. Computers have been promoting digital data acquisition, processing, and dissemination; however, with the emergence of mobile devices a revolution in Human-Machine or Real-Virtual environment interfaces was initiated, regarding multiple functions and applications and their special features, such as portability and mobility (fitting in the pocket and taken almost anywhere by its user). The use of smartphones had a huge impact on society, changing human behavior, individually and between each other, with information and communication technologies, and their perception of the virtual and real spatial environment. Large amounts of information in digital format have become more accessible to the user through the Internet at fast growing speed and broadband access progression (increasing amount and size of transmitted content). Social networks and other tools provide instruments to communicate and share information within a synthetized virtual environment (parallel and associated with the real environment), where people interact with each other in nearly real time. The digital revolution has now penetrated our culture so deeply that the many new forms of communication that have been transforming spatial environments are now revealing previously unknown aspects in the form of large databases (Big Data), providing us with opportunities for analysis and modelling, quite different from the methods applied earlier (Batty, 2013). This Volunteered Geographic Information (Goodchild, 2007) is particularly relevant in the field of cultural heritage, comprehending the value that each patrimonial object has for each individual, providing tools to a continuous valuation, evaluation and modelling.

The concept of Cultural Heritage assumes the notion of value and cultural inherency, often related with unicity, rareness, importance, memory, or symbolic representation of one or more specific objects, events, milestones, achievements, or historical significance. Value has always been the reason underlying heritage conservation. However, the notion of valuation might be identified or increased, when supported individually or collectively by external and/or internal representations as a process of increasing the intrinsic value of the cultural heritage. Digital representations of cultural heritage are highly valuable for scientific study, conservation, educational or tourism purposes and more recently also relevant for virtual users in times of confinement (i.e. as due to a virus outbreak). Technology permits to extend the real world to interdependent mixed virtual environments, allowing a global access to unlimited information, virtually, without barriers, physically anywhere. The public space is no longer limited to the physical space to become virtually perpetual,

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