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DISPLACING THE FRONTIERS OF RECONSTRUCTED CULTURAL HERITAGE

Representation of the non-existing within an urban context

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Abstract. Reconstruction work on more than twenty synagogues in Vienna has been ongoing for more than a decade. The fact that these sacred buildings no longer exist is a pivotal aspect in this undertaking. Research revealed archived material, however, which served as reliable basis for the reconstruction work. The paper focuses on the possibilities and limits of this exploration and discusses the long-term options for handling 3D models and the dissemination of results to a large audience. The appropriate illustration of spatial contexts is another aspect that has been explored. The publication of results in the form of a city guide is in line with the objective of conveying the reconstruction results to a large audience.

Keywords. Virtual reconstruction; 3D modelling; visual representation; urban context.

1. Introduction

For more than ten years, the virtual reconstruction of synagogues in the City of Vienna (Austria) has been dealt with as a research topic. Within this relatively long time, particularly the increasing use of 3D-modelling is a salient feature which required the introduction of conventions for layer structures to

ensure long-term transparency and comprehensibility of the data structures, even when the original members of the research team (which was partly interdisciplinary in composition) are no longer available for information purposes. Frequent software updates (approx. every 15–18 months) make data migration an eternally topical issue. Another major issue is data export, either for purposes of visualisation or for computer-aided model-making (by means of rapid prototyping), which requires a certain degree of detail. The reconstruction work itself can be compared to a virtual building site. The focus is on sacral buildings that were built around 1900, i.e., more than 100 years ago. Although historical records are usually available in the form of designs submitted for building permits, implementation records are often missing, since the planning firms involved have usually ceased to exist. Reference buildings offer a useful option for filling information gaps, as do historical photographs. The appropriate handling of information gaps is a vital aspect in this reconstruction effort.

This contribution presents the results of comprehensive modelling efforts and explains the specific use of rendering processes within the context of a project involving a *city guide* (Martens and Peter, 2009), which needs to address a broad circle of readers. For the purposes of this guide, it was important to clearly present the particularities of each location, a task which is helped considerably by the image of the computer-model. Three-dimensional imaging within the city fabric is of major importance since the synagogues were hardly ever free-standing buildings.

The novel contribution of this work lies in its longevity. Computer-assisted reconstruction projects hardly ever extend over such long periods, and further continuation is intended. Another essential aspect is the dissemination of results to a much larger audience than the narrow sector of specialists in the field at hand.

2. Framework conditions for virtual synagogue reconstruction

Computer-assisted imaging is usually forward-looking and oriented towards the future. Resounding slogans may well promise the user a virtual "heaven on earth". This future-orientation notwithstanding, the technique may just as well be used for throwing a "learning glance" back into the past (Grellert, 2007).

When buildings that no longer exist in reality are virtually reconstructed, the question arises as to whether this visualisation is a construction method based on abstract – i.e., fragmented – data. After all, the existing information includes a good number of uncertainties and gaps. The necessary information fillers and/or the resulting "distortion" of the original image need to be seen with a critical eye - a necessity well known to archaeologists. At any rate, the

reconstruction of historical structures puts at least a visual stop to decay or alterations.

Any reconstruction work is based on well-researched archived material, the quality of which is a determining factor for the validity of virtual reconstruction. It must be noted that the majority of reconstructions in this project involves synagogues that were erected in the second half of the 19th century. Due to the requirements imposed by the City of Vienna's building authority, the plan material submitted for approvals and any later implementation modifications (scale of 1:100) is reliable. As the plans do not, as a rule, include information about furnishings, this aspect requires more in-depth research. It is quite surprising that, despite some information gaps, a wealth of plan material has been preserved in the archives. When archived material has been lost, the three-dimensional visualisation has to work within stricter limits and the process is dominated by speculation, based for instance on comparable reference buildings. A great abundance of various section views of the structure will notably increase the realistic nature of the reconstruction. This is also the case whenever photographic material of interiors exists. The fact that there are very few interior photographs of Jewish prayer houses and synagogues is hardly surprising, since photographs are not made during religious services and celebrations, and the handling of cameras available at the time was hardly comparable with modern-day equipment. It would have been a great benefit to avail of some photographs in order to verify the details of structures and furnishings. Any photographic material would, of course, have been in black and white only, since colour photography was only just emerging in the first half of the 20th century. Monochrome pictures cannot convey more than an inkling of the original colour scheme. The fact that hardly any photographs exist seems to underline the need for the visualisation of interiors.

