Developing Systematics Regarding Virtual Reconstruction of Synagogues

Bob Martens* and **Herbert Peter****

*Vienna University of Technology (Austria) / **A-Null (Austria)

Abstract

Computer-assisted reconstruction of no-longer existent (architectural) objects and their surroundings 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 during the so-called “Reichskristall-Night” of November 1938, the synagogues of the Jewish community in Vienna will only survive by means of virtual reconstruction. Sixty 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 additional synagogues as 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 paper deals with handling of modeling in a systematic manner, taking into consideration personnel changes,aiming at a traceable data structure for subsequent use and follow-up work.

Keywords

3D Modeling, Virtual Model, Computer-generated Reconstruction, Digital Patrimony

1 Introduction

The present project covers synagogues almost entirely destroyed in 1938. Because any remainders thereof had been eliminated shortly thereafter, no information as to constructional reality is available and thus the virtual reconstruction is based on “information records”.

Reconstruction work is based on well-founded archive material that tests 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.

These plan documents, however, usually do not furnish information about fixtures and furnishings. A substantial number of plan documents have been filed, though many are missing. Loss of archive material results in limitations affecting three-dimensional representation. Thus speculations - e.g. with reference buildings - will gain in importance. A substantial number of sections of buildings, however, will increase the degree of authenticity of the reconstruction.

A search for possibly archived records of execution and detail plans at design studios was a complete failure. This is not surprising because it is practically a century since completion of building activities. Moreover, many planners chose to leave the country due to the changed political situation. The technical journals dating from the time of completion of building, however, provide relevant building descriptions for some cases. Photographs also represent an essential information source. Therefore, the research focused on taking stock of photographic images always bearing in mind that the Viennese synagogues were part of the urban image for no longer than half a century. Any pictures stored in the various archives mostly are black-and-white shots showing the exterior. Most are picture postcards which are not to be regarded as unique specimens. There are few interior shots. The few works of art in form of depictions in oil or water paintings are to be taken with a pinch of salt, but they too represent supplementary source material.

The call for (private) archive material by "David" Magazine (from the Jewish Community) was not successful, because picture-taking is not considered appropriate during religious ceremonies and feasts. Moreover, the photographic equipment of former days does not compare to the presently available equipment. Due to the lighting conditions in the interior, photography was rather complicated (long exposure). The configuration of non-existant building members naturally can be verified more authentically by means of photographs, but these would have been mostly black-and white shots because color photography was in its infancy in the first half of the 20th century. Therefore, precise specification as to color and material effects cannot be made. Non-availability of photographic material thus increases the importance of (computer-assisted) visualization of the interior.

Because destruction occurred only six decades ago, contemporary witnesses could have been contacted. This, however, might not have been very successful considering the tragedies involved and respecting reluctance regarding speaking about childhood memories.

2 Modeling Conditions and Setup

Continuing developments in the field of computer-assisted modeling techniques as well as the implementation of knowledge acquired in cooperation with art historians led to advancements concerning modeling procedures. Modeling, moreover, is tackled by different people (individuals and teams) and in differing frame conditions (workshops, diploma theses and commissioned projects, etc.), very easily resulting in 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”. Parapets with applied ornaments for example- mostly modeled in several vertical layers - can only be filed in a traceable way by means of structured data organization. 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 doubtlessly is an essential prerequisite for subsequent modeling 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 the form of an individual three-dimensional representation. Specification of layers and the graphic representation of the specific contents should determine the building’s components in a suitable manner. Representation of each layer’s contents should preferably be shaded. A wire mesh model does not lend itself to this form of documentation because all clarity is lost as soon as a great number of building elements within one layer are involved.

A nomenclature has not been provided for the layers. However, documentation clearly explaining the layers used regarding their name specification and content is available. A pre-defined layer management limits the possibilities for this project series (reconstruction of synagogues) regarding modeling and does not prove meaningful considering the maximum of approximately 20-30 layers. Moreover, the building structure has already been defined and will not result from a design process to be performed subsequently.

The implemented software package *ArchiCAD®* as a basic set already provides a number of functions meeting the demands of the required geometry modeling, storey administration, and layer allocation. The subsequent steps of material identification, texture verification, and light simulation can be performed without requiring any complicated additional efforts. Furthermore, compatibility with other

CAD programs makes for data transfer to other software applications possible without major information loss.

