

The Medieval Jewish Quarter in Cologne

A virtual reconstruction of 6000 m² of archaeology

Marc GRELLERT, Technische Universität Darmstadt, Digital Design Unit, Germany

Norwina WÖLFEL, Technische Universität Darmstadt, Digital Design Unit, Germany

Sebastian RISTOW, MiQua – LVR-Jewish Museum in the Archaeological Quarter in Cologne, Germany

Ertan ÖZCAN, Archaeological Zone – City of Cologne, Germany

Michael WIEHEN, Archaeological Zone – City of Cologne, Germany

Abstract: The reconstruction of the medieval Jewish quarter—situated in the immediate vicinity of the Cologne town hall—is a shining example of a scholarly reconstruction. Working closely together, the team of the Archaeological Zone – City of Cologne, the research team of the MiQua project, the TU Darmstadt and external architectural historians/building researchers are currently investigating the architectural history of the synagogue and the Jewish quarter and developing exhibits for a planned museum. The Cologne example of a large archaeological site shed light on the potential of combining features, finds and virtual reconstructions. The most recent excavation results of the Archaeological Zone, City of Cologne as well as earlier records of excavations and features provided the basis for an initial digital model that presents a three-dimensional record of the features within the museum area. Although a plausible layout of the site and the floor plans had been developed, the question what the buildings actually looked like remained unanswered. An engraving of a panorama of Cologne in 1531 by Anton Woensam shows numerous half-timbered buildings. It is thus reasonable to assume that 200 years earlier—in 1349—most buildings in Cologne and in the Jewish quarter were half-timbered. Since Cologne no longer has any extant buildings of the period, the team took suitable examples from Limburg, a mere 120 km away, which still has comparable half-timbered houses of the time around 1300 documented by an extant comprehensive body of scholarly research including drawings of their original structures. These buildings served as models for the reconstruction of the rising walls. In a paradigmatic solution the reconstruction shows on the one hand bird's-eye perspective views which follow a comic-strip-inspired graphic style that underlines the reconstructive and hypothetical nature of the image. On the other hand, the films feature atmospheric tracking shots from a pedestrian's perspective.

Keywords: *digital feature model—virtual reconstruction—graphic representation—Jewish quarter—synagogue*

CHNT Reference: Grellert, Marc; Özcan, Ertan; Ristow, Sebastian; Wiehen, Michael, and Wölfel, Norwina. 2021. The Medieval Jewish Quarter in Cologne. A virtual reconstruction of 6000 m² of archaeology. Börner, Wolfgang; Kral-Börner, Christina, and Rohland, Hendrik (eds.), Monumental Computations: Digital Archaeology of Large Urban and Underground Infrastructures. Proceedings of the 24th International Conference on Cultural Heritage and New Technologies, held in Vienna, Austria, November 2019. Heidelberg: Propylaeum.

doi: [10.11588/propylaeum.747](https://doi.org/10.11588/propylaeum.747).

Introduction

The virtual reconstruction of large archaeological sites has a long tradition at the Digital Design Unit of the Technical University Darmstadt. Prominent examples are projects relating to the imperial tombs at Xian with a sub-project devoted to the Terracotta Army (2005–2007), Ephesus in Turkey (2007–2010) and the excavations at Tell Halaf, Syria (2013–2014). Usually, the results of these reconstructions are presented in exhibitions; sometimes they are undertaken as part of the exhibition preparation. Of particular interest in the presentation of virtual reconstructions is the consideration of archaeological features and findings: Not only do digital feature models in film show the starting point of the reconstruction, there is also a trend towards developing exhibits that combine archaeological relics and digital reconstructions in new and exciting ways.

For the MiQua (LVR-Jewish Museum in the Archaeological Quarter in Cologne) in the heart of Cologne—currently under construction—the Digital Design Unit of the TU Darmstadt (Faculty of Architecture) is developing a virtual reconstruction of the medieval Jewish quarter of Cologne and the synagogue. The reconstruction is based on the excavations which cover an area of 6,000 m². Further to the vestiges of the Jewish quarter, the archaeological exhibition also presents the remains of Roman buildings, among them the foundations of the Roman praetorium.

Several exhibits for MiQua's permanent exhibition are being developed in Darmstadt: an introductory film about the history of the Jewish community of Cologne in the Middle Ages and on what the Jewish quarter may have looked like, another film detailing the four phases of the architectural history of the synagogue, a third dedicated specifically to the Bimah, which sheds light on how the discovered architectural fragments inform the current reconstruction, and, finally, a general introductory film—shown at the beginning of the exhibition—that presents the 6,000 m² of archaeological exhibition space and introduces the two main subjects, namely the Roman praetorium with the aula regia and the Jewish quarter with its synagogue. The reconstruction of the Roman buildings was carried out at the Technical University of Budapest and was integrated into two films conceptualised and produced in Darmstadt.

The reconstructions thus far are the result of in-depth discussion with all the institutions and individuals involved in the project¹ as well as exhaustive preliminary studies and research that take their starting point in the findings of the Stadtarchäologie Köln (Cologne City Archaeology), which has been conducting excavations on the Cologne Rathausplatz (town hall square) since 2007, and the archaeological findings of Otto Doppelfeld in the 1950s.

Archaeology and Reconstruction

Drawing on the Cologne example of a large archaeological site, we will shed light not only on the possible combination of features and finds as well as on their digital and haptic images and the virtual reconstructions they give rise to but also on the potential they hold. The paper is typologically structured by scale – from urban space to building to a specific interior.

¹ Of particular note for the Archaeological Zone, City of Cologne are, above all, Katja Klieman (†), Ertan Özcan, Gary White, Michael Wiehen; for MiQua, Thomas Otten, Tanja Potthoff, Sebastian Ristow and Christiane Twiehaus; for the TU Darmstadt, Digital Design Unit: Marc Grellert, Patrik Grlic Shoran Soltani and Norwina Wölfel. As consultants: Pia Heberer, Norbert Nußbaum and Tina Schöbel.

Urban Space I – Buried Structures

The reconstruction of the medieval Jewish quarter—situated in the immediate vicinity of the Rathausplatz—is a shining example of a scholarly reconstruction. Working closely together, the team of the Archaeological Zone, City of Cologne, the research team of the MiQua project, the TU Darmstadt and external architectural historians/building researchers are currently investigating the architectural history of the synagogue and the Jewish quarter² and developing exhibits for the planned museum. The most recent excavation results of the Archaeological Zone, City of Cologne as well as earlier records of excavations and features (Doppelfeld, 1959)—among them a point cloud scan of parts of the features produced by the earthquake monitoring station Bensberg³ of the Cologne University—provided the basis for an initial digital model that presents a three-dimensional record of the features within the museum area (Fig. 1).

Among these features are the vestiges of the Roman praetorium.⁴ The background to the generation of the model was the fact that the architectural firm planning the exhibition did not have access to the site which had been backfilled with sand in preparation of the construction of the museum. The digital feature model was to serve as the starting point for a haptic working model (scale 1:100). Produced with rapid prototyping technologies, it helped the architectural firm to plan the exhibition. It was a stroke of luck for the reconstruction because it provided a good three-dimensional basis.