Sometimes, artist watercolours or paintings exist. While some caution is recommended in their use, they may well be useful as complementary information. Unfortunately, the plan material of the building firms involved has not been archived, which would have offered access to more detailed plans and design data. Sometimes, professional journals published at the time of the structures' completion offer pertinent descriptions of the buildings.

Although a century has passed and some information has been lost, the step back in time is still realistically possible. Unlike archaeological finds from classical antiquity, where sometimes only fragments exist that have to be assembled into a whole, the gaps encountered in this project are usually not as massive. Comparative studies of related buildings from the same era and typical effects of building materials and surfaces help to fill many gaps.

3. Design of appropriate information structures

The notion of "new frontiers", the title of this conference, can be interpreted in different ways (Affleck and Kvan, 2005). Are we continuously exhausting the performance limits of currently available hardware and software? What exactly does "new" refer to? What is meant is probably the continuous shifting of frontiers: CPU performance (hardware) is getting better as continuously as new software features emerge. We started out with kilobytes, went on to mega- and gigabytes, have arrived at terabytes and will certainly not have to wait another century for peta-, exa- and zettabytes to become common currency. "Unprecedented frontiers" are something like a higher level in the shifting of frontiers and refer to "that which has never been seen before". What could that be? The pace of development is still breathtaking, and access to affordable hardware and software tools plays a pivotal role in the process.

Even if frontiers are credited with major significance within the title of the conference, they are not really new if considered as such. Rather, it is the awareness that is new when we speak of a nearly unstoppable flood of development which users have to find a way of coping with, if they do not want to become "upgrade objectors". Mere orientation on growth and accumulation may lead to information structures becoming unusable or inaccessible if they are not subject to (constant) maintenance.

What about potential frontiers in the context of modelling environments? The first thing that comes to mind is the monopoly situation of individual software packages. Manufacturers probably would like to create lasting user commitment to an individual product and data exchanges are often linked to a certain degree of information loss. Interoperability efforts (cf. IFC) have mitigated this phenomenon to a certain extent. Some software developers lure users by integrating well-loved functions from competitor packages in their own CAD environments thus making it easier to switch products.

What impact did the above considerations have on the project of reconstructing more than 20 different synagogues? In principle, there is a clear preference for the ArchiCAD software environment (object-oriented modelling). At the project start, the product range had already reached a stable development status. Availability, including a range of useful interfaces (3ds, vrml, IFC, etc.), was secured for the long term, which is an important aspect, since more than half of the reconstructions were dealt with by students in diploma theses. Other useful aspects were the development of complex profiling tools or the handling of elements across several floors.

We have already reported about this project in previous publications (Martens and Peter, 2002a-b) and elaborated on the conventions developed for the layer structures and the handling of storey content (figure 1). These

structural conventions have turned out to be helpful for the people working with the data and with a view to long-term usability. It is quite remarkable that a CAD file first created a decade ago can still be read and processed almost in its entirety today. In the long run, a transparent modelling structure is therefore indispensable. The established conventions, which have been successfully translated into reality with ArchiCAD's "Virtual Building Concept", are now being investigated in other software applications with the help of the IFC and/or IFCXML data exchange formats. While the use of other CAD environments was not "prohibited", with the output being exported to ArchiCAD, it was found that the results suffered in terms of diminished data compactness (table 1).