The ArchiCAD software is based on the concept of the *Virtual Building.* Design (or in this case documentation) with the software focuses on the production of a structured project database as the user draws. ArchiCAD also has built-in capacity for creating reusable intelligent objects through its GDL module (GDL – Geometric Description Language). GDL allows for the parametrification of CAD objects including object form, color/material properties, and selectable options. The GDL-script language is based on the Basic-computer language. ArchiCAD's development of this internal programming language doubtlessly represents a real achievement. One of the major advantages of using GDL is the compact file size and the file's transparency across platforms.

The so-called "hotlink-module technique" also is a great help. Once an element within the hotlink-module is adjusted, the module information implemented in a specific project document is accordingly updated. This, however, does not mean that object technology is no longer required when working with modules. The module technique basically deals with the reference related to the project document and to the modules associated therewith. Hotlink modules thus can include various elements (including GDL objects).

3 Example of Implementation: Synagogue Kluckygasse

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. It is assumed that the storey management makes up the "horizontal structure". The layer management, however, males up the "vertical structure" of the building. The terms "storey" and "layer" in this context refer to the software "ArchiCAD". The systematics are now described step-by step:

• Research work concerning plan documents, picture material and descriptions

This information pool is of basic importance, and if possible plan documents should be available at the beginning of computer-assisted reconstruction work. The more high-quality archive material that is available, the more exact will be the reconstruction of a synagogue.

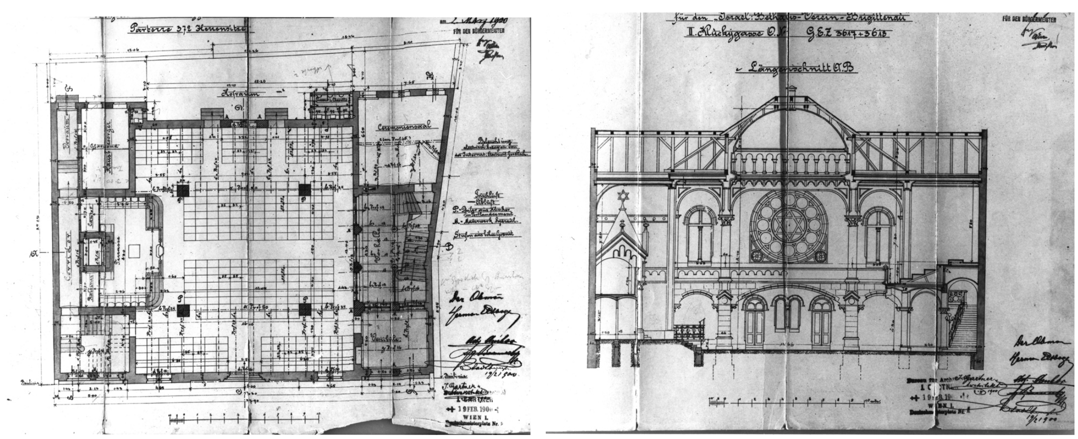


Figure 1a-b. Archive material of Synagogue Kluckygasse

• Comparing plans with photographs

In order to determine differences between planning and execution, plans are to be compared with photographs and any discrepancies are to be spotted. Moreover, first analyses concerning the constructive building structure (e.g. grids, sections of facades, etc.) are to be made.

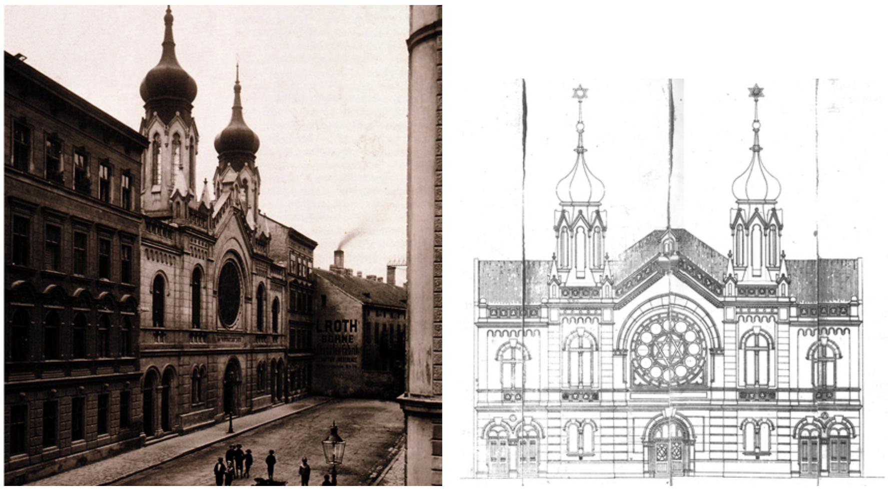


Figure 2a-b. Comparison of façade of Synagogue Kluckygasse: plan-photography

• 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; they 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 ideal “1-meter-section”. Particularly when several individuals are involved in the course of project work, the storey structure helps to determine the correct positioning of building parts within the three-dimensional space.