The creation of the digital feature model—which is not only of great importance as the basis for any reconstruction but also central to the above-mentioned presentations in various media—was based on foundations that were as wide-ranging as they were heterogenous. There were three very distinct areas with different parameters. For the archaeological remains of the praetorium—which have been accessible to the public since 1956 – there was a 3D scan that was combined with current photographs and extant architectural surveys to create a simplified digital polygonal model. The reconstruction of much of the Jewish quarter, on the other hand, relied on the maps drawn up by the Archaeological Zone, City of Cologne team. From a catalogue of hundreds of digital drawings, individual plan drawings and profiles had to be selected to digitally reconstruct sections of the walls in simplified 3D models. Several of the plan drawings lacked vital information about absolute heights, which meant that it was necessary to go back to the digitised original archaeological drawings. A third area lay precisely between the other two. Here the dig and its documentation were still ongoing, so that scans of on-the-spot-drawings documenting the archaeological features were used to create the 3D models.

² For an overview of the research results regarding the Jewish quarter, see Kliemann and Potthoff (2019), Kliemann and Wiehen (2019), Potthoff and Wiehen (2018), Kliemann and Ristow (2019)

³ We are grateful to Prof. Dr. Klaus G. Hinzen for making the data available.

⁴ For the most recent research into the Cologne praetorium, see Ristow (2019)

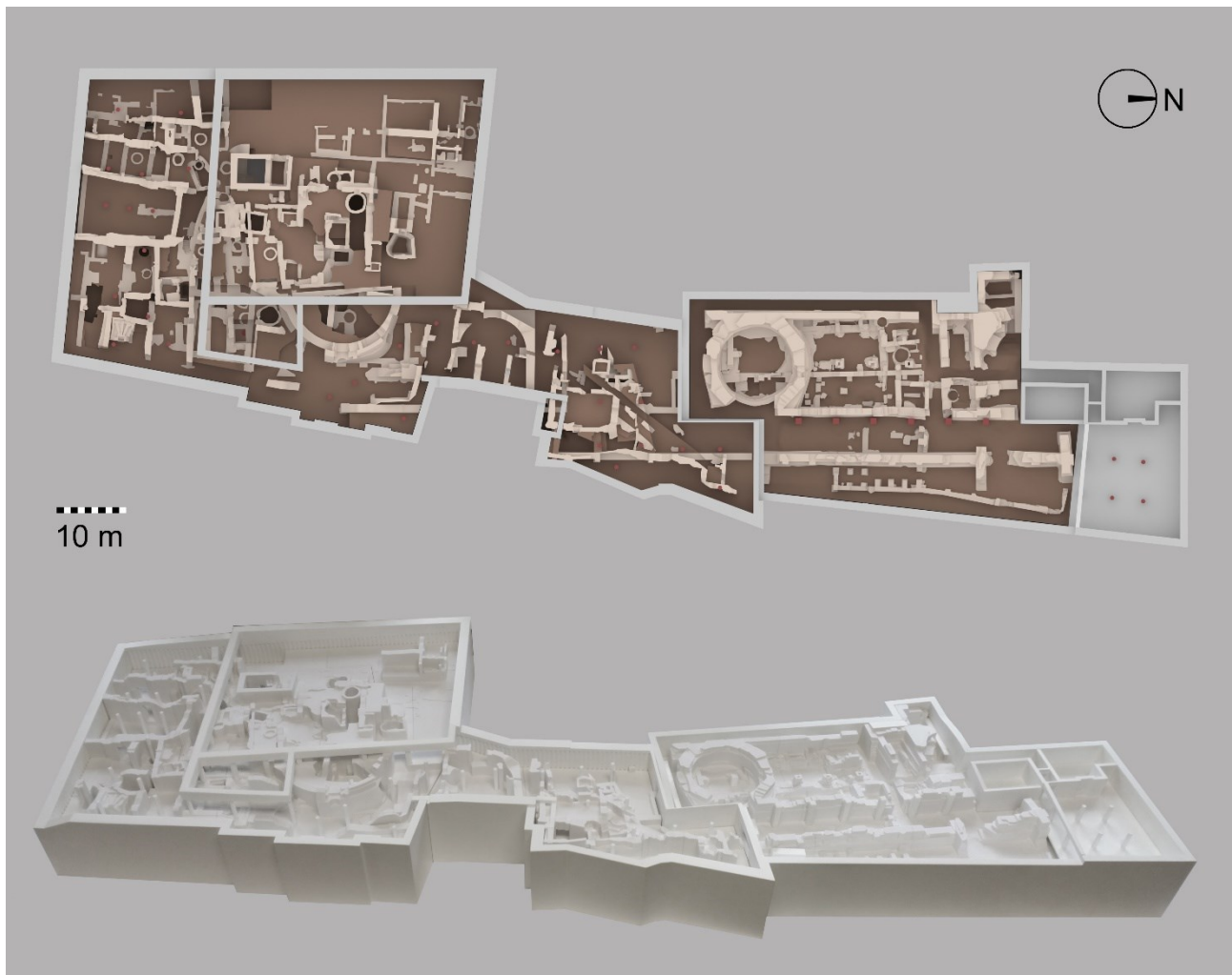


Fig. 1. Above: digital feature model, below: rapid prototyping model (© Architectura Virtualis, Cooperation partner of TU Darmstadt).

Proceeding from this digital model, which consists primarily of cellar walls, the next step was to construct a model that included the site and the floor of the ground floor. Because there were only a few spots that yielded information about the medieval street level, further sources had to be consulted to reconstruct the terrain. An architectural survey of the Rathausplatz, which had been part of the Judengasse ('Jews' Lane') in the Middle Ages, showed a ground slope. In a process of parallel translation this was shifted downwards until congruence with the three original heights of the medieval street level was achieved. Research into the architecture of the old city suggests that cellars were lit and ventilated above street level, so that the floor level of the ground floor probably lay between 50 and 100 cm above street level.

As the Jewish quarter was bigger than the excavated plots, the question arose as to whether it was possible to establish the footprints of further buildings. Comparison of the excavated cellar walls with the earliest, relatively precise map of the city of Cologne—the cadastral map of 1837—yielded interesting results. Overlaying the archaeological findings with the cadastral map, which had already been georeferenced during an earlier Cologne University research project under Norbert Nußbaum, showed that the extant cellar walls are almost exactly congruent with the situation of 1837. For an abstract orthogonal representation of the Jewish quarter, further plot boundaries were hypothesised

with the aim to delineate a typical medieval architectural structure. At the same time, these results were compared with earlier research into the Jewish quarter. As early as 1920, Adolf Kober, a rabbi and historian, developed a map of the quarter (Kober, 1920). He analysed the Cologne *Schreinsbücher* (Real estate cadastre register) – a unique medieval record of property transactions, recording the sales and changes of ownership of buildings and plots. The *Schreinsbücher* are organised by Cologne parishes, and one of the books is devoted to properties in the Jewish quarter with entries in Latin and Hebrew (Schmandt, 2002, Stern and Hoeniger, 1888). The plan, which was drawn up in Darmstadt on the basis of this multifaceted body of information, shows the possible situation of the period immediately before the pogrom of 23/24 August 1349.⁵

Urban Space II – Structures Above Ground Level

Although a plausible layout of the site and the floor plans had been developed, the question what the buildings actually looked like remained unanswered. An engraving of a panorama of Cologne in 1531 by Anton Woensam shows numerous half-timbered buildings. It is thus reasonable to assume that 200 years earlier—in 1349—most buildings in Cologne and in the Jewish quarter were half-timbered. What little had remained of that into the twentieth century disappeared in the destruction of Cologne in the Second World War. The last systematic investigation of the old city of Cologne was undertaken before 1939. Hans Vogt's studies into the appearance of the medieval half-timbered houses suggest that the upper floors were jettied (Vogts, 1966). Since Cologne no longer has any extant buildings of the period, might suitable examples be found in other locations? Limburg, a mere 120 km away, still has comparable half-timbered houses of the time around 1300. What's more, the team could draw on an extant comprehensive body of scholarly research including drawings of their original structures (Ebel, 2002; Bomert, 2002). These buildings served as models for the reconstruction of the rising walls. Based on the drawings, seven of the Limburg buildings have been virtually rebuilt. Where the Cologne cellar floor plans matched, the constructive structures were adopted. The overriding principle was to retain the dimensions of the supporting posts and bays, changing the distance between them by no more than 5 cm. Where that did not fit, it was attempted to insert two supporting posts into the construction in order not to change the system of the construction what inserting only one post normally would do.