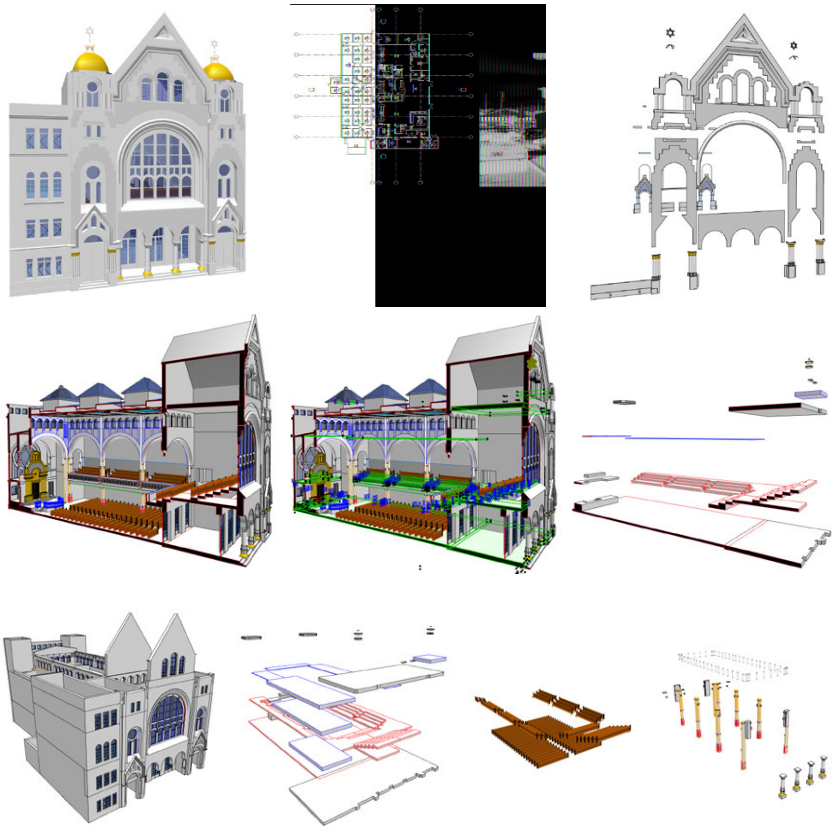

Figure 1. Grouping of building elements in a layer structure (example of Pazmanitengasse).

Although the process may look simple, it is time-consuming and does not generate immediate benefits. In the long term, it still harbours advantages, and it would make sense to archive earlier model versions (including earlier software releases) so that stepping back to earlier states is possible.

Table 1. Overview of accumulated data volume.

Location	Objects	Shape-polygons	AC File (PLA) Mb	GDL Model (bin) Mb	Artlantis Render Mb
Schiffschul	786	194.093	18,9	21,4	53
Humboldt-Tempel	1503	433.580	22,7	48,2	105,6
Kluckygasse	979	235.430	7,9	29,4	55,7
Polnische Schul	856	552.660	15,1	27,3	128,6
Pazmanitengasse	990	421.462	14,8	28,2	98,7
Tempelgasse	979	2.350.515	5,5	95,2	524,6
Turnergasse	611	431.524	7,6	47,8	88,9

4. Visualisation: communicating with larger audience

From the outset there was the intention of making the result of the reconstruction work accessible to the public at large (Tan and Rahaman 2009; Martens and Peter, 2008). Visualisation on the basis of detailed modelling seemed the obvious step to take in this context. It will hardly come as a surprise that developments have occurred in this area in the last ten years. While the internal ArchiCAD render engine has been helpful, a specific study of interior daylight conditions required the use of external rendering applications (3D-Studio; Artlantis Render Studio 2; etc.).

When the conceptual outline for the publication of a *city guide* was established, it turned out that some explanatory efforts were required for the illustration of built structures that are no longer physically available. If the site is a vacant lot, this may be relatively simple, but this was rarely the case. Free-standing synagogues were sacrosanct and were hardly ever found in Vienna. Several synagogues were built in a courtyard context, which made visual reconstruction harder. The disappeared structure was visualised as though it were still in its old place but with the current neighbouring buildings (Figure 2). Although on-site visits (with the city guide in hand) would be ideal, online solutions based on "street view-like applications" are a viable substitute today in an urban context (figure 3).

During the final editing of the city guide, most of the rendered illustrations were recomputed in order to provide maximum realism and consistency of the visualisations (figures 4–9). Visualisation of interiors was indispensable in cases where no photographs were available.

