The Virtual Reconstruction Project of Unavailable Monuments: An Example of the Church of Santa Maria Paganica in L'Aquila

Giovanni De Gasperis, Silvia Mantini and Alessio Cordisco

Abstract This contribution highlights the potential that modern technologies offer for virtual reconstruction and immersive navigation of monuments that are unavailable due to catastrophic events or other causes. A methodology is proposed for the enjoyment of the Cultural Heritage, starting from modeling, three-dimensional and photorealistic, to arrive at visualization in a virtual world enriched with extra content.

Keywords Cultural heritage · Virtual reality · Archeomatics · Public history

1 Introduction

The project of virtual reconstruction of monuments damaged by catastrophic events arises from the need to continue to enjoy the good during the stages of safety-laying, reconstruction and finishing, large-scale interventions that usually take a long time, especially for buildings of the Cultural Heritage. The experience of the earthquake in L'Aquila of 2009 has reflected on the importance of Heritage and collective identity that changes whenever a cultural asset is not used anymore, as in the case of the youngest aquilan population who has no memory of the destroyed heritage after 8 years, except through memories of their parents. In recent years, computer graphics have allowed to create more and more complex three-dimensional models that can be very realistic, built for desktop or mobile devices, but the question is: how to design

G. De Gasperis (✉) · S. Mantini · A. Cordisco
Dipartimento di Ingegneria e Scienze dell'Informazione e Matematica,
Università degli Studi dell'Aquila, Via Vetoio 1, L'Aquila, Italy
e-mail: giovanni.degasperis@univaq.it

S. Mantini
e-mail: silvia.mantini@univaq.it

A. Cordisco
e-mail: alessio.cordisco@univaq.it

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and implement, with what features, a 3D model for immersive use without losing in definition and detail that characterizes the historical-artistic and archaeological heritage?

2 The Example of the Church of Santa Maria Paganica in L'Aquila

The church of Santa Maria Paganica is one of the monuments of L'Aquila, which has contributed to the history, to the social, economic, political and cultural growth of the city, occupying the role of the church of "Capoquarto". Built in 1308, it is today in its eighteenth-century style, the result of post-earthquake reconstruction of 1703, a single space with lateral chapels and a large transept in the presbytery area, topped by a majestic dome. With the earthquake of April 6, 2009, the structure suffered significant structural damage both to the roof, to the side walls and to the chapels. The 3D reconstruction work and virtualization has seen several steps:

1. the collection of graphic and photographic material;
2. modeling and rendering;
3. virtualization.

For the first step, in addition to the study of existing official and non official documentation, we attempted to record the historical memory from those who knew the building well by working in it, with the typical techniques of the anthropological study; very important was the contribution of the Parish, Priest Don Stefano Rizzo who has made possible not only to reconstruct a significant the photographic archive of more than 200 high-resolution photos of works in the church before the earthquake, but also his visual memory to reproduce small and large elements that had not been photographed and digitized. Before embarking on the modeling process, exterior and interior inspections to the post earthquake ruins were carried out, indispensable for photo shoots, consisting of a set of 380 photos of detail and overall, and measurements of surviving environments with direct metering techniques. At this stage, two still existing elements were the object of a deep photogrammetric acquisition: the side portal and the baptismal font. So in general it was then possible to recover a considerable amount of material, but unfortunately not enough to reconstruct the whole building in detail. The photographic material, published and not, was analyzed and divided into two groups: monochromatic and color, using black and white models as the basis for modeling, while others to reproduce the color range of walls, floors and furnishings. For the modeling phase, several software was used: SketchUp for basic modeling, Cinema 4D for details and Lumion for video rendering. Using a 1: 1 scale plan and a side panel representing the side of the church, the perimeter walls, the openings, the chapels and vaulted roofs were created. The raw model has been iteratively improved to the achievement of a structure as faithful as possible to the former reality. In some cases, using photos as a base, it was possible to reproduce real-life models.

The resulting 3D virtual reality model was presented to the public on 26 September 2016, after 3 months of intensive work, as a dissemination event of the Night of Researcher.

A demonstration video in available in YouTube at: http://youtu.be/G5Tf1Jv88gA.