The resulting picture of the Jewish quarter with half-timbered houses was complemented by what we know of a synagogue built in stone. The reconstructions—also in stone—of the women's synagogue, the architectural structure above the mikvah, one residential building, an assumed bakehouse and a probable bathhouse were based on historical sources and very scant archaeological evidence.

The question was how to deal conscientiously with the hypothetical nature of the reconstruction of the buildings above ground level on the one hand and the visitors' need for vividness on the other. We believe our approach provides a paradigmatic solution to this problem. A bird's-eye-perspective overview presents the Jewish quarter with the communal facilities of the synagogue, women's synagogue, bakehouse, and *hekdesch* (hospital-cum-poorhouse) in black and white. The emphasis on

⁵ The pogroms, which were perpetrated all over Europe and in which Jewish communities served as scapegoats for the ravages wrought by the plague – sometimes months before the disease actually reached the cities – also affected the Jewish population of Cologne. All of Cologne's Jews were either killed or driven out.

the edges of the reconstructed buildings invests the overview with a certain comic-strip aesthetic that underscores the reconstructive character of the representation (Fig. 2, 5). This is complemented by tracking shots from a pedestrian's perspective, in which the reconstruction is atmospheric and features a large number of details based on medieval examples, among them stone socles, stairs, doors, windows, roofing and guttering (Fig. 3, 4, 11).

The two styles of representation – ‘comic strip aesthetic’ and ‘atmospheric’ – are embedded in an installation devoted to the history of the Jewish community. The exhibit consists of two elements: a haptic model of the medieval walls extracted from the digital model of the findings and situated within the archaeological exhibition space (the Roman walls and foundations have been deliberately disregarded) and a monitor on the wall behind.

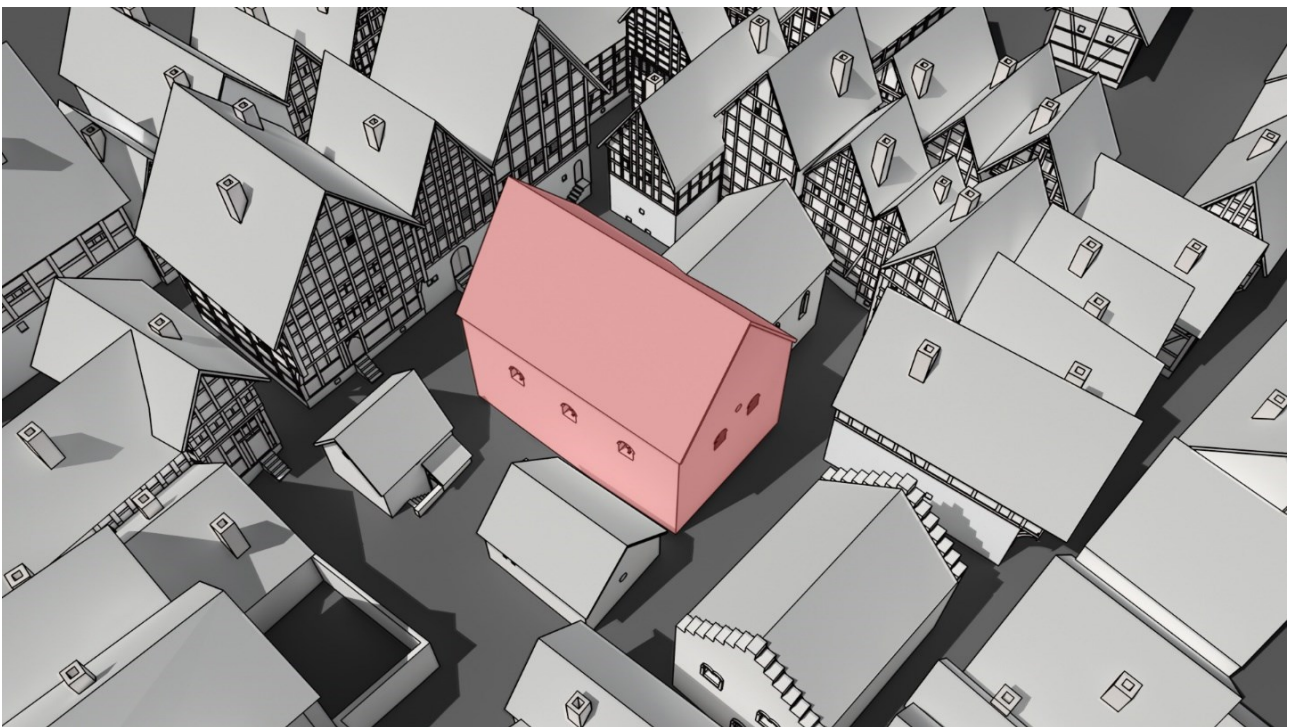


Fig. 2. Simplified (comic-strip aesthetic) bird's eye view of the Jewish quarter with the synagogue highlighted in red (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).

A beamer can be used to project orthogonal top views of different spatial states onto the model and to pick out specific structures, walls, or buildings. Complementing the projections and synchronous with them, further information is presented on the monitor. For example, as the foundations of the different Jewish institutions are consecutively picked out on the model, the monitor singles out the same buildings in a bird's-eye view of the 3D reconstruction of the quarter. When the monitor plays a sequence of atmospheric tracking shots, the camera movements are echoed by a wandering pictogram that tracks and locates them on the model. This cinematic presentation features several striking moments in which monitor and model home in on one and the same motif (Fig. 6).

The exhibit described above sheds light on how the Jewish quarter with its timbered buildings was reconstructed. It does not provide any details on how and on what basis the synagogue was reconstructed. This is done in a different exhibit.



Fig. 3. Atmospheric reconstruction of the Enggasse in the Jewish quarter seen from a pedestrian's perspective, (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).



Fig. 4. Atmospheric reconstruction of a corner in the Jewish quarter seen from a pedestrian's perspective (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).

