

Reality VS Virtual Modeling

From Building to Landscape Heritage Representation

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Introduction

The relationship between reality and its representation is a philosophical conundrum that has fascinated humanity since the beginning of rational thinking. Nowadays, developing digital representations of natural and cultural heritage is symptomatic of the broader trend toward digitisation that the Architecture, Engineering and Construction (AEC) sector is facing. This growing interest in the existing environment, spacing from building to landscape, involves different approaches, such as the Historic/Heritage Building Information Modeling (HBIM) or the Landscape Information Modeling (LIM). However, besides the brand-new terms, the question is still the same: what is a model of the built environment?



Fig. 1. Word cloud around the term "model" (© Ambra Barbini and Chiara Chioni, 2021).

The notion of model in architecture

In the architectural field, the notion of “model” has been associated with different concepts: from a tangible object, namely a maquette, to a mental construction, a “scheme” in its etymological meaning. With this respect, to mention a few eminent positions, Brunelleschi and Michelangelo considered the model as the physical representation of an idea already fully formed in the mind and intended to serve as a guide to the construction process. According to Alberti, the model was a proper working tool, which had to evolve and multiply to sift through the diverse project solutions. Later, following a similar concept, Milizia highlighted the visual value of the model to better understand the project, both for the architect and for the general public (Empler, 2002, p. 14). In the nineteenth century, the term “model” denoted an object to replicate, namely a prototype, as reported by Quatremere de Quincy, who used the term “type” to refer to the idea of an element that should itself serve as a rule for the model (intended as “paradigm”). Finally, in its modern notion according to Vittorio Ugo, the model is configured more as a construction than as an object to be copied or reproduced, a “scheme” as a set of properties (e.g. dimension, geometry, material, aesthetic and function) (Ugo, 1992, pp. 9-23).

New technologies and cultural heritage

Today, considering both the theoretical and the operative levels, new technologies applied to cultural heritage allow the development of new approaches to merge in a virtual model several kinds of data (e.g. geometric, material, technological, historical). The necessary steps to move from reality to the model require an informative selection. Such an interpretative paradigm, reflecting the purpose of the model, its object and its cultural framework, is a key element for the model development. Through collection, elaboration and communication of data, virtual models can offer precious tools to represent the present, understand the past and design the future considering specific purposes in various contexts and at different scales.

One of the main drivers towards the digitalization of the built and natural environment is the management of cultural heritage. Environmental issues concerning polluting emissions and non-renewable resources consumption require managing existing assets and updating buildings and urban systems to new standards. The awareness about the worth and at the same time the vulnerability of cultural heritage is increasingly rising, bringing the need to preserve and protect cultural heritage, both as single elements and as an aggregate, to be able to transmit current values to future generations.

At the building scale, most of the approaches move in the direction of HBIM, which was firstly intended as a library of parametric historic building components and that subsequently evolved in the semi-automatic generation of complex geometries within which recognise and inform components. Currently, the different approaches are trying to find a trade-off between visual fidelity and parametric flexibility (Radanovic et al., 2020). At the landscape scale, there is an increasing pressure to conform with the BIM paradigm, as demonstrated by the relatively new term LIM and the research interests in the integration between the architectural scale of BIM and the territorial scale of Geographical Information System (GIS) (Kolbe and Donaubaer, 2021).

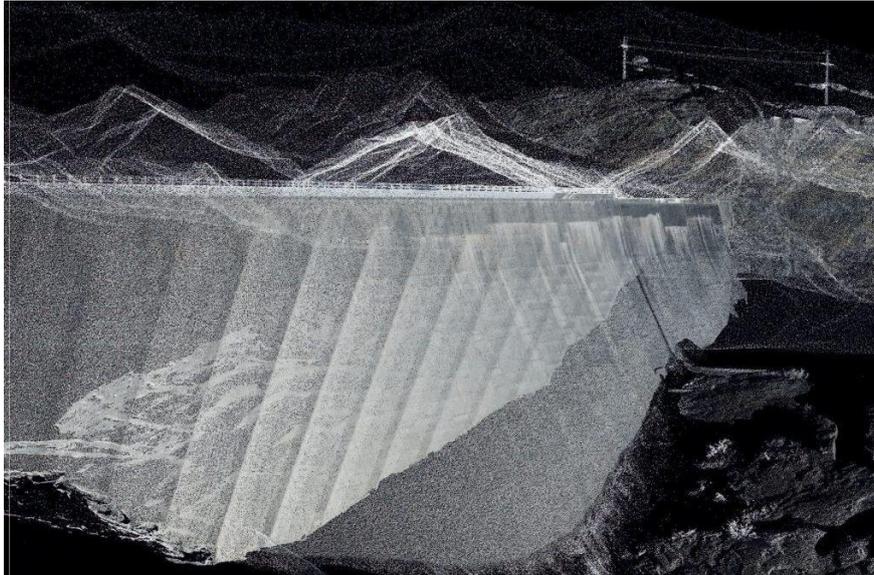


Fig. 2 Gotthard Landscape: The Unexpected View. Point cloud model of the Lucendro Dam showing both the inner tectonics and the outer surface of the structure (© Christophe Girot, ETH Chair of Landscape Architecture).

Discussion and conclusion

The relationship between reality and its model has certainly changed within the virtual environment, for example overcoming the issue of reduction/enlargement of the model, as well as including the parameter time. Considering smaller time frames until the real-time update, the contemporary notion of Digital Twin (DT) is the maximum expression of the model as a working tool for heritage and data management, operating directly on the real environment from the virtual realm (Batty, 2018).

The opportunity of cultural heritage documentation and management are increasingly expanding through new technologies such as sensors and actuators able to connect real elements with virtual environment, supported by real time data acquisition, processing, simulations and projections. These tools are already able to support decision-making, alert and optimization systems and in the near future are likely to further expand their potential not only at the building scale, but also considering a wider part of urban aggregates and of the natural environment.

By analysing and comparing current workflows to construct a virtual model, not only at the building scale, but also considering wider elements of the natural and built environment, this research aims to outline the most common approaches to virtual models development and to recognize connections between them and the different meanings of the term model. After recognizing the most common approaches, existing gaps and transferable methods in modelling at the different scales will be pointed out, also analysing previous developed studies and experimentations.

Conflict of Interests Disclosure

Authors have no conflict of interest to declare.

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