Virtual Reconstruction of Viennese Synagogues: Sustainable 3D Models

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Abstract

Computer-aided reconstruction of no-longer existent synagogues amounts to a “virtual comeback”. Irreversible destruction having removed identity-establishing buildings from the urban surface forever is the principal reason for re-creating them by imagination. Following the destruction of the so-called “Reichskristall-Night” of November 1938 the synagogues of the Jewish community in Vienna will only survive by means of virtual reconstruction. 60 years later, in the commemorative year of 1998 the first synagogue reconstruction was initiated. The medium-range goal, however, aims at the reconstruction of at least ten further synagogues within a project to be carried out in stages over a period of several years. Changes in personnel also call for a structure to be tracked down later on. This contribution deals with handling of modelling in a systematic manner taking into consideration software fluctuations aiming at a traceable data structure being of importance for subsequent use and following-up work.

Introduction

The basis of reconstruction work proves to be well-founded archive material determining the validity of virtual reconstruction to a high extent. The majority of the present reconstructions concerns synagogues dating from the second half of the 19th century. Due to the “thoroughness” of the building authorities in Vienna and their resulting requirements governing submission plans and alteration planning (1:100 scale) this source is to be considered highly reliable. The technical journals dating from the time of completion of building, however, issue relevant building descriptions for some cases. Photographs also represent an essential information source as they depict an actually realized situation. Any pictures stored in the various archives mostly are black-and-white shots showing the exterior. The major part is picture postcards not to be regarded as unique specimens, whereas the number of interior shots is pretty low.

Modelling Conditions and Setup

Continuing developments in the field of computer-assisted modelling techniques as well as the implementation of knowledge acquired in cooperation with art historians led to advancements concerning modelling procedures. Modelling, moreover, is tackled by different people (individuals and teams) and in differing frame conditions (workshops, diploma theses and commissioned projects, etc.), very easily resulting

into considerable confusion regarding data organization. Generally speaking, the structure principle of separation of building members within a simple floor structure will not prove adequate for keeping “track”. In order to provide sufficient vision to a reconstruction it is essential to develop structuring relying on the available sources prior to commencement of producing the virtual model to be based on the CAD-program used.

The aspect of usability at a later time is an essential prerequisite for subsequent modelling procedures. First of all, planning documents of the reconstruction object to be dealt with are structured according to constructive criteria. Wall structures in their differing functions (interior and exterior walls) are to be identified and supplemented by supporting pillars, ceilings, intermediate ceilings, staircases, roof constructions, roof covering, framework (roof truss), facade elements, ornaments, furnishings etc., in order to ensure the required overview within the data organization for the changing user community at all times. In any case coherent (geometric) elements within the respective layer are to be documented in form of an individual three-dimensional representation. Specification of layers and the graphic representation of the specific contents should determine the building components in a suitable manner. Representation of the layer contents should preferably be shaded. A wire mesh model does not lend itself to this form of documentation as all clarity is done away with as soon as a great number of building elements within one layer are involved. A nomenclature has not been provided for the layers, however a documentation clearly explaining the layers used regarding their name specification and content is to be available. A pre-defined layer management limits the possibilities for this project series (reconstruction of synagogues) regarding modelling and does not prove meaningful considering the maximum of approx. 20-30 layers. Moreover, the building structure has already been defined and will not be resulting from a design process to be performed subsequently.

The implemented software package *ArchiCAD*® as basic set already provides a number of functions meeting the demands as to required geometry modelling, storey administration and layer allocation. The subsequent steps of material identification and texture verification can be performed not involving any complicated additional efforts. Furthermore, compatibility with other CAD-programs makes for data transfer to other software applications without major information loss. Development of the ArchiCAD-intern language (GDL – Geometric Description Language) doubtlessly represents a real achievement. One of the major advantages of GDL surely is the compact file size next to the open programming language (open source).

The main term of the ArchiCAD-product philosophy is the concept of the *Virtual Building* not primarily focusing on the production of technical drafts and pictorial rendering, but rather on the information production these are based on in form of a structured project database. Regarding virtual reconstruction the object-oriented working mode makes ArchiCAD so interesting. The possibility of subsequent re-using once produced GDL-objects (object-oriented modeling) over and over again seems meaningful. The option of parametrification not only includes the geometric constellation but also the definition of varying material and colour properties and selectable options. Additionally, further non-geometric particulars and functional

properties can be programmed by means of the GDL-script language matching the Basic-computer language in its essential features.