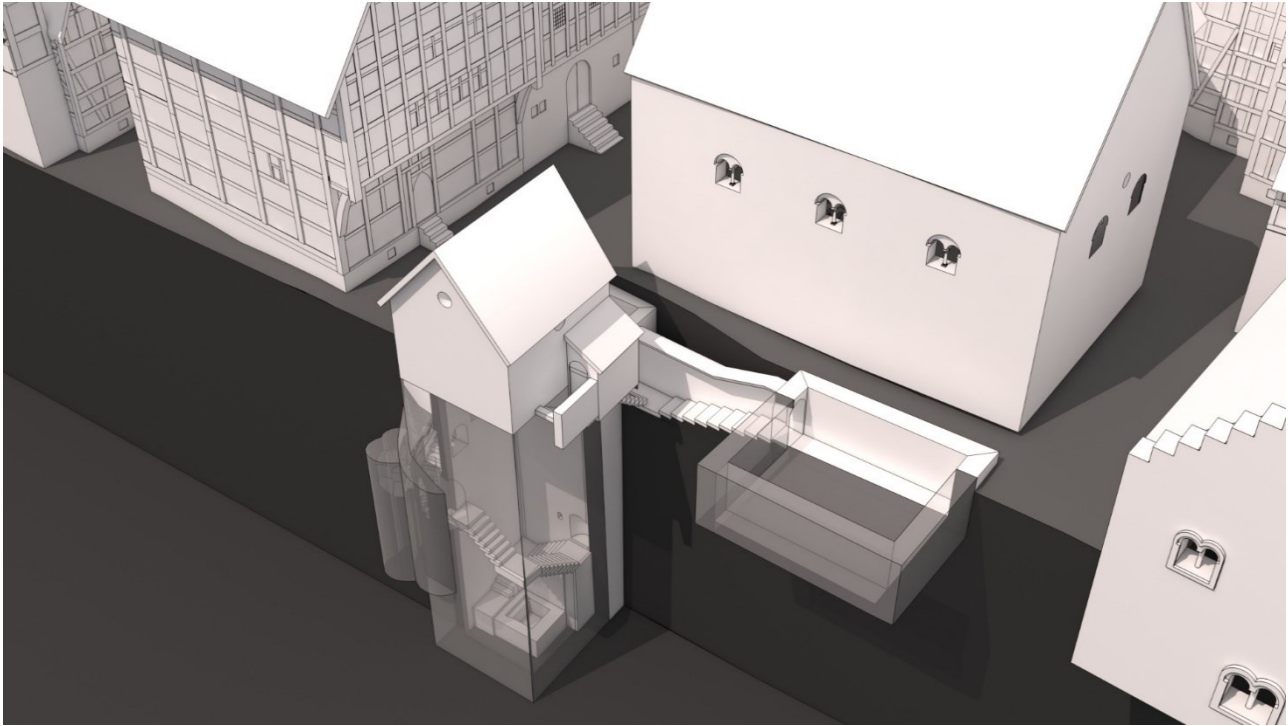


Fig. 5. Simplified (comic-strip aesthetic) bird's eye view of the Jewish quarter with a cross section of the mikvah (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).

Buildings

Archaeological features provided not only the starting point for the reconstruction of the urban structure of the Jewish quarter, they also formed the basis of the detailed reconstruction of the Roman buildings and the synagogue. In both cases, the foundations and other architectural vestiges indicate several building phases. The visualisation by means of digital models for the exhibition at MiQua and the academic papers are based directly on these phase-specific vestiges. Fig. 7 shows a still from a film about the Roman praetorium. This paper does not go into the details of that reconstruction—carried out by the Technical University of Budapest under the direction of Zsolt Vasáros—instead it focuses solely on the reconstruction of the synagogue undertaken in Darmstadt.⁶ The medieval synagogue was located at the very heart of the city, less than a hundred metres from today's old town hall. Written sources date its construction to either 1012 or 1040. Until the expulsion of the Jews in the Middle Ages in 1424, four distinct construction phases can be distinguished:

Phase I: 1012 / 1040 to 1096

Phase II: 12th century to 13th century

Phase III: 13th century to 1349

Phase IV: 1372 to 1424

⁶ The subdivision draws on the work by Otto Doppelfeld and Katja Kliemann. Doppelfeld identified four, Kliemann five phases. She counted the non-Jewish interim use between 1349 and 1395 as a separate phase. The phases presented here are in line with the planned presentation at the MiQua and disregard the non-Jewish interim use. This focus on the synagogue seemed to make more sense in the context of the planned museum and its audience. See Doppelfeld 1959 and Kliemann / Ristow 2019.

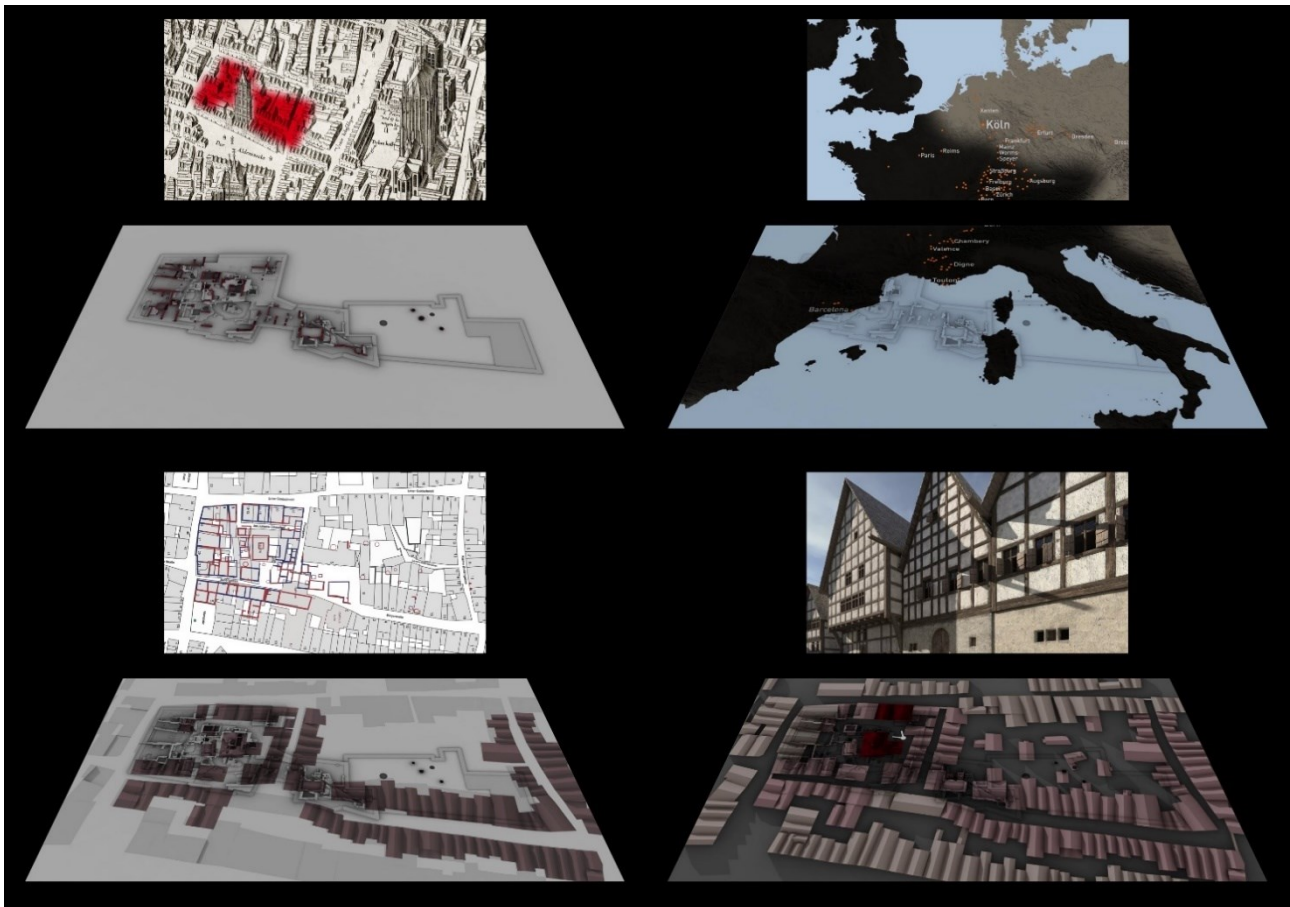


Fig. 6. Simulation of the installation of the Jewish quarter (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).

