

On how to link patrimonial information and 3D simulations: a methodology for enhanced exploitation and visualisation of architectural documentation, experimented on Kraków's historical centre

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Abstract:

In the field of the architectural heritage, the recent development of computer technologies has opened opportunities to achieve easier and more efficient data management and produce better 3D simulations showing edifices at different stages of their development. Numerous scientific contributions have proven that computer tools available today can favour a better documentation, understanding and representation of architectural monuments and ensembles both for research and management purposes, or presentation to a wider public. What is more, internet-based technological solutions have come to a reasonable level of reliability, thereby opening renewed perspectives to share experiences and information on issues raised by the conservation of patrimonial sites.

Still, taking a closer look on what existing computer tools and formalisms offer when dealing with the architectural heritage clearly shows that their relevance on this particular application field may not be optimal. E-databases and XML technologies are today applied in building or site management and their documentation (see references). In parallel, geometric modelling tools, along with photo-modelling platforms when dealing with still standing edifices, allow the construction of 3D models in which a simulations of an edifice's morphology is possible(see references). Moreover, GIS systems have proven useful in numerous site management experiences, particularly in the field of archaeology (see references). But whether *there is a way in between* those families of technologies remain to be proved: can 3D models be interfaced to an architectural documentation? can they be efficient in data visualisation or retrieval? Can they offer a view on the data collection that other media forbid? Can they synthetically localise pieces of information with regards to a position in space and a moment in history? Can they inform the system's user on whether the proposed shape is original or reused, documented or hypothetical, etc.? All these questions remain unsolved and we believe draw the contours of our proposal's main research issue.

As an answer, our first statement is that when talking about architecture, it appears as highly necessary to develop a data representation and management methodology in which the data to handle (bibliographic, cartographic, iconographic) is clearly connected to what it is really about: physical shapes or spaces. Our second statement is that it appears as highly necessary to use what the documentation says of the edifice or *site as well as what it does not say* : in other words to produce 3D models in which inferences made when making the simulation are visually marked in the final graphical result.

Our contribution introduces the methodology we propose in order to tackle the above mentioned research question, how can we ensure an in-depth link between what we know of the edifice and how we represent its morphology.

Our experiences are carried out in the framework of a Franco-polish bilateral co-operation established, with the support of both national scientific bodies (CNRS / KBN), between the MAP research unit (dealing with applications of computer formalisms to architecture) and the HAIKZ Institute (specialised in architectural conservation, with a strong expertise on Kraków's heritage). The field of experimentation of our research is Kraków's Rynek Główny (Main square), a UNESCO-listed urban ensemble of great architectural value and diversity. The Rynek Główny is a particularly relevant application field since its morphological evolution has been constant and complex, and the documentation gathered on each stage is very rich,

ranging from early XIXth century investigations to actual conservatory studies and scientific publications, or from old maps and iconography to recent intervention projects.

The understanding of Kraków's urban development, and the management of data collections in relation with it, therefore closely addresses the main issues of our contribution, information and visualisation. What is more, the Rynek Główny has since the city's foundation in 1257, seen the erection, development and transformation of both monumental architecture (Ratusz, Kosciół Mariacki, Sukiennice, ...) and of urban houses, thereby widening the areas of concern of our proposal.

In terms of documentation, a special focus is put on better exploiting the vast and rich conservatory surveys gathered since the fifties in a remarkable long-term effort that we believe deserves today an enhanced valorisation.

Our paper will favour a contextualized presentation of our research, with introductions to key methodological and technological aspects:

- Documentation issues (how we structure and qualify sources, how we use them inside 3D simulations) .
- Knowledge representation issues (how we identify and structure architectural concepts in a generic architectural model from which are birthed out 3D simulations).
- Data management issues (how we store instances of the model and handle their space and time localisation).
- Visualisation issues (how we implement query mechanisms that monitor real-time, internet-based, calculation of 3D simulations in which control of appearances is done with regards to the graphical codes that represent the documentation's qualification).
- Technological issues (the combination of formalisms used, ranging from XML/VRML standards Object orientation in the model's structure).

In an effort to better represent what we know of an urban fabric's architectural evolution, we believe that there is a gap to fill between GIS technologies, geometric modelling and e-databases. We consider that none of them taken separately can really help coping with the complexity of the architectural heritage if taking into consideration for instance morphological aspects and reliability of the documentation. We therefore propose a three-steps approach –concept modelling, documentation, representation- that beyond our technological implementation can, we believe, be a fruitful methodological contribution to the major issue of data management and exploitation in the context of the architectural heritage.

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