Chapter 21
Model 3D in Service of Preservation, Restoration, Structural Analyses of the Architectural Heritage

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ABSTRACT

This contribute aims to explore 3D modelling and its practical applications investigating scales of representation and scales of contents from architecture to landscape. The goal of this approach is to test the flexibility of modelling tools to different fields of application and to draw shared methods, even if they are applied in so different context. Changing the scale, is obvious, the language changes – because it is necessary to recompose symbolic and iconographic elements – themes and scales of representation change. So is possible to pave the way to strictly disciplinary thinking on outcomes and on instrumental and methodological guidelines for further research. The topic focuses on developing guidelines and creating a simple three-dimensional model designed to represent both the complexity of the “cultural heritage” morphology, as well as the need to manage the process of restoration in all its phases: from first findings to the restored final output.

AN ARCHITECTURAL SURVEY BY MEANS OF A THREE-DIMENSIONAL MODEL

The research presented here is connected to direct experience on a restoration site and has produced critical considerations that are useful for a first approach in developing operative guidelines. Every construction site is a complex system where many competences enter into contact. Therefore the archive of all the interventions on the construction site can receive a very useful basis for storing and managing the complexity of the building morphology, for representing its characteristics and for monitoring the evolution of degradation and damages during the restoration. Therefore the 3D model will be a basis for the documentation of the whole process of restoration in all its phases: from first findings to the restored final output. The innovative aspect of this study is the mapping of degradation and of structural damage on a three-dimensional model rather than of on a two-dimensional one, as in the traditional procedure.

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In traditional procedures the presence of curved and complex surfaces determine substantial deformation of the images represented on a horizontal surface. The 3D procedure was implemented and verified on a case study to report every phase of the construction site activities and to store all the information collected in the various stages of restoration. The 3D model has also been arranged in order to simulate and display different scenarios and possibilities of intervention, and it can be used as a decisional support. The complex system of the 3D model with the connected databases is an excellent support for structural analysis of large restoration sites, allowing a simplified view for issues of deformation, as well as for monitoring and adjusting the lighting and acoustic status of the building. The system was developed and tested on the restoration site of a baroque church and the results obtained have been processed for a detailed critical review. The metadata that accompanies each point of the structure can be conveniently organized for future off-line retrieval and elaboration if a structured language is set up which is capable of quantitative description of the architectural heritage status and of its modifications.

The model system was built by adding all the information collected in the various restoration stages, in order to return a full overview of the whole restoration process at the end of the process. Thus, the system is a sort of three-dimensional database that gathers together any information required. This model system could in addition display different scenarios and possibilities of intervention, and thus be used as a decisional support. Another plausible use could be to verify the stability and safety of buildings in reference to structural survey, dislocations, movements and deformations. These general considerations have been tested on the restoration site of Chiesa di San Giovanni Decollato della Confraternita della Misericordia (the Church St. John Beheaded of the Brotherhood of Mercy), a baroque building in Turin, Italy.

The first stage of the project was the mapping of degradation handmade performed by restorers. The second stage was the transfer of the mapping of degradation to a three-dimensional model. These stages were necessary to obtain a detailed metric quantification of the interventions planned and to refer these interventions to the structural frame of the building, where the curved surfaces must be taken into account. The third stage was the organization of the future operative actions.

*Figure 1. Architectonical and urban context of the Church of the Brotherhood of Mercy in Turin*