The Representation of Architectural Heritage in the Digital Age

Stefano Brusaporci
L'Aquila University, Italy

INTRODUCTION

Computer and digital technologies, associated with a higher diffusion and development of Information and Communication Technologies, have led to profound changes in the field of architectural survey and representation. In particular the use of representative digital 3D models has acquired an inescapable role.

An architectural digital representation conceptually cannot be limited to its surfaces – as far as conducted at the highest level of photorealism – or to the problem of measurement's metric accuracy – as far as necessary –, but inevitably it must also include the issue of understanding, representation and communication of historical and aesthetic characteristics, interpreted in the broadest sense of the terms. Consequently the contents are influenced by: building characteristics (for example a ruin of classical age, a medieval castle, a renaissance palace, a baroque church); specific representation aims (such as geometrical-dimensional surveying, degradation analysis, communication addressed to non-expert users, etc.); last but not least, level of definition (scale or, for a 3D model, the Levels of Details).

Digital technologies favor the representation of architecture by the definition of virtual 3D complex models (Figure 1). In particular these models have to contain not only dimensional and geometrical building's aspects, but they also have to represents architectural and constructive ones, describe transformations, be a core for the aggregation, organization, analysis, and management of the vast and heterogeneous number of information associated to an architectural heritage – such as surveying and design drawings, historical documents, scientific data (Centofanti & Brusaporci, 2012).

BACKGROUND

An Architecture is a complex organism, synthesis of spaces, surfaces, volumes, materials, made with specific constructive systems, result of processes of transformation and modification over time, expression of interventions and of architectural cultures that have occurred since its construction to the present day. Each building has its own quality of "individual," for this reason it is often used the term "handmade" (or "artifact"), to highlight how a historic building can be seen as a product of human activity.

Digital technologies have fundamentally altered techniques and tools of surveying and drawing, basing the representation on the three-dimensional model. The debate is concentrated on issues related to the problems of modeling and rendering, necessarily involving disciplinary fields such as computer graphics and topography. A broadly interdisciplinary approach is necessary (for example Cigola, 2012), however, remaining the same problems and objectives set by the critical historical study of architecture, and in particular the need of the use of architectural surveying for the analysis, acknowledgment and communication of historical and aesthetic values (Docci & Maestri, 2009).

In recent years many researchers have been interested in cultural heritage digital representation, in particular focusing on computing issues, often without distinguishing between cultural and architectural heritage.

The themes of cultural heritage survey and 3D modeling have found a place in many international conferences, and are the subject of several associations (http://cipa.icomos.org/; "IEEEXPLORE"; Digital Agenda for Europe of European Commission; Remondino & El-Hakim, 2011; Boehm, Remondino & Kersten, 2013). However, in such cases, specific building heritage's representation problems are not studied autonomously, but they are analyzed accord-

Figure 1. 3D model of a block of buildings of the historic center of L'Aquila city (Francesca Cerasoli)
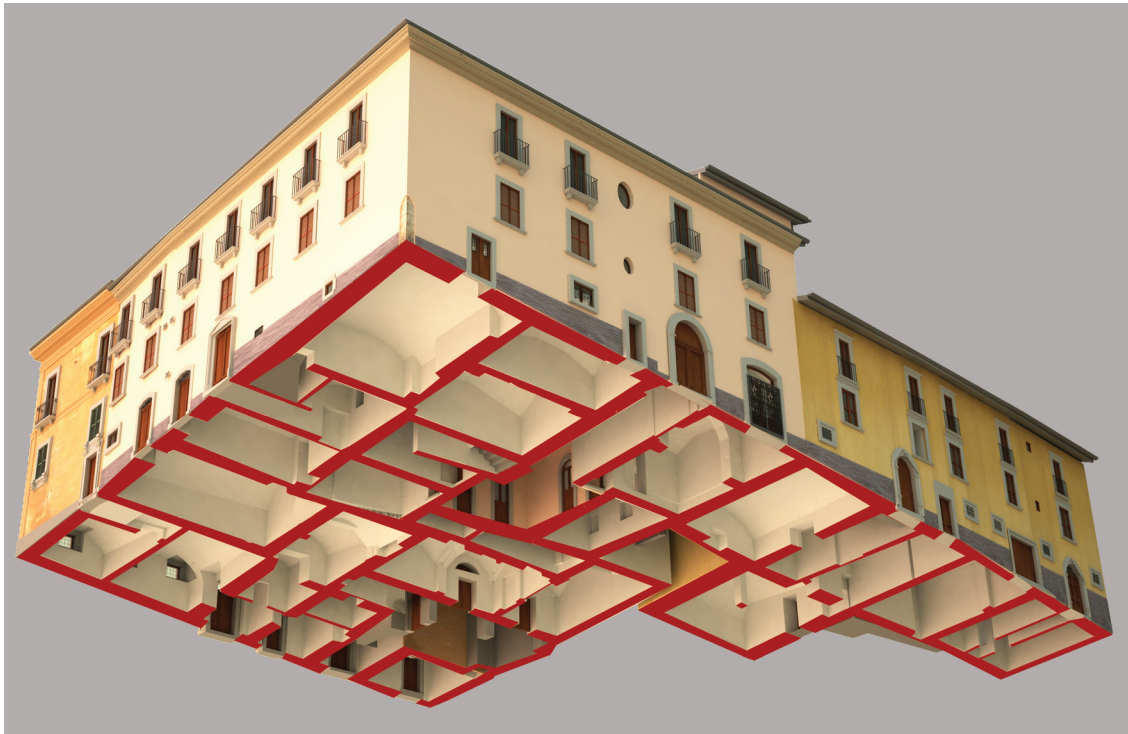
ing to those aspects and issues that architecture has in common with other kinds of cultural heritage, such as archaeological ones.