Example of Implementation: Synagogue Leopoldsgasse

In the course of the project work regarding this synagogue the frame conditions for the structured data model generation were determined. It not only is the geometry defining this structure but also any related (object-specific) parameter, such as material and texture. What is assumed is that the storey management makes up the “horizontal structure”, the layer management, however, the “vertical structure” of the building. The terms “storey” and “layer” in this context refer to the software package *ArchiCAD*®. Below the systematics are described step-by step:

- *Research work concerning plan documents, picture material and descriptions*
- *Comparing plans with photographs*
- *Definition of a storey structure:*

Every building element within a virtual reconstruction is to be assigned to a storey. As many stories as desired can be produced which do not have to be identical with the storey structure of the plan documents. It might even prove wise to work with intermediary storeys if a great number of ornaments or ceiling elements occur above the ideational “one-meter-section”. Particularly when several individuals are involved in the course of project work the storey structure helps figuring out correct positioning of building parts within the three-dimensional space.

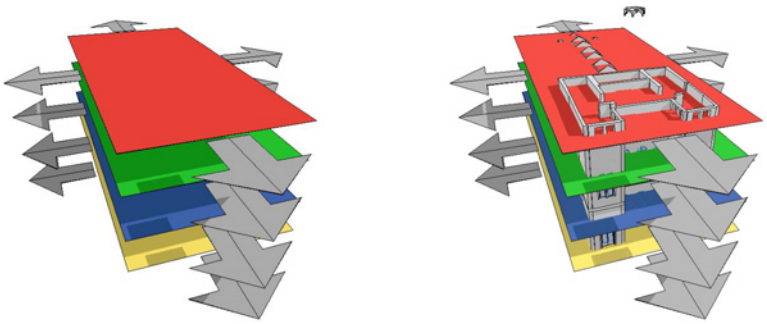


Figure 1a-b. Storey management in the Synagogue Leopoldsgasse

- *Determining a layer structure:*

The number of layers to be associated with the matching building parts is to be specified and the criteria for allocation of building elements are to be selected according to constructive aspects. It might be possible that building elements of one layer might fall below or exceed the imaginary horizontal boundaries of the storey management.

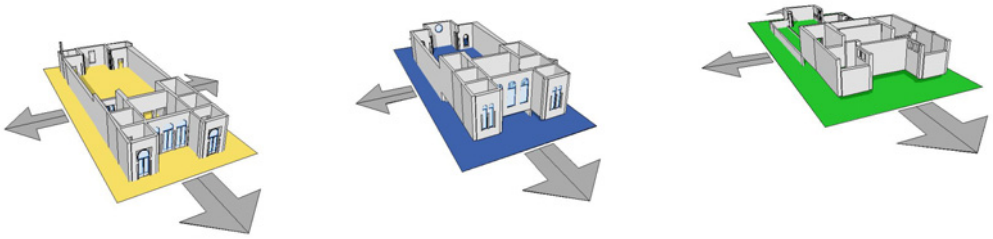
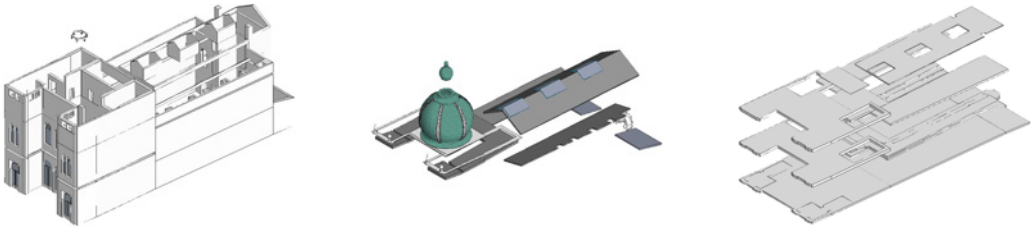
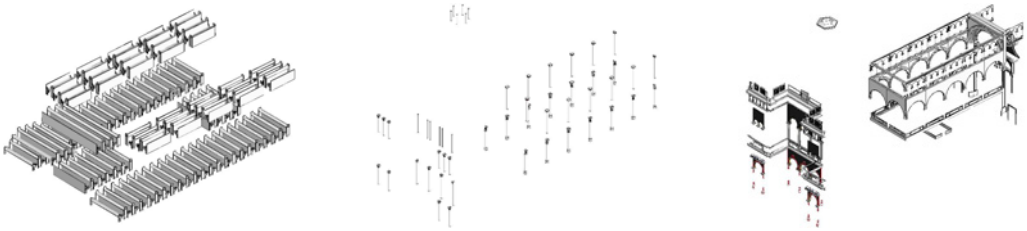


Figure 2a-b. Layer “exterior walls” per storey at the Synagogue Leopoldsgasse

After completing the reconstruction all layer contents is to be documented. Therefore, first all layers are to be faded out and subsequently the contents of each single layer are to be rendered. Regarding the example Kluckygasse the layers are specified as follows (selection):



Exterior Walls Roofs Floors bearing



Interiors/Seats Columns Façade elements

Figure 3 Layer documentation Synagogue Leopoldsgasse

• *Compiling materials used*

Each element on one layer and in a storey provides of a specific surface colour (corresponding to the material). This colour is related to the single geometric faces and thus can differ within one object. The element as such, however, is not split up between the various layers.