Starting point for the reconstruction are the archaeological excavations undertaken by Otto Doppelfeld in the 1950s as well as the more recent excavations by the Archaeological Zone, City of Cologne (since 2007), currently under the aegis of Gary White. During the Second World War, the old city centre of Cologne was largely destroyed. Archaeologists have since been able to investigate the area in front of the old town hall and to excavate the vestiges of the synagogue and the surviving mikvah. These excavations were extensively documented in drawings, photographs, and a detailed diary. The results were published by Doppelfeld. During the subsequent levelling of the site, some original architectural vestiges above the foundations of the synagogue were inadvertently razed. It was not until the excavations of 2007 that attention once again focused on the remains of the synagogue, and numerous fragments were (re)discovered and secured.

The results of Doppelfeld's dig are at the heart of the reconstruction. In Darmstadt, Doppelfeld's documentation was studied, analysed, and translated into a 3D model that outlines the four above-mentioned phases (Fig. 8).⁷ In a joint session of representatives of Archaeological Zone, City of Cologne, MiQua and TU Darmstadt as well as associated outside experts, this phase model was

⁷ The archaeological results were analysed by Norwina Wölfel at the Digital Design Department. The digital feature model was developed under her aegis with the assistance of Shoran Soltani and Patrik Grlc. The results were discussed, revised, and adapted in Darmstadt in conversations with Sebastian Ristow (MiQua team) and later discussed with the whole project team of Archaeological Zone - City of Cologne, MiQua and TU Darmstadt.

discussed and developed further. The models presented here reflect the state of the investigation as of February 2020 (Fig. 9, 10).



Fig. 7. Reconstruction of the Roman Aula Phase IV (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Budapest, Fakultät für Architektur, Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).

Phase I – 1012/1040 to 1096

The vestiges feature four ashlar (red in Fig. 9, top left) that are interpreted as part of the structuring of the facade. The absence of infill between the two central ashlar suggests an entrance. The western wall is reconstructed as the entrance façade with blind arches (Fig. 9, lower left). We do not know how many windows the synagogue had. The assumption is that it had ten round-arched windows, three each on the northern and southern sides and two each on the eastern and western sides. On each of the latter a further circular window has been reconstructed. This hypothetical arrangement follows the surviving window plans in the medieval synagogues of Speyer and Worms.

Phase II – 12th to 13th century

During Phase II, the western wall was reinforced. One of the thresholds found on the northern wall could possibly be on a level associated with Phase II. It is assumed that the entrance was moved to the northern wall and that the original organisation of the western façade was obliterated by the reinforcement of the wall. Fragments of a mullioned window, found during excavations near the synagogue in the heterogeneous rubble that was the result of the medieval pogroms, have been integrated into a hypothetical reconstruction of the synagogue—but they could also have been part of different buildings in the vicinity. In reconstructing architectural details, the team sought to use extant archaeological finds that could plausibly have been part of the lost original building—in many cases we cannot be absolutely certain that a given fragment was part of the synagogue rather than of another building nearby.

The reinforcement of the western wall and the insertion of the mullioned windows may have been undertaken as part of the restoration work carried out to fix the damages the building suffered in the wake of the Crusade of 1096. Also from this period is the first evidence of a stone plinth, located in the centre of the eastern wall, which supported at the Torah shrine.

Also of note is a threshold on the eastern end of the northern wall. It may be interpreted as a link to a first women's room. However, the size and orientation of that space must remain hypothetical and cannot be reconstructed with any certainty (Fig. 9, top and lower right).

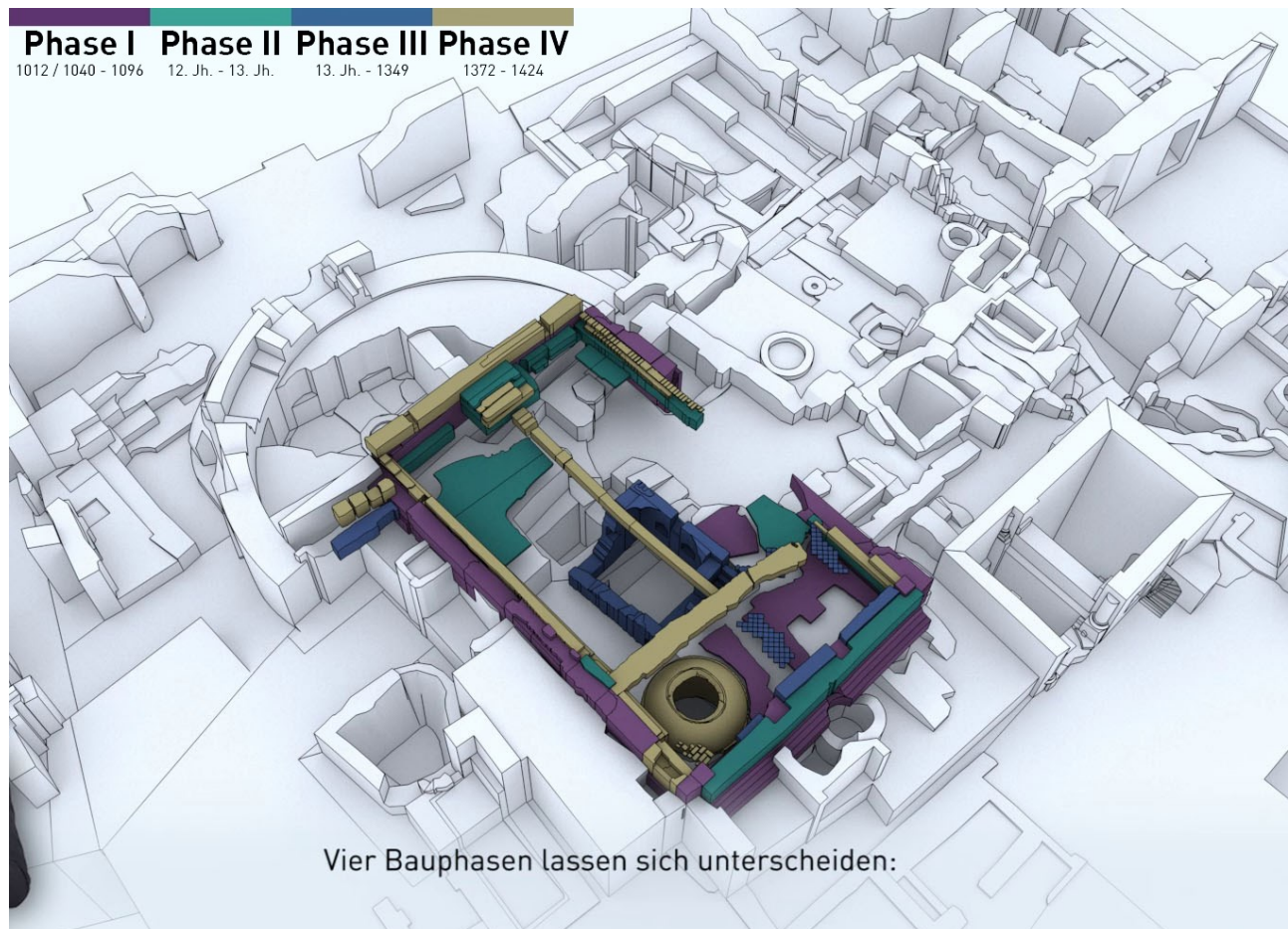


Fig. 8. Reconstruction of the excavation by Otto Doppelfeld (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).