Instead some specialized magazines present a specific attention to historical architecture (for example *Disegnare Idee Immagini / Drawing Ideas Images*, *EGA Revista de Expression Grafica Arquitectonica*, *DisegnareCon*). In general, papers may be distinguished according to the following lines of research: studies on existing historical architectures – also modern and contemporary ones – and studies on buildings no more existing or profoundly transformed (Centofanti, Brusaporci & Lucchese, 2014).

Even when dealing with existing architectures, the drawing plays a heuristic role, typical of the knowledge scientific method: The researcher, re-drawing – or "modeling" – the building, analyses its characteristics and understands its values; moreover the 3D model favors the architectural analysis and communication (Galli & Mühlhoff, 2000; Brusaporci, 2012).

Another issue is related to the construction of architectural databases. There are numerous proposals, explained mainly by those who are concerned with the definition of virtual museums, digital archives, and information systems: Not ever this line of research is carried on by scholars of architecture and usually it concerns issues of museology, human sciences or computer sciences (Figure 2).

DIGITAL MODELS FOR ARCHITECTURAL HERITAGE

On the Construction of the Model

In architectural surveying and modeling, one of the main controversies concerns the survey techniques based on laser scanning and digital photogrammetry. They produce, as a first result, point clouds, i.e. three-dimensional discrete points of architectural surfaces. Point clouds can be projected, sectioned or even browsed; they are useful because, first of all, give accurate metric information. As far as point clouds are three-dimensional data, often they are interpreted as 3D models; however they are a raw data, because they must be processed to build models critically representative of architecture.

Related Content

New Factors Affecting Productivity of the Software Factory
Pedro Castañedaand David Mauricio (2020). *International Journal of Information Technologies and Systems Approach (pp. 1-26).*
www.irma-international.org/article/new-factors-affecting-productivity-of-the-software-factory/240762

Method of Fault Self-Healing in Distribution Network and Deep Learning Under Cloud Edge Architecture
Zhenxing Lin, Liangjun Huang, Boyang Yu, Chenhao Qi, Linbo Pan, Yu Wang, Chengyu Geand Rongrong Shan (2023). *International Journal of Information Technologies and Systems Approach (pp. 1-15).*
www.irma-international.org/article/method-of-fault-self-healing-in-distribution-network-and-deep-learning-under-cloud-edge-architecture/321753

Efficient Optimization Using Metaheuristics
Sergio Nesmachnow (2018). *Encyclopedia of Information Science and Technology, Fourth Edition (pp. 7693-7703).*
www.irma-international.org/chapter/efficient-optimization-using-metaheuristics/184465

Classification of Sentiment of Reviews using Supervised Machine Learning Techniques
Abinash Tripathyand Santanu Kumar Rath (2017). *International Journal of Rough Sets and Data Analysis (pp. 56-74).*
www.irma-international.org/article/classification-of-sentiment-of-reviews-using-supervised-machine-learning-techniques/169174

A Particle Swarm Optimization Approach to Fuzzy Case-based Reasoning in the Framework of Collaborative Filtering
Shweta Tyagiand Kamal K. Bharadwaj (2014). *International Journal of Rough Sets and Data Analysis (pp. 48-64).*
www.irma-international.org/article/a-particle-swarm-optimization-approach-to-fuzzy-case-based-reasoning-in-the-framework-of-collaborative-filtering/111312