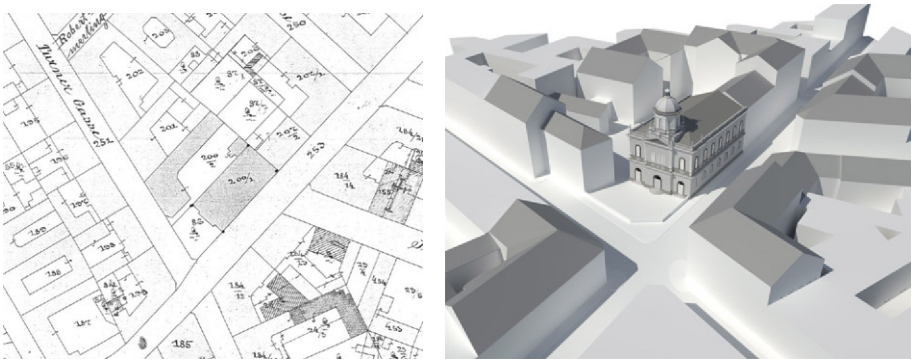

Figure 2a–b. Building in context (freestanding structure): Turnergasse 22.

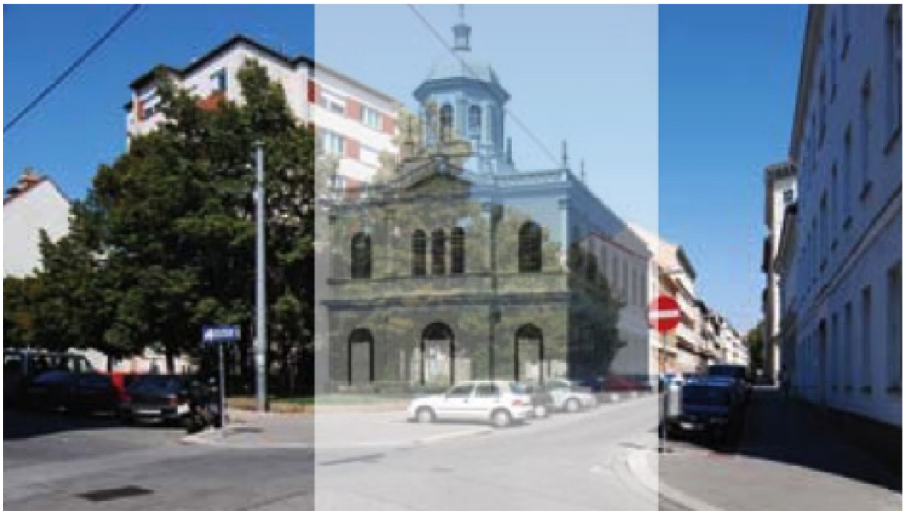

Figure 3. Street view: photomontage of situation at Turnergasse 22.

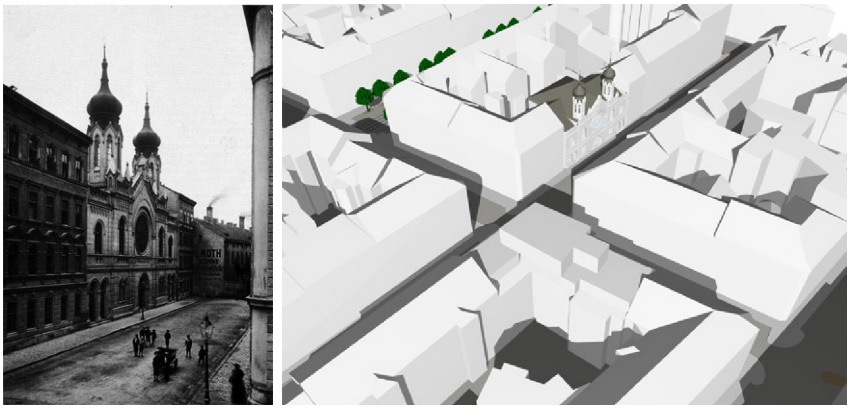

Figure 4a–b. Kluckygasse: historical photograph | illustration of urban context.