Phase III – 13th century to 1349

There are written sources that testify to the existence of a women's synagogue by 1281 at the latest. Katja Kliemann, member of the Cologne archaeological team, interpreted a section of a wall on the eastern part of the northern wall as the eastern boundary of the women's building. Following Kliemann and in view of the later Phase IV, two vestiges of walls can be interpreted as the boundaries of the later women's synagogue, which was most likely reduced in size after the pogrom of 1349 (Fig. 10 lower right). Kliemann further argued that if these do indeed define the location of the women's building in the later phase, it is not unreasonable to assume that the earlier building had the same orientation. No trace of the western wall of the women's synagogue has been found. In the reconstruction it was placed close to the entrance to create a space of a similar size to the women's

synagogues in Worms and Speyer. Fig. 10 lower left and Fig. 11 show the possible appearance of Phase III. Of particular importance in Phase III is the cellar—still extant—which has been interpreted as a storage space and above which a Gothic bimah (Fig. 10 top left) has been reconstructed (more about this later).

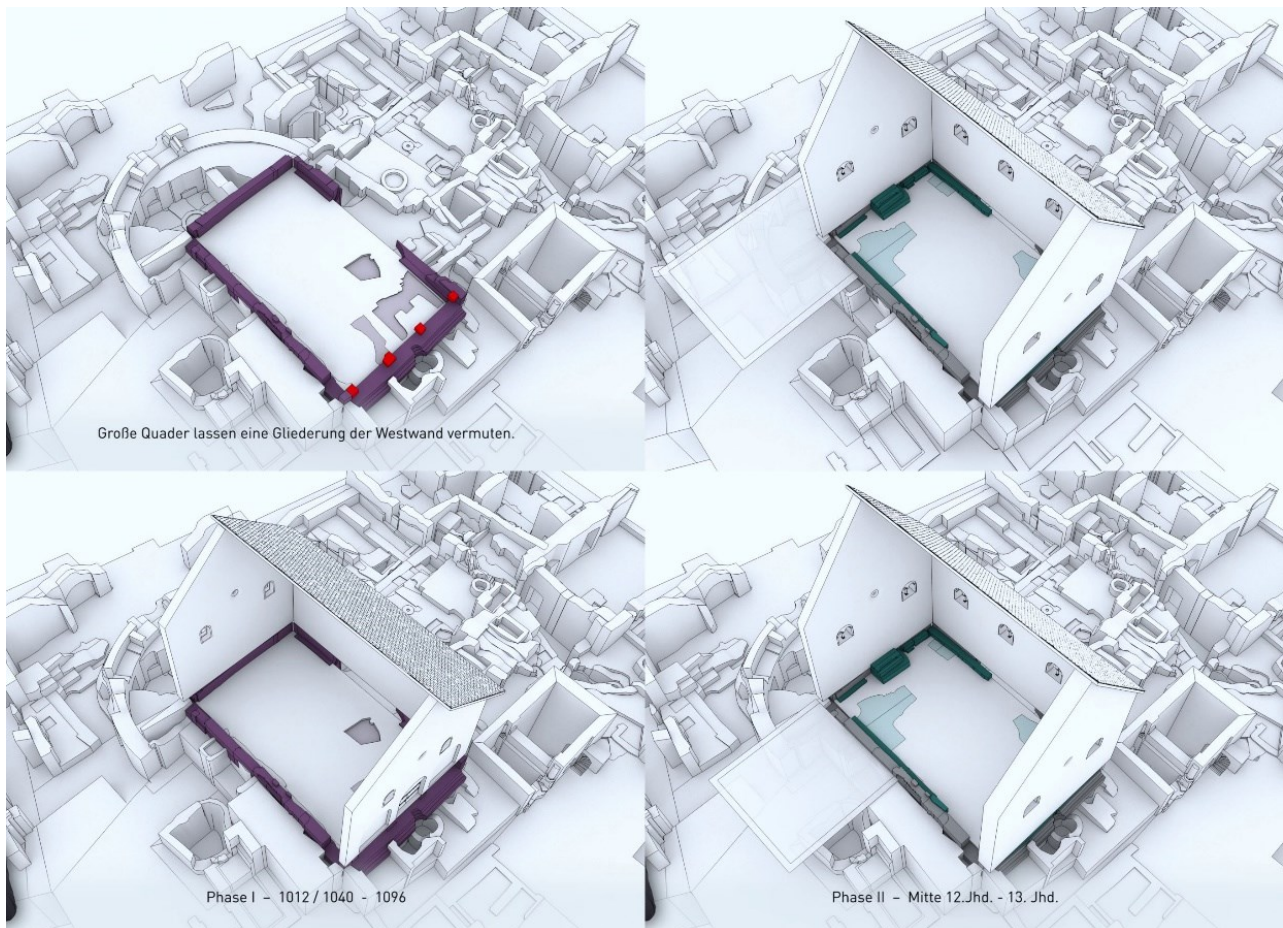


Fig. 9. Feature model and reconstruction, synagogue Phase I and II (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).

Phase IV – 1372 to 1424

Annihilated in the pogrom of 1349, the Jewish community re-established itself in Cologne after Jews were readmitted to the city in 1372. Historical sources indicate that in 1395 it became once again possible to use a synagogue on the old site. Between 1349 and 1395, the site had thus been put to a non-religious use by the city's Christian population. The construction of a latrine in the north-west corner of the synagogue terrain is the clearest indication of a profane use. It probably also accounts for the reduction in size of the new synagogue building in the west (Fig. 10 lower right). Another indication of the non-religious interim use of the site is the bit of wall in the middle of the synagogue (Fig. 9 top right), orientated west-east towards the plinth of the Torah shrine. The vestiges of a wall shown in red in Fig. 10 upper right are interpreted as the new western wall. In the west, adjacent to the former western wall of the synagogue, residential use is to be assumed. The two vestiges of

walls mentioned earlier, which jut out perpendicularly from the northern wall and are shown in red in Fig. 10 lower right, may have been the exterior walls of the pared-back women's synagogue.

