

Performing the Past and the Present for the Knowledge of the Future

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Abstract. *The aim of this paper is to discuss the role three-dimensional models play in addressing performance issues in virtual reconstructions of the heritage buildings. Heritage visualisation is considered here as a process of representing knowledge about space, time, behaviour, light, and other elements that constitute cultural environments. The author aims to analyse the process of digital reconstruction of heritage buildings and the impact of the decisions taken during its development on the final performance. Based on the examples drawn from practice, various stages of development are discussed, confronted with the principles of London Charter.*

Keywords. *Virtual reconstructions; cultural heritage; 3D modelling; London Charter.*

BACKGROUND

Information technologies support a number of domains, including - among the others - virtual modelling of built heritage. One of the earliest examples of such projects was a reconstruction of ancient buildings in Bath, which was done as early as 1983 (Dave, 2005). Another example might be Winchester cathedral which was modelled in 1984-1986. A decade later the Urban Simulation Team from the University College in Los Angeles was commissioned a real-time visual simulation model of the Forum of Trajan, the largest of the Imperial Fora in the Forum Romanum for the exhibition at the Getty Center. The project aimed at exploring the historical, cultural, and technological information contained within ancient works of art as well as examining new ideas in archaeology, conservation, scholarship, education, and digital technology (Jepson and Friedman, 1998).

For many years, digital reconstructions have been presented and discussed at the eCAADe conferences. The author also contributed to this subject

(Kepczynska-Walczak, 2003). However, the use of 3D modelling in the virtual reconstructing of heritage buildings is no longer a subject of research itself. It rather opens new fields of research and application. First, it is necessary to indicate approaches to considering a heritage building reconstruction as a data container. For example Boeykens and Neuckermans (2009) studied the possibility to improve and increase information by adding supplementary metadata to the 3D model through "metadata enrichment". According to the authors "this structured information can, in turn, facilitate the retrieval and recovery of such models, when searching or browsing for design information through online architectural repositories". Another interesting project was the use of BIM deployed in the historical reconstruction of the Vinohrady synagogue in Prague (Boeykens et al., 2012). It is worth mentioning here the book devoted to the former Viennese synagogues that were destroyed and disappeared from the city

space. Rebuilt virtually, accompanied with the historical photographs recreate and perform the past in the context of the present day city (Martens and Peter, 2011).

Other contributions of particular interest include ornament modelling and deployment of rapid prototyping technology in making physical models (Breen and Stellingwerff, 2008) and augmented reality (AR) allowing better understanding of original appearance of a heritage interior and instant comparison with an extant state (Tonn et al., 2009).

Concurrently, at the beginning of 21st century researchers started to express their interest in the computation and the performance in architecture (Kolarevic, 2003). The subject is complex due to the multiplicity of associated meanings, including sustainable, technical, social and semantic issues. The performative approach was also implemented in the case of built heritage objects (Albayrak and Tunçer, 2011). Authors stressed the importance of “the shift in the orientation of architectural theory and practice from what the building is to what it does. Therefore, it defines the architectural object, not by how it appears, but rather by its capability of affecting, transforming and doing; in other words, by how it performs”. Their research suggested that this method might be useful in the heritage conservation - in this case in transforming fortifications of Amsterdam, listed as the UNESCO World Heritage.

CREDIBILITY OF VIRTUAL RECONSTRUCTIONS

In the light of the above, it is clear that contemporary digital technology offers a vast arsenal of techniques of modelling, representation and analysis. Objects of any chosen time period can be reconstructed and placed inside their original context. Especially in cases where the building is not existing, is demolished or largely renovated or altered, the reconstructed model can be used to provide insight into the evolution of the building or the site.

In this context the interpretation issues seem extremely important, especially when the reconstruction of not existing object is being considered.