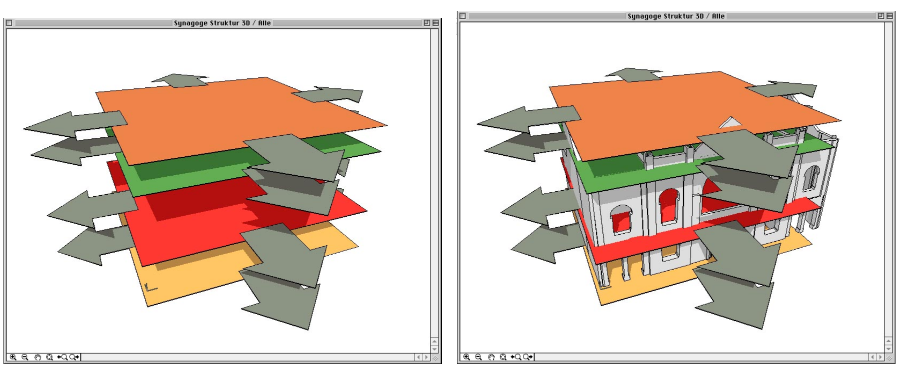
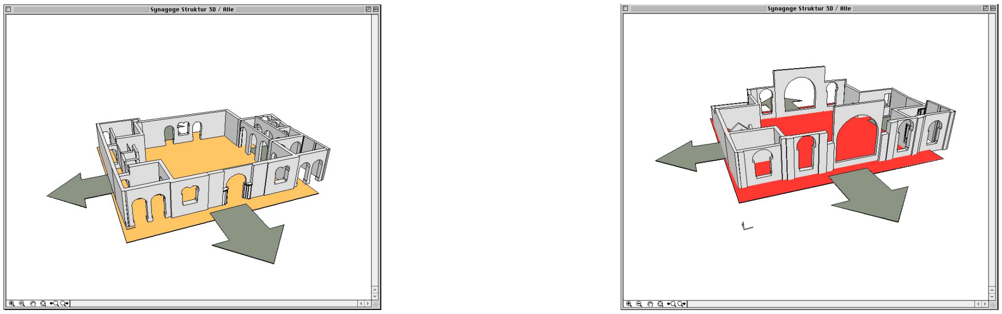


Figure 3a-b. Storey management in the Synagogue Kluckygasse

• Determining a layer structure

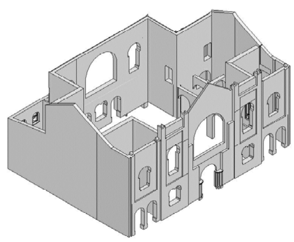
Now the number of layers to be associated with the matching building parts is to be specified. The criteria for allocation of building elements are to be selected according to constructive aspects. It might be possible for building elements of one layer might to below or above the imaginary horizontal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



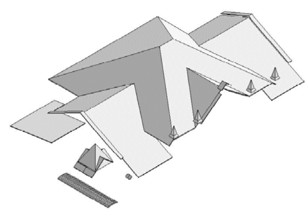
a b

Figure 4a-b. Layer “exterior walls” per storey at the Synagogue Kluckygasse

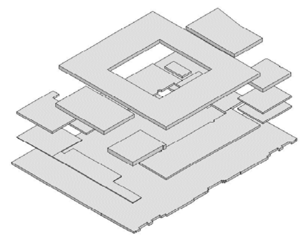
After completing the reconstruction, all layer contents are to be documented by means of shadow-marking. Therefore, first all layers are to be faded out and subsequently the contents of each single layer are to be rendered. Regarding the example synagogue the layers are specified as follows:



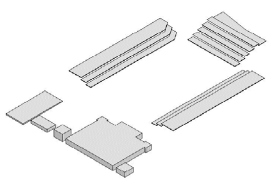
Exterior Walls



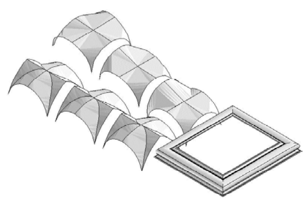
Roofs



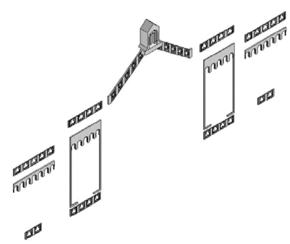
Floors bearing



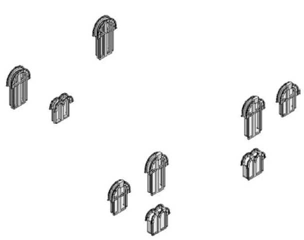
Ceilings



Ceilings stucco

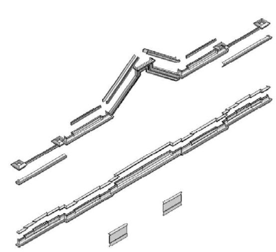


Facade elements



Windows

Banister



Cornice facade

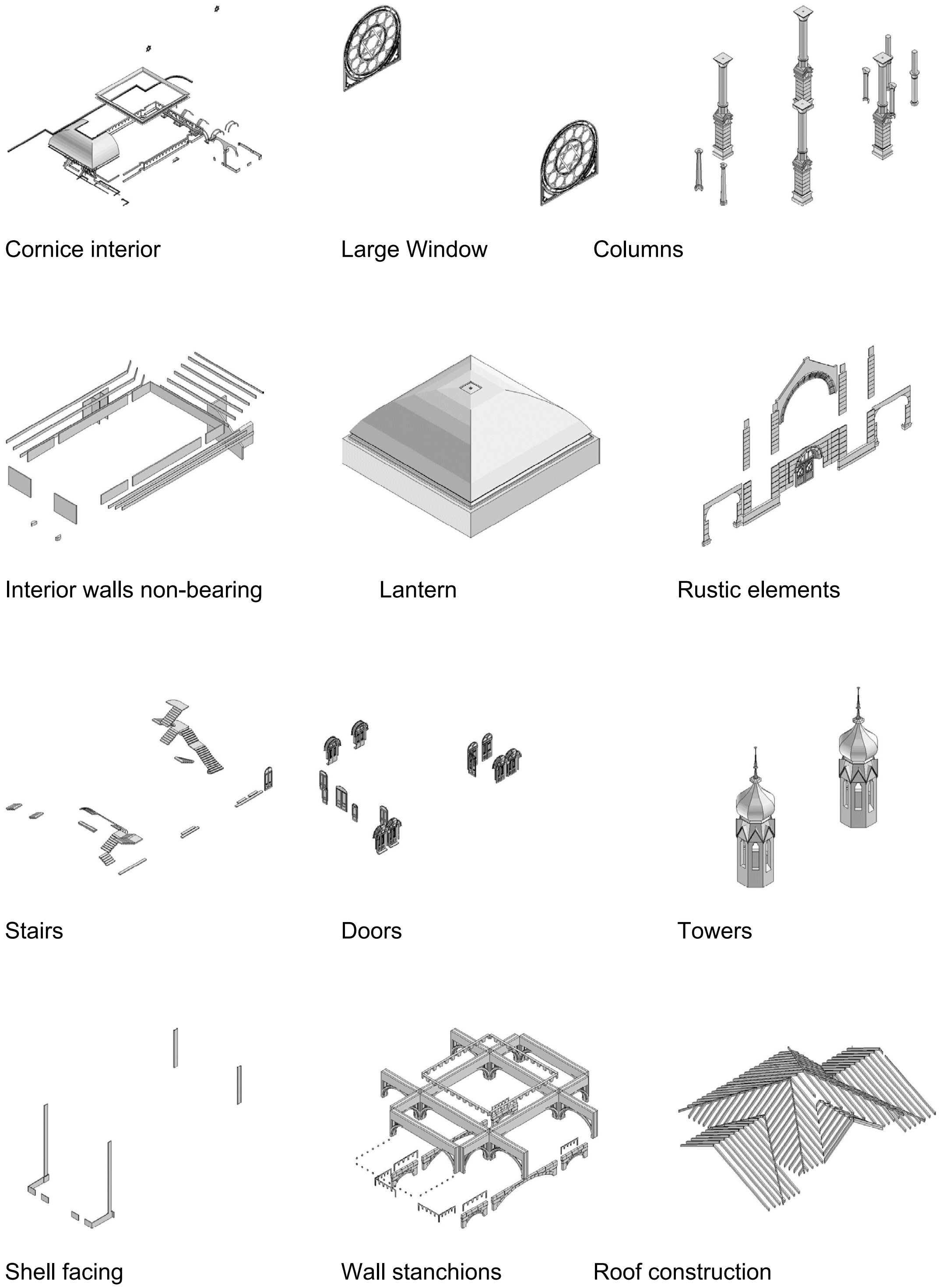


Figure 5 Layer documentation Synagogue Kluckygasse

• Compiling materials used

Each element on one layer and in a storey provides specific surface color (corresponding to the material). This color is related to the single geometric faces, and therefore 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 color. 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 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 utilizing 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 permits subsequent 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 indoor configuration of synagogues can be comprehensively visualized. By means of comparative studies of related buildings dating from the same time period as well as typical material and surface effects, a material- and color-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. A compilation of materials used and specification of textures can be carried out at a later date, if required information is missing. An impression of the reconstruction of the Synagogue Kluckygasse is illustrated in figures 6a-d.