• *Determining textures*

A further step regarding classification is the material texture assigned to the specific surface colour. A texture is the graphic rendering of a building material, which is projected to the geometry of the building element when a photorealistic rendering is being generated. Special

effects of photorealistic rendering possibilities of a CAD-software may also issue additional light, gloss or reflecting effects, influenced by various light sources within and/or outside the building model.

• *Compiling library elements and modules*

The construction of project-related building elements is achieved by implementing all ArchiCAD-standard tools available. Building parts stored as library elements are to be stored as so-called "modules" in a specific directory. This procedure enables any following alterations of individual library elements.

• *Archiving project files*

Finally, all project data are to be stored in a clearly laid-out directory structure. An expansion by individual directories can be furnished whenever required (e.g. regarding textures).

The so far unrecorded interior configuration of synagogues can be comprehensively visualized. By means of comparative studies of related buildings dating from the same time and typical material and surface effects a material- and colour-related reconstruction can be developed. Individual materials are to be specified by means of data organization of the building elements in order to avoid the already mentioned tiresome subsequent editing. Compilation of materials used and specification of textures can be carried out at a later stage, if required information is missing. An impression of the reconstruction of the Synagogue Leopoldgasse is issued below.

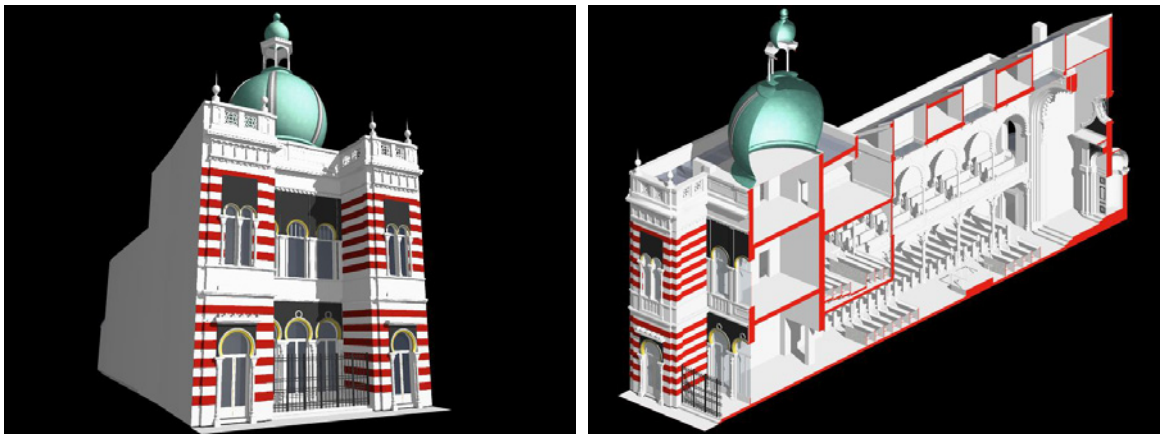


Figure 4a-d. Findings of reconstruction work

Conclusions

This paper provides a contribution establishing a relationship between a technique increasingly used in architectural history with a more rigorous process of data analysis and authenticity. CAD is often employed with less care than the authors propose. What is to be considered is that reconstruction work furnishes the specific levels of detail, i.e. any further art-historical findings are to be included subsequently. We might be dealing with longer periods of time where the initial team is no longer involved in modelling work. Moreover, it is difficult to specify if a certain CAD-software package will still be available a few years later. These reasons might severely affect advancement of work and therefore investing in systematic maintenance will be beneficial and pave the way for further utilization – possibly also in a different CAD-environment.

References

GENÉE, P., 1987. Wiener Synagogen 1825-1938. Löcker Verlag, Vienna.

MARTENS, B., UHL, M., TSCHUPPIK, W.-M. and VOIGT, A., 2000. Synagogue Neudeggergasse: A Virtual Reconstruction in Vienna. In Kos, R. (ed.), *Constructing the Digital Space*, *Proceedings IVth Sigradi-Conference Rio de Janeiro*:165-170.

PETER, H., 2001, unpubl. Die Entwicklung einer Systematik zur virtuellen Rekonstruktion von Synagogen. Diploma-Thesis, Vienna University of Technology, Vienna.

WALLMÜLLER, D., 2001, unpubl. Computergestützte Rekonstruktion des Leopoldstädter Tempels. Diploma-Thesis, Vienna University of Technology, Vienna.