In such case it is only a supposed, hypothetical image of a building based on the archival documents. However, the resources are often either incomplete or represent only architectural drawings, while implementation records are usually not available. This means that it is often impossible to confront the above-mentioned archival documents with an executed object due to the lack of photographic images or other reasons. The problem of trustworthiness emerged already with the first pioneering reconstruction drawings made in the 18th century by Giambattista Piranesi, who filled them with a number of imaginary elements. The foundations of scientific approach to the subject were laid in the mid 19th century by Austin Henry Layard and Luigi Canina, who paid a particular attention to the evidence and veracity of performed reconstructions (Dave, 2005).

The subject of reliability was recently discussed also in the context of 3D modelling of heritage buildings. A good example of problems emerging in this field might be a question of light analysed by Hauck (2009) in the Hagia Sophia in Istanbul. In this case, the researcher dealt with the problems of reflection of materials. Although a number of various ready-made rendering software were deployed, the results remained unsatisfactory, especially when compared with the existing object. The solution was the use of an open source program, which allowed to write appropriate scripts to expand capabilities of the software. What is more, the modelled building was visualised with the use of ‘sky models’, depending on the location, date and time. The ‘sky models’ were provided by the International Commission on Illumination - also known as the CIE after its French title, the Commission Internationale de l’Eclairage - an organisation devoted to worldwide cooperation and exchange of information on all matters relating to the science and art of light and lighting, colour and vision, photobiology and image technology.

An issue of great importance was also raised by Earl (2011) who dealt with the problem of insufficient data and, in consequence, tried to answer a question how to visualise the hypothesis proposed by researchers - in this case by archaeologists. In

other words, computer based visualisation tools have the capacity to create convincing reconstructions of historical structures that appear to be authentic and complete. The challenge is how to make the process of reasoning drawn from relatively limited evidence, more self-evident in the model and also make known the alternative options that were possible but less probable.

Therefore, virtual reconstructions of heritage buildings might be considered as a process of representing knowledge about space, time, behaviour, light, and other elements that constitute cultural environments. What is more, data credibility is of particular importance in the development of the society of knowledge.

LONDON CHARTER

Taking into account the current state of research already presented and the issues of the virtual reconstruction reliability, it is of crucial importance to present the London Charter for the Computer-based Visualisation of Cultural Heritage [1], which was conceived in 2006 to ensure the methodological strictness of visualisation as a means of researching and communicating cultural heritage. The Charter was officially approved by several national and international bodies, including the Italian Ministry of Culture, which adopted it as an official guideline.

In the Chapter preamble it is stated that the document "aims to enhance the rigour with which computer-based visualisation methods and outcomes are used and evaluated in heritage contexts, thereby promoting understanding and recognition of such methods and outcomes". What is more, authors indicate a number of earlier documents and initiatives (including AHDS Guides to Good Practice for CAD and Virtual Reality, Virtual Archaeology Special Interest Group and Cultural Virtual Reality Organisation), which stressed necessity for scholarly reliability of virtual visualisation methods, as well as the care for the choice of an appropriate form of presentation of research results, reflecting the current state of historical knowledge. The central issue is clear distinction between facts confirmed by sources and

hypotheses and differentiation degree of probability of arguments.

What is interesting, similar assumptions were made some 80 years ago, when the Athens Charter for the Restoration of Historic Monuments was adopted in 1931 during the First International Congress of Architects and Technicians of Historic Monuments. For example, it was stressed that in case of a heritage building reconstruction new materials used for this purpose should in all cases be recognisable. Such an approach to the heritage reconstruction was developed in the Venice Charter in 1964: "the process of restoration is a highly specialized operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents. It must stop at the point where conjecture begins, and in this case moreover any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp" [2].