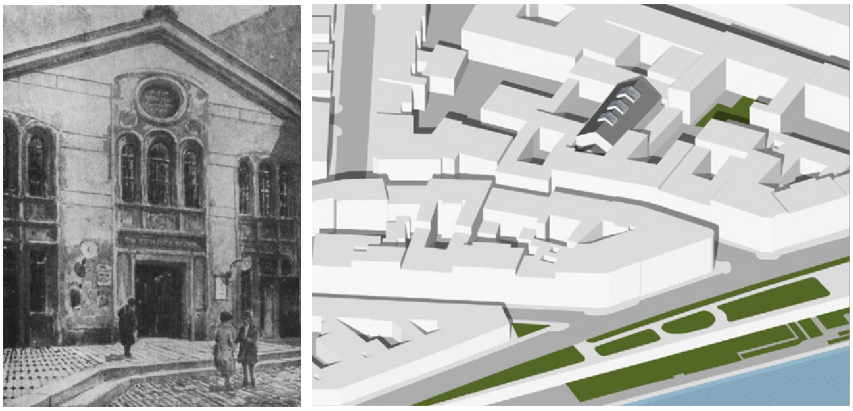

Figure 5a–b. Schiffschul: historical photograph | illustration of urban context.

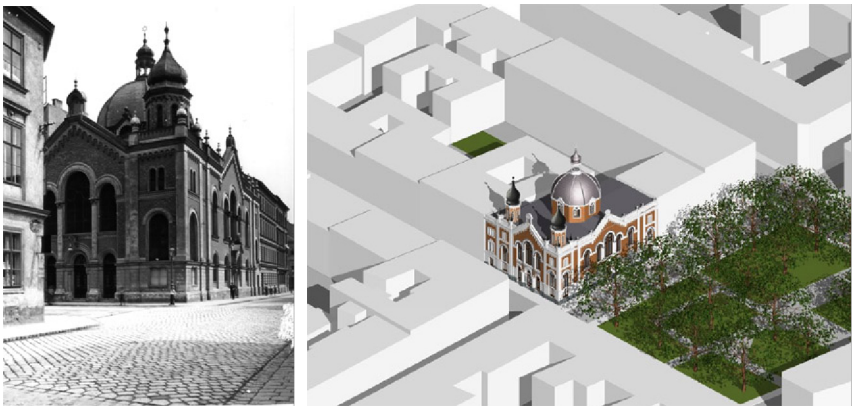

Figure 6a–b. Humboldt-Temple: historical photograph | illustration of urban context.

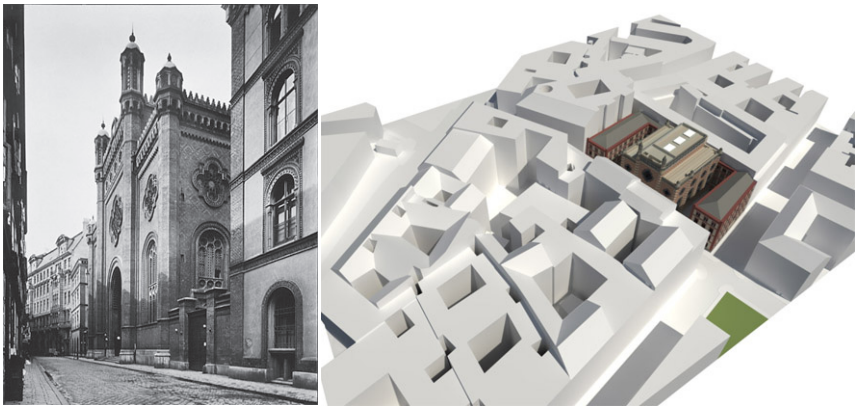

Figure 7a–b. Tempelgasse: historical photograph | illustration of urban context.

