3D HYPOTHETICAL RECONSTRUCTION: DOCUMENTATION OF RECONSTRUCTION PROCESS AND ITS REPRESENTATION

The research program addresses the still not solved challenges concerned with the sourced-based 3D reconstruction, visualization and documentation in the domain of archaeology, art and architecture history.

The emerging BIM-methodology and the exchange data format IFC are changing the way of collaboration, visualization and documentation in the planning, construction and faculty management process. The introduction and development of the Semantic Web (Web 3.0), spreading the idea of structured, formalized and linked data, offers a semantically enriched human and machine readable data.

In contrast to the civil engineering (BIM/IFC) and cultural heritage (CIDOC CRM) academic object-oriented disciplines, like archaeology, art and architecture history, are acting as outside spectators. An approved e-documentation for the mass on 3D reconstruction projects since the beginning of the 1990-ties is missing, the validation of the outcomes is not fulfilled. The digital research data is ephemeral, the 3D reconstructions projects are filling the growing digital cemeteries.

Starting from the analysis of the documentary sources, it is possible to define, at different levels of detail, the shape of the object in its complexity and then to obtain the data necessary to identification of morphological-dimensional parameters of the basic elements of which that form is composed.

The areas in which the research should move are: analysis of the compositional rules of architectural artifacts, semantic analysis of the constituent elements, interaction and integration of different digital models (numerical, mathematical and parametric), parametric modeling by means of the use of formal languages.

The research program focus on the evaluation of the sourced-based 3D reconstruction, the web-based knowledge representation and visualization.

The research project will therefore address the following issues:

- the process of the 3D hypothetical reconstruction
- the structure and the work-flow of the 3D hypothetical reconstruction
- the definition of the data model behind the 3D visualization
- the definition of an appropriate scale/grade of hypothesis in the visualization in the data model (human and machine readable)
- the definition of different kind of form of representation of 3D hypothetical reconstruction of unbuilt project (drawing-based 3D reconstruction)

**Project's qualifying points**

The project's qualifying points are the answer to a series of extremely topical issues:

- Standardized procedures in the production of 3D digital models
- Creation of semantically conceived and structured 3D digital models
- Production of models from high-quality geometric, formal and perceptual 3D data

Within the framework of the objectives defined by the Project, the production of digital 3D models is aimed at creating a representation system that is able to reproduce, in the least subjective way possible, the characteristics of the project (not built) or the original artefact (no longer existing):

- the ability of scientific simulation and its use as a tool for studying architecture;
- the visualization both iconic and orthogonal, for a complete definition of the architectural object.
Activity plan
The aim of the research is, therefore, the development of a procedure, with a high information and semantic content, able to guarantee the transparency and the reversibility of the hypothetical 3D reconstructions of projects never realized or of artifacts that no longer exist.
Qualifying points of the project are:
- accuracy of the shape and dimensions in accordance with the characteristics of the project/manufact being studied (different levels of detail);
- semantic description of the single elements that compose it, in order to correctly interpret it;
- reconstitution of the object according to the application of procedural-parametric methods capable of guaranteeing a posteriori transparency with respect to the criteria adopted and the procedure followed;
- representation of the reconstructed 3D model able to ensure the fidelity to the basic documentary data.

Activity phases
Step 1 - months 1-3: identification of typologically significant and representative case studies of architectures that never existed or no longer exist
Step 2 - months 4 -6: testing of the hypothetical reconstruction chain; extraction of information related to the formal characteristics of architectural elements
Step 3 - months 7- 9: definition of procedural algorithms for modeling and representation of 3D data
Step 4 - months 10 -12: production of operational guidelines

Results
The project will result:
- guidelines for the procedure of hypothetical reconstruction/3D modeling of data from documentary sources
- production of 3D models with semantic structure
- production of textured 3D models for the reproduction of the original formal and stylistic characteristics.
- production of prototype models / 3D models draft