Therefore, the London Charter is of great value and importance, since the availability of powerful hardware and software allows to perform delusively realistic reconstructions. What is more, at present nearly everything can be straightforwardly published on-line and, in consequence, easily available to unlimited number of the Internet users. This might be regarded as a great advantage but, on the other hand, there is a risk that laymen lacking analytical capacity may consider those visualisations as representing the truth - according to notion "seeing is believing". Such situation in case of virtual modelling may cause erroneous interpretations of a history. This issue was further developed by some authors, who indicated that although for certain purposes visualisations can exceed text in an expressive power, their explanatory value may be poor. Therefore Denard (2012) stressed that "for a heritage visualisation to match the rigour of conventional research, its rigour must be visible. That is why, at the heart of The London Charter is the principle that heritage visualisations should accurately convey to users the status of the knowledge that



Figure 1
Virtual reconstructions of
the Scheiblers chapel at the
Lutheran cemetery (left), the
Richters villa (top right) and
the Mutual Credit Society (bot-
tom right).

they represent, such as distinctions between evidence and hypothesis, and between different levels of probability.”

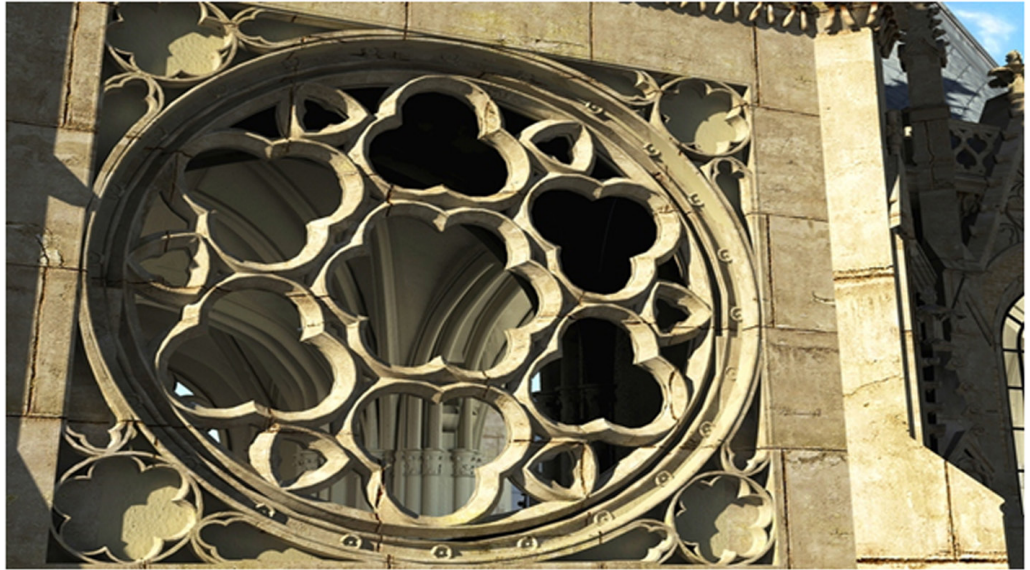
CASE STUDIES ANALYSIS

The purpose of this section is an analysis of a digital imaging process of heritage buildings and the impact of decisions on the final output. The analysis is based on examples taken from the author’s didactic experiences in virtual reconstruction. Parallel references to the London Charter (LC) allow better understanding of its principles and practical application.

The issues related to credibility of virtual reconstructions are based on the cases of historic

buildings in Lodz, including the Richters villa, the Scheiblers funeral chapel and the Mutual Credit Society premises (Figure1). All the buildings represent various architectural types and forms from the late 19th century. The Mutual Credit Society, built in the 1870s, is an excellent example of neo-renaissance public edifice. The Scheiblers chapel is an impressive mausoleum of one of the most prominent textile manufacturers in Europe and his family. This building erected in 1888 is one of the best exemplars of 19th-century European gothic revival. While the Richters villa illustrates the living conditions in the industrialist residence at the turn of the 19th and 20th centuries.

Figure 2
The rose window of the front
façade of the Scheiblers
chapel.