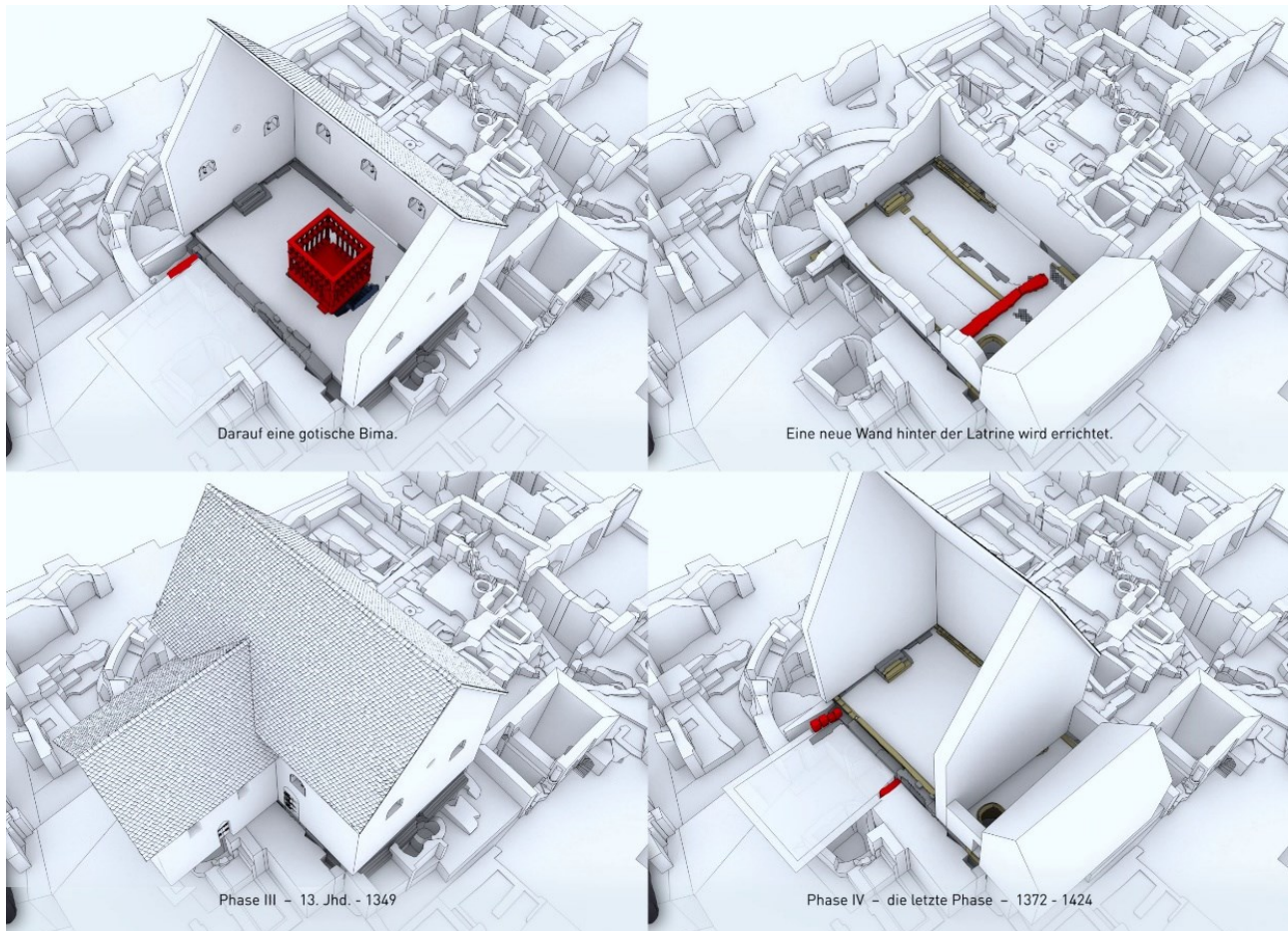


Fig. 10. Feature model and reconstruction, synagogue Phases III and IV (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).

With the expulsion of the Jews in 1424, the Jewish use of the medieval synagogue came to an end. Two years later, the site was occupied by the Ratskapelle (city council chapel) Saint Mary in Jerusalem. Its dimensions are identical to those of the synagogue in phase I to III. Because the Ratskapelle was destroyed in the Second World War, it cannot be ascertained how much of the architectural fabric of the former synagogue had been incorporated into the chapel.



Fig. 11. Atmospheric reconstruction of the synagogue, Phase III (© Stadt Köln, Dezernat Kunst und Kultur, VII/3 - Archäologische Zone/Jüdisches Museum, LVR-Jüdisches Museum im Archäologischen Quartier [MiQua], Technische Universität Darmstadt, Fachgebiet Digitales Gestalten).

Interior

Even more detailed is the reconstruction of the bimah, which is based on the extant features and findings. In preparation of the archaeological documentation, the MiQua team had already scanned hundreds of finds dug up as part of the excavations ongoing since 2007. Most of the catalogued objects were assigned to the bimah. The virtual 3D models of the finds allowed for an architectural reconstruction of this central element of the medieval synagogue. At the heart of the argumentation are three matching fragments of moulding with traces of two column bases. These three fragments provide a clear indication of the distance between the centre lines, while the still extant cellar beneath the bimah outlined the structure's footprint. This raised the question whether a multiple of the distance between the centre lines coincided with the dimensions of the socle formed by the cellar. The answer was unequivocal: both along the length and the width, multiples of the distance between the centre lines correspond with the dimensions of the socle.

Column fragments and capitals were found to match the cross sections of the column bases of the moulding fragments. They formed the vertical support of the bimah. Gothic construction principles such as the use of compass and ruler set the parameters for the calculation of the Bimah's height. The state presented here is very much a work in progress and not final. As the reconstruction proceeds, it will integrate further finds.

The presentation of the finds in the permanent display of MiQua is to combine originals and virtual reconstructions and draw on an earlier installation. In the exhibition *Restless Times. Archaeology in Germany*, shown from 21 September 2018 to 6 January 2019 at the Martin Gropius Bau in Berlin, several architectural fragments of the bimah were set on a pedestal. A monitor installed above allowed visitors to follow the reconstruction of the bimah and where in the reconstructed architecture

the fragments on display could be found. While the film presented the reconstruction step by step, picking out, enlarging, and rotating the individual fragments, a beamer highlighted the corresponding objects on the pedestal (Fig. 12).