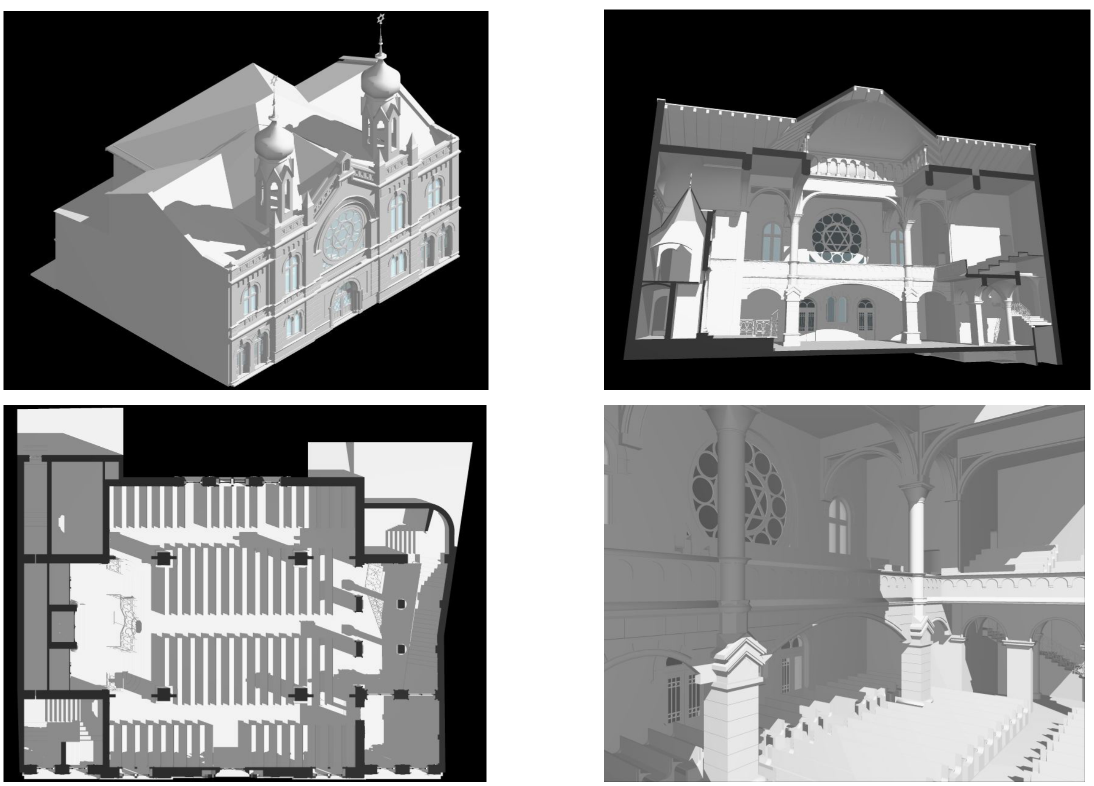


Figure 6a-d. Findings of reconstruction work

4 Conclusions

A physical model may be produced of the digital reconstruction. It's resulting variety of details entails more work than computer-assisted processing. The rapid prototyping process (3D-printing requires architectural information) might prove meaningful to generate physical casts as required – similar to that required for a patent board. Printing in 3D holds the potential for viewing physical versions of the reconstruction at a variety of scales, physical disassembly, and variants. This can be performed with relative ease if the “Virtual Building” database is well structured. The virtual reconstruction of no-longer-existing building structures, however, is no longer novelty and “digital libraries” meanwhile have become popular all over.

This paper establishes 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. Reconstruction work must furnish 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 the modeling work. Moreover, it is difficult to specify whether a certain CAD software package will still be available a few years later. These conditions might severely affect advancement of the work and therefore investing in systematic maintenance will be beneficial and pave the way for further utilization – possibly also in a different CAD environment.

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