It is necessary to stress that all the above-mentioned objects exist, so the process of digital reconstruction required a high quality realistic representation in accordance with Rule 6 of LC: “the creation and dissemination of computer-based visualisation should be planned in such a way as to ensure that maximum possible benefits are achieved for the study, understanding, interpretation, preservation and management of cultural heritage (...) The aims, methods and dissemination plans of computer-based visualisation should reflect consideration of how such work can enhance access to cultural heritage that is otherwise inaccessible due to health and safety, disability, economic, political, or environmental reasons, or because the object of the visualisation is lost, endangered, dispersed, or has been destroyed, restored or reconstructed.”

Among the principal goals of analysed cases was an education, including the dissemination of Lodz cultural heritage, allowing access to these magnificent buildings which are not open to public due to their current state and use. What is more, the Scheiblers chapel has been listed by the World Mon-

uments Fund as one of 100 most endangered sites in the world since 2006.

The inventorial measured drawings and photographic documentation were used as the initial material for digital reconstruction. The inventory was made using a hybrid method that combines a traditional analogue and digital techniques of documenting heritage buildings. The range of measurement drawings included not only the shells of buildings, but also their interiors. The high level of accuracy was obtained, which can be seen on some of details drawings. Therefore, such comprehensive data enabled to create very detailed digital models (Figure 2 and 3). Unfortunately, it was impossible to use 3D scanning due to high costs. Despite the growing knowledge on this technology among the conservators, the financial barrier makes 3D scanning in Poland not widely used in heritage documentation practice.

Pursuant to Rule 4 of LC the goal was clearly defined - to reflect the existing state: “4.4. It should be made clear to users what a computer-based visualisation seeks to represent, for example the existing



Figure 3
The lantern at the main entrance of the Richters villa.

state, an evidence-based restoration or an hypothetical reconstruction of a cultural heritage object or site, and the extent and nature of any factual uncertainty”.

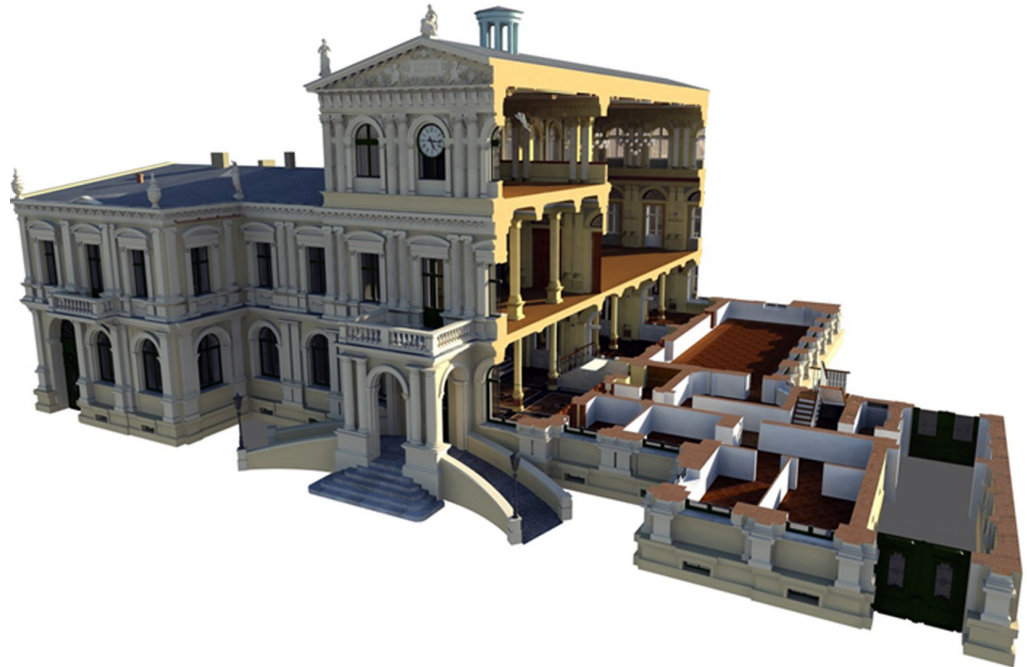
In the context of the above the question arises whether - referring to the London Charter principles - a model and subsequent visualisation, made on the basis of the inventory, are sufficiently reliable for “study, understanding, interpretation, preservation and management of cultural heritage”? On the other hand, however, one of the principles of LC is that “the costs of implementing such a strategy should be considered in relation to the added intellectual, explanatory and/or economic value of producing outputs that demonstrate a high level of intellectual integrity”.