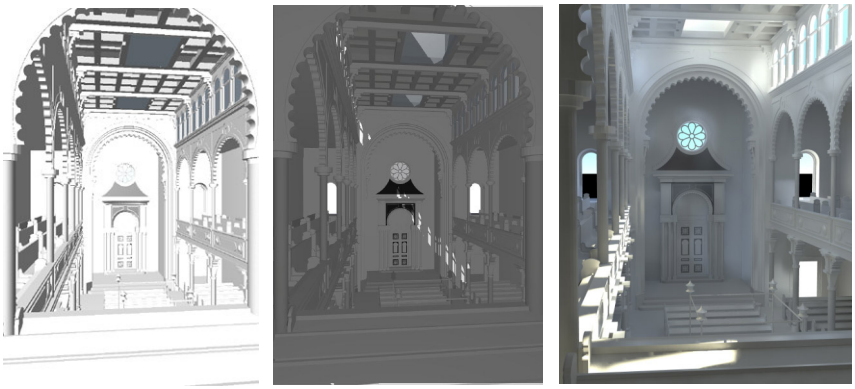

Figure 8a–c. Rendering results "Polnische Schul": shaded visualisation (ArchiCAD9 without shadow casting) | rendering with ArchiCAD9 | Artlantis Render.

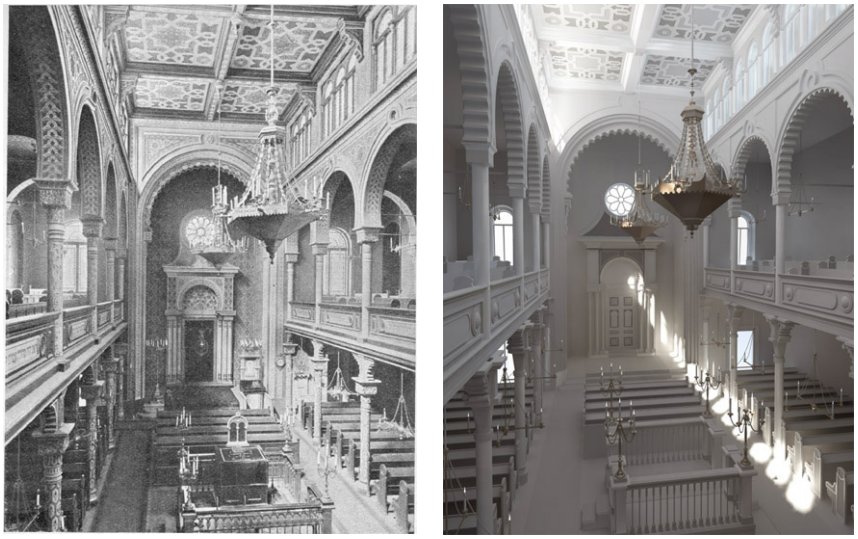

Figure 9a–b. "Polnische Schul": historical photograph | interior, visualisation using Artlantis Render Studio 2.

5. Conclusions and outlook

It is unlikely that the former synagogues of Vienna will be rebuilt in the foreseeable future. Apart from the fact that other structures have been erected on these sites, there is not currently the required volume of worshippers. These facts speak in favour of virtual reconstruction. Yet, there are a few exceptions: the courtyard at *Große Schiffgasse 8* has not been built up to date, and the basic structure at *Kaschlgasse 4* is available again after a supermarket has moved away.

This contribution has addressed the rarity of projects extending over a long period and the need to consider the future usability of data records. In terms of outlook we must mention the expansion of the knowledge base. In neighbouring countries (particularly Slovakia, Czech Republic, Hungary and Poland) eminent synagogue structures from the 19th and early 20th century are still preserved. Even if many of them are in need of restoration, they may at least be used for reference purposes. Another important aspect is the possibility for other disciplines (e.g., art history) to make use of the data structures established.

The dissemination of reconstruction results does not have to rely on rendered visualisations only, but may also use computer-assisted model-making on the basis of existing 3D modelling (Martens and Stellingwerff, 2005), since the investment involved can be estimated realistically. A travelling exhibition of model artefacts seems a conceivable goal.

The *city guide* concept has turned out to be very successful and has reached a large range of readers. Apart from the sales of the book, the guide received remarkable attention from German-language print media and radio channels and also resulted in local follow-up events related to the issue.

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