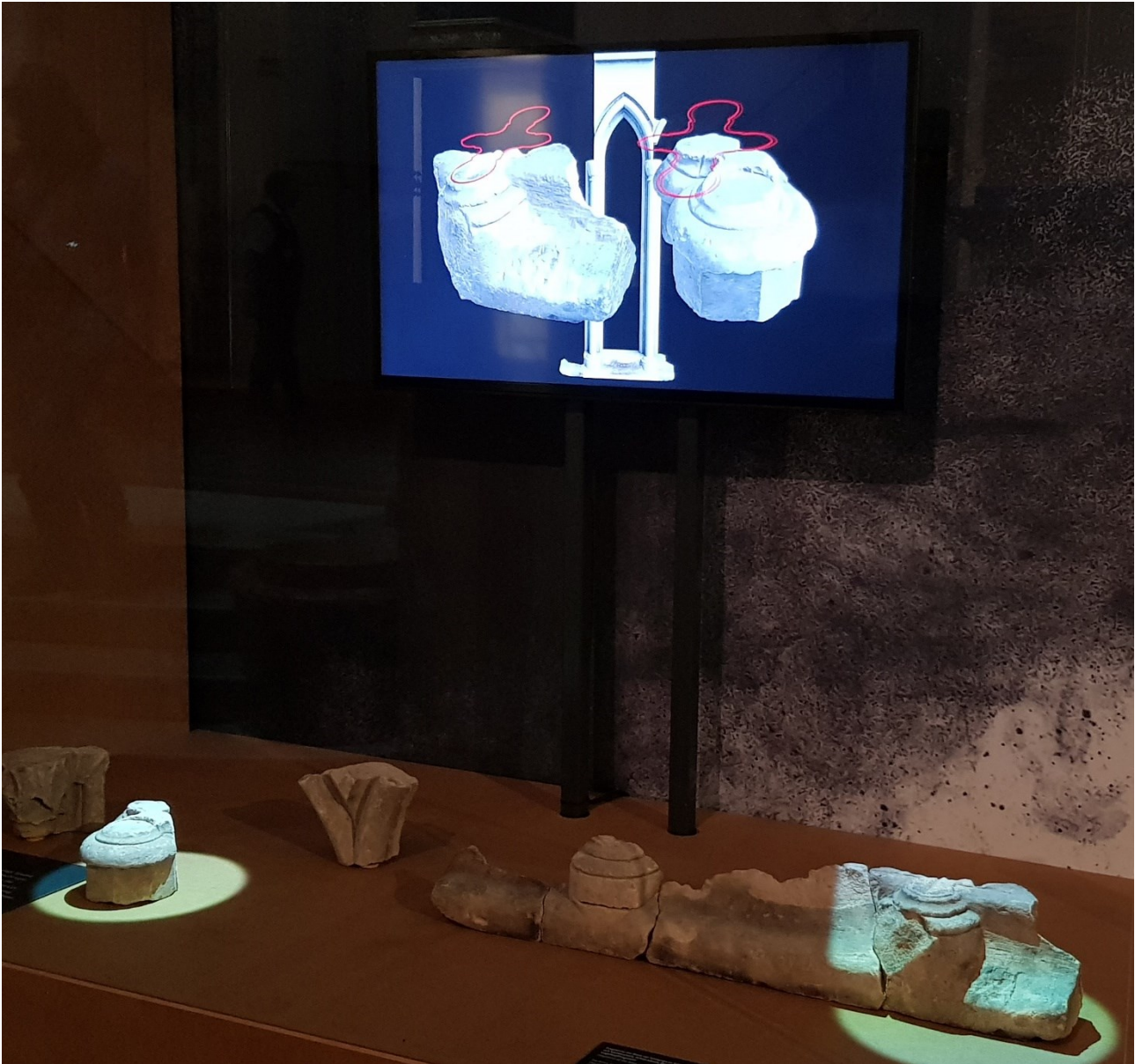


Fig. 12. Installation of the virtual reconstruction of the bimah at Martin-Gropius-Bau 2019. (© Architectura Virtualis, Cooperation partner of TU Darmstadt)

Concluding Remarks

Working on this project has highlighted just how much scholarly reconstructions benefit from the digitisation of archaeological features and finds. Possible solutions and variants can be arrived at and crosschecked with greater ease. Moreover, digitisation has enormous potential in the presentation of findings. The three-dimensional visualisation of finds, features, and their interpretations brings together different forms of knowledge in an immediate and compelling way that allows viewers to follow complex lines of arguments. Furthermore, rapid prototyping has the potential to create haptic models of archaeological or architectural features that can become projection screens for more

detailed information on the site or its history over time. The example of the bimah illustrates the potential inherent in the mutually enhancing presentation of virtual reconstructions and original objects in a combined exhibit.

The members of the project team seek to forge new ways of presenting virtual reconstructions. Particularly in exhibitions, two very different expectations must be reconciled. On the one hand, the museums, audiences and colleagues involved in the field want to see a scholarly and scientific approach to reconstructions, on the other, audiences call for comprehensibility, immediacy and atmospheric images. In this project, it was tried to develop a differentiated visual language that would satisfy all those demands. In the representation of the Jewish quarter and in the derivation of the reconstruction of the synagogue, we have worked with a dual visual aesthetic. On the one hand, the bird's-eye perspective views follow a comic-strip-inspired graphic style that underlines the reconstructive and hypothetical nature of the image (Fig. 2, 5, 8–10). On the other hand, the films feature atmospheric tracking shots from a pedestrian's perspective (Fig. 3, 4, 11).

To satisfy the demand for scholarliness, the decisions informing and driving the reconstruction process and the results and findings are recorded in a documentation tool for virtual reconstruction co-developed by the team in Darmstadt (www.sciedoc.org) (Grellert et al., 2019; Pfarr-Harfst and Grellert, 2016). A first publication of the Cologne project in this tool is planned for 2021.

References

- Bomert, J. C. et al. (2002). Limburg an der Lahn, Forschungen zur Altstadt. Limburger Fachwerkbauten des 14. und 15. Jahrhunderts. Heft 3. Limburg.
- Doppelfeld, O. (1959). Die Ausgrabungen im Kölner Judenviertel. in Asaria, Z. (ed.) Die Juden in Köln. Von den ältesten Zeiten bis zur Gegenwart. Köln, pp. 71–145.
- Ebel, J. (ed.) (2002). Limburg an der Lahn, Forschungen zur Altstadt. Limburger Fachwerkbauten des 13. Jahrhunderts. Heft 2. Limburg.
- Grellert, M., Pfarr-Harfst, M. Schmid, J. (2019). Documentation for Virtual Reconstructions. One Year R-A-M – Reconstruction-Argumentation-Method – A Report of First Experiences. in Proceedings of the 22nd International Conference on Cultural Heritage and New Technologies 2017. Vienna, 17 pages. Available at https://www.chnt.at/wp-content/uploads/eBook_CHNT22_Grellert_etal.pdf (Accessed: 29 June 2019).
- Kliemann, K. and Potthoff, T. (2019). novus murus aedificatus a judeis, Grenzen und Befestigungen des mittelalterlichen jüdischen Viertels in Köln, in Müller, J. (ed.) Befestigung und Grenze in Mittelalter und Neuzeit, Mitteilungen der Deutschen Gesellschaft für Archäologie des Mittelalters und der Neuzeit, 32, Paderborn.
- Kliemann, K. and Wiehen, M. (2019) Topographie und Infrastruktur des mittelalterlichen jüdischen Viertels in Köln, in Stürzebecher, M. and Paulus, S. (eds.), Erfurter Schriften zur jüdischen Geschichte. Band 5. Inter Judeos – Topographie und Infrastruktur jüdischer Quartiere im Mittelalter. pp 64–79. Quedlingburg.
- Kliemann, K. and Ristow, S. (2019). Köln und das frühe Judentum nördlich der Alpen. Kontinuität, Umbruch oder Neubeginn? Beiträge zur rheinisch-jüdischen Geschichte 9, H. 9, 2019, pp 8–36.
- Kober, A. (1920). Grundbuch des Kölner Judenviertels 1135–1425. Ein Beitrag zur mittelalterlichen Topographie, Rechtsgeschichte und Statistik der Stadt Köln (Publikationen der Gesellschaft für Rheinische Geschichtskunde 34). Bonn.
- Pfarr-Harfst, M. and Grellert, M. (2016). The Reconstruction – Argumentation Method: Proposal for a Minimum Standard of Documentation in the Context of Virtual Reconstructions, in Ioanides, M. et al. (eds.), Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection, Heidelberg, Berlin, pp. 39–50.

- Potthoff, T. and Wiehen, M. (2018). "da man die Juden zu Colne sluch [...] inde die hus in der Judengassen verbrannt wurden" – Das Kölner Judenpogrom von 1349, in Diener, A., Müller, J., Untermann, M. Archäologie des Glaubens. Umbrüche und Konflikte. Mitteilungen der Deutschen Gesellschaft für Archäologie des Mittelalters und der Neuzeit. 31.2018. Paderborn. pp. 21–36.
- Ristow, S. (2019). Das Praetorium von Köln, in Havas, Z. AUTHENTICITY AND EXPERIENCE, Governor's palaces of Roman imperial period and the limes, Proceedings of the international conference, Budapest, 5–6 November 2018, AQUINCUM NOSTRUM II. 8. Budapest.
- Schmandt, M. (2002) Judei, cives et incole: Studien zur jüdischen Geschichte Kölns im Mittelalter (Forschungen zur Geschichte der Juden, Abt. A, Abhandlungen Band 11). Hannover.
- Stern, M. and Hoeniger, R. (1888). Das Judenschreinsbuch der Laurenzpfarre zu Köln. Im Auftrage der historischen Commission für Geschichte der Juden in Deutschland (Quellen zur Geschichte der Juden 1). Berlin.
- Vogts, H. (1966). Das Kölner Wohnhaus. Bis zur Mitte des 19. Jahrhunderts. Erster und zweiter Band. Neuss.