Discussed reconstructions present high level of details - not only exteriors but also interiors were modelled carefully (Figure 4). Special regard was paid to the issues of lighting and texturing objects,

including, in particular, the problem of texture mapping and performance of the same texture in different lighting conditions (Figure 5). Texturing turned out to be a very difficult task, many attempts have been done to achieve an effect similar to reality. It was impossible to use textures from photographic pictures since in different lighting conditions the same material performed different appearance. Another interesting observation was a selection of lighting - mimicking the actual lighting conditions in a virtual environment, the virtual textures changed their characteristics unlike to what could be observed in reality. What is more, a colour palette of the interior successfully reproduced in one visualisation, turned up different from the actual interior appearance in another visualisation.

It is worth to confront the observations with one of the objectives of the London Charter, which “seeks to establish principles for the use of computer-based visualisation methods and outcomes in the

Figure 4
The three-dimensional cross-section showing variety of volumes and spaces within the Mutual Credit Society building.



research and communication of cultural heritage in order to (...) ensure that computer-based visualisation processes and outcomes can be properly understood and evaluated by users”.

To sum up this section, it is necessary to stress that the ability to confront the results achieved in the process of creating the virtual model with the actual state allowed the ongoing verification of the decisions and to introduce necessary adjustments. It might be argued that the situation was comfortable since modelled objects existed. Nonetheless, it was impossible to avoid the compromises because, as the experience has shown, a reliable digital representation depends not only on the input data.

SUMMARY AND CONCLUDING REMARKS

The considerations put forward in the first part of this paper relate to the reconstruction of non-existent, destroyed objects and to existing structures.

The main obstacle of such tasks lies in limited source materials. On the other hand, it is relatively easy to accept the achieved results, since it is impossible to compare them with the actual building. On the contrary, when the existing object is a subject of modelling, it is perfectly possible to achieve its geometry through the measuring or scanning. However, there is much stronger pressure on reliable representation of real appearance. It is not easy if not just a general impression but the knowledge about the object is to be represented. What is more, the problems associated with modelling of existing structures make clear that reconstructions of non-existent objects may occur extremely imperfect.

Similar problems apply to other fields of art - such as sculpture. For example, replicas made in a different material, although keep shapes of originals, trigger different aesthetic experience. The topicality of the above-mentioned issues can be proved by



Figure 5
The entrance hall and the main stairs of the Mutual Credit Society edifice.

the solution adopted in the Tate Gallery on-line catalogue, in which objects could be seen in a different light exposure, allowing their better understanding, including texture and other features (Stanicka-Brzezicka, 2012).

To summarise, the author aimed to analyse the process of digital reconstruction of heritage buildings and the impact of the decisions taken during its development on the final performance.

Assuming that the imaging is treated as a visualisation of knowledge, these issues are of particular importance, since contemporary culture is based on the visual perception, in which not intellect, but the senses are activated to experience the past [figure 6.]. What is more, the image acts as the dominant form of memory. According to Szpocinski (2009) memory visualisation is a phenomenon which essence is the dominance of visual events in the processes of transmission and perception of the past.

Taking above issues into account, the author believes the paper will contribute to the discussion on performative values of virtual reconstructions in the cultural heritage domain.

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Figure 6
The pulpit and the presbytery
of the Scheiblers chapel.



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[1] <http://www.londoncharter.org/>

[2] <http://www.icomos.org/>