Digital Models

Reconstructing and understanding exhibitions spatially

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Introduction

The digital modelling of exhibitions is a new form of multidimensional reconstruction that not only serves to recreate auditive and visual dimensions but entire object-space constellations. Beyond their significance for the museology and historiography of exhibitions, digital exhibition models also offer innovative educational and structural qualities for museum practice and archival work. The range of possible applications outlined above indicates that, depending on how they are used, different functions are required, which in turn necessitate different approaches to front- and backend design. Thus, the design of digital models of past exhibitions depends on various factors, such as the data available from the archive material or the intended users.

Based on the current state of research, we can, for the sake of simplicity, differentiate three categories: firstly, there are the so-called *digital twins*, digital reconstructions that attempt to replicate as accurately as possible exhibitions that have already taken place in physical form and thus fulfill historical and archival functions. One example is the three-dimensional model of the first *documenta*, the result of the work of an art-scientific research group led by by Kai-Uwe Hemken at the Kunsthochschule Kassel (Hemken 2023: 400–406).[1] The model shows the rooms of the Fridericianum, at the time still used exclusively as an exhibition space, together with the artworks on display, according to information obtained primarily from archival material. A special feature here is that it was not developed as browser-based software, but for use with VR goggles in the museum space, offering only limited access as a result.

Secondly, digital models and modelling procedures are used, often in addition to physical reenactments or reconstructions, in hybrid constellations of digital and physical elements. An example is the project *File Under: The Work / Björn Lövin*. Lövin

1 A video walk through the application by Kai-Uwe Hemken is available here: https://www.youtube.com/playlist?list=PLGW8aXSoptPA00fsI4q5l5C97E1yaIgVM (05.08.2024).

was the first Swedish artist who created artistic environments. Three of these environments were reconstructed for the exhibition *The Surrounding Reality*, based on the research by Peo Olsson, Katarina Sjögren and Jonas Williamsson. This subsequently resulted in the book *File Under: The Work / Björn Lövin* (2018), which contains renderings of digital reconstructions of Lövin's *environments*. At first glance, these renderings resemble the photographic documentation of an actual exhibition, blurring the boundary between fact and fiction, past and present.

In the course of our research, a third way of digitally engaging with past exhibitions emerged, which we call emulation. The term originated in computer technology, where it is used for software or hardware that allows a HOST computer system to act like another GUEST computer system. The digital model of the past exhibition *Iconoclash*, which here serves as a case study for this methodological approach, can be seen as an emulation (Koberstein and Nolasco-Rózsás 2023: 205–214), as it digitally replicates the physical exhibition and, at the same time, updates its functions, like programming an outdated computer game with new software. The digital space of the exhibition is a walk-in simulation of an actual physical space. However, what happens during the virtual visit differs from an actual walk through a museum exhibition like *Iconoclash*: the exhibited objects, represented by digital models, alter their location and are constantly rearranged, according to an algorithm based on the behaviour of the visitors. Likewise, an attempt was made to emulate other phenomenological dimensions, such as the soundscape and ambience, using generative artificial intelligence.

Aim of the method

Our article focuses primarily on the methodological steps towards a specific digital model. In this context, the process of creating the digital model is to be understood as the actual methodological act of exhibition analysis. The model thus becomes the result of the analysis and can be regarded much like a research report. At the same time, however, it can also be a methodological tool: since the development of the software and the architecture of the content management system behind it is ideally processed in sync with developing the material and honing the research hypothesis, the interactive model allows us to reveal, beyond the often linearly constructed curatorial narratives, implicit thought patterns of the actors, which, among other things, can be visualized by isolating and focusing on particular groups of objects. This is made possible, for example, by using machine learning and filter algorithms, which can be used to relate the most diverse exhibition elements to each other via predefined aesthetic, content-related and context-dependent research parameters. Digital models are also helpful tools for qualitative data collection, such as surveys

of contemporary witnesses, since they permit a new walk-through of no longer accessible situations, thus allowing a different form of *Go-Alongs*.

Spatial science research in particular can benefit from the method of digital modelling of exhibitions. Digital exhibition models, insofar as they are represented in a digital 3D space, can primarily visually illustrate the spatial topographical relationships between the individual exhibition elements. They make the compositional relationship between objects, discursive and scenographic elements and the architectural specifics of the exhibition space comprehensible and, in a sense, re-experienceable. In this sense, they offer a new form of representability not only for past exhibitions, but also for any kind of temporary constellation, such as performances, happenings or concerts. One of the strengths of digital models is the ability to adjust dynamic variables, such as camera perspective, lighting, acoustics etc. Also, it is much easier to view constellations relationally, since current 3D modelling software also allows viewing several models at the same time. These new possibilities for representing and interacting with archival and research materials provide scholars with tools that will have long-term implications for methodological approaches to exhibition analysis. The following guideline is a suggestion of the methodological approach drawn from our own practice (Koberstein et al. 2023: 196–204).

Step-by-step guideline

1. Collecting material

At the beginning of the research process, the primary concern is to obtain access to the widest possible range of information about the various theoretical and sensory dimensions of the exhibition to create a comprehensive basis for further research and subsequent conversion into the concept of the model. It is not only important to know how the exhibition was developed conceptually and arranged spatially, but also how it was designed, communicated, marketed and reviewed. For this, it is helpful, besides examining the documentation archived by the institution, to get in touch with curators, advisers and members of the exhibition team in order to gain access to recollections and personal documents. Ideally, data acquisition should yield information about visual, acoustic, written and, if applicable, haptic aspects of the exhibition and its context of origin.

2. Acquisition of rights

One task that should not be underestimated and that is relatively time-consuming is clarifying image and performance rights with the respective rights holders. In case

of a publication online, it is necessary to find a suitable license agreement for the online presentation of artworks in cooperation with various collecting societies – in particular VG Bild-Kunst and its European sister organizations. Also, the rights holders have to be found and contacted if they are not represented by a collecting society. From a legal point of view, a digital exhibition model that is published online has more similarity to a website or publication than to a physical exhibition. This means that, with regard to online usage rights, one has to obtain the permission of the rights holders of the exhibits, but not necessarily the consent of the owners.

3. Data organization

It is recommended to structure the collected data in an asset management system, as used for archival data bases, for example. In this way, not only the typical meta data can be stored, but also conceptual information, such as the responsible curators or references to thematic connections; data that are particularly important for the later model development, as they provide information about the content architecture of the exhibition. Online repositories can be an equally important tool for storing and downloading historical image and video material, as well as documents. Cloud storage, which can be used both via the internet and with client applications, is another helpful organizational structure, as it can be accessed by multiple end users simultaneously. Here, the collected files can be deposited, identified and organized using a labeling system, and linked to the two already mentioned databases. The unambiguous and systematically organized labeling is an important tool for the further research process, since important information, such as the placement of the exhibits in the exhibition or the respective curator, can already be derived from the codification. The 'unique code' and the organizational structures of the respective databases can be described in a guideline document so that they can be understood by the various groups of actors involved without the need for extensive instruction.

4. Mapping

The next step is mapping the data, which is usually a graphical relational representation of information to clarify the connections between them. This is often done on the basis of the floor plan of the exhibition where the research material can be arranged in clusters. This step is primarily about closing gaps in research by linking the collected material. In particular, the spatial arrangement of the exhibition can in this way be reconstructed in relatively great detail, depending on the abundance of available material. From an (art-) historical perspective, this offers the opportunity to update the associated information as closely as possible to the final setup by comparing and re-arranging the material. The reconstruction of the spatial constellation of exhibition elements and the exhibition concept is the result of a time-con-

suming research process. Besides mapping the exhibition structure, the aim is also to achieve a better understanding of the connection between the spatial arrangement of the exhibition elements with the underlying thematic scheme. It is also by no means uncommon for the data from exhibition archives to present problems due to poor documentation, with inventories not matching the listing of artists in the catalogue or exhibition plans showing diverging scenographic layouts. For this reason, it is important to compare several sources, if available. Photographic images of the original exhibition setting have proven to be particularly helpful here.

5. Moving on to developing the concept of the digital model

Subsequently, the investigation moves on to a more conceptual work phase in which the modes of presentation and operation of the digital model are defined. Here, archival material such as early exposés, meeting minutes or correspondence between curators prove helpful in further developing the concept of the respective exhibition units. Visual information about the scenographic elements and the discursive exhibition texts should also be given due consideration in this act of conversion. It can prove beneficial to involve former collaborators at this point in order to discuss the necessary adjustments, but also the intended design interventions for the digital model. Consultation with the artists and curators is recommended, particularly in the case of complex spatial installations thar are difficult to document, or objects whose representation is difficult to visualize with digital platforms.

As mentioned in the beginning, a distinction needs to be made between the preparation of the archive material and its further processing when describing the necessary equipment. While preparing the, often