

Special Issue on Cultural Heritage and Architecture 3D

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Architecture, for each one of its activities, has a great demand for documenting and archiving a lot of layouts and maps. Progress in digital 3D and images creates background for replacing drawings of artifacts locations with high resolution digital photos and fast development of close range photogrammetric techniques allows producing virtual 3D creation of architecture heritage. The capability of reconstructing virtual 3D models of valuable architectures finds and their wide availability for studying directly or via Internet creates new environment for historians and architects.

Unfortunately 3D scanning of architecture objects is still rather expensive in most cases mainly in historical towns where we found many narrow streets. This special issue overviews advanced methods and systems which can be successfully applied for cultural architecture archiving.

The main requirements for 3D reconstruction system to be used for architecture 3D documenting are the following:

- Metric characteristics of produced virtual architecture finding providing the possibility of performing some necessary measurements by expert for his investigation
- Photorealistic 3D model texturing providing adequate visual presentation of virtual 3D model for an expert or an virtual tourist
- High productivity (short time of 3D model generation)
- High degree of automation
- Simplicity of installation and calibration
- Low cost

Laser scanning of historic buildings and set of culture heritage sites should not be regarded solely as the means of recording, but it should be widely applied to the development of 3D digital archives. 3D archive does not only bring efficiency to conventional contents such as drawings and structures analyses, but also make the management of whole attribute information such as components, breakage parts and repair parts possible.

Moreover, 3D technology indicates various future possibilities in the conservation of historic buildings. The simulation of restoration using 3D data obtained by laser scanning will greatly advance the ways of restoration from conventional ones like models and perspective drawings. It will also provide a great visualization method when it is applied to virtual reality that can offer real-time change of views and free movement. It is desirable that the 3D data should be obtained periodically in order to find changes in cultural properties, and the obtained data should be stored as a database so that they are available at any time necessary for various uses. The accumulation of the data will help restoration activities against unforeseen crises for cultural properties such as natural disasters.

This special issue overviews the most recent tools in the area of architectural documentation of the form and the color and to study forms of representation that may be alternative or complementary to traditional ones with a view to building a system of documentation and knowledge focused and structured in accordance with the characteristics of the culture heritage buildings.

The need for digital documentation, together with the possibility of computer management of the 3D models, seems to be shifting the discipline towards a co-existence of the traditional static representations and the dynamic models. This conflicts with the needs of designers to have two-dimensional supports that, as we know, represent a spatial and functional model of the architecture. One solution would seem to be to bring together innovative concepts with the traditional methods, in other words, bringing together 3D digital models and orthogonal projections.

Among the newest techniques that provide a deeper understanding of the works, the scientific management of color is surely important and closely related to modeling. The importance of photography in architectural documentation is widely recognized: just

think of the desire to document materials (stone, metal, glass, concrete and wood components) and their state of conservation. Today, we have the possibility to quantify color in a strict and exacting way: this quantification would add to the quality evaluation that we usually make on photography, the precise measure of the subtle changes in color that are caused by chemical or physical changes in the material.

Management of cultural heritage information systems mostly confront with multi disciplinary content of cultural databases. Factors such as history, time, location, space, social behavior, tradition, etc. provide a wide variety of data and make the process of data gathering and distribution complicated. Therefore developing proper architectural models for each special cultural field in order to conceptualize the content, to specify and represent its technical knowledge seems essential. Such models need to share common understanding of the structure of information and introduce standards to allow data interoperability between different systems and communities, especially over internet.

As a subset of cultural heritage, creating a knowledge model for architectural remains will face the main characteristics of a building, three-dimensional form and spatial organization of components as a whole. This characteristic is mostly reflected in visual data (3 dimensions information such as photos or 3D models) that record a historical building from different angles or views and show its components from different perspectives. Such data based on their specific content contain many technical details of the domain. The special issue includes selected papers presented at the EVA International Workshop on Cultural Heritage and 3D Architecture, May 11th 2004, Laval in conjunction with the 6th International Conference on Virtual Reality and Laval Virtual 2004.

The first paper *Developing a Visual Lexical Model for Semantic Management of Architectural Visual Data Design of Spatial Ontology for Caravanserais of Silk Roads* by Elham Andaroodi et al overviews the methodology to create a multi-lingual ontology for caravanserai, an historical type of cultural heritage buildings from the Middle East. The second paper *The city in four dimensions: the Nu.M.E. Project* by Francesca Bocchi (University of Bologna) provides a methodology overview of the New Electronic Museum project so called "Nu.M.E." relative to the visualization of the reconstruction of the city of Bologna. The third paper *Semiautomatic Reconstruction of 3D Buildings from Map Data and Aerial Laserscans* by Jens Olav Nygaard (SINTEF, Norway) describes an approach for combining outlines of buildings from map data, with aerial laser scans in the form of 3D point clouds to reconstruct 3D models of buildings. This paper also describes an interactive and semi-automatic tool which is very helpful for cultural heritage preservation. In the fourth paper *Haptics technology in Education ? A Case Study* by Michalis Pantelios, Labros Tsiknas, Sotiris Christodoulou, Theodoros S. Papatheodorou (University of Patras, Greece), applying haptics technology in the Education field gives a new perspective for cultural heritage visualisation and experience using 3D and virtual reality. Haptics technology used for virtually touching and feeling provides additional capabilities for teaching and learning to apprehend architecture 3D. Finally, the paper *Normal Mapping Technology: Parthenon Case Study* by Nikos Vassiliou, Nikos Vassiliou, Joseph Psistakis, Paris Zafiris, Theodore S. Papatheodorou (University of Patras, Greece) is a good example of architectural 3D construction and presentation.

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* <http://www.eva-conferences.com>

**<http://www.laval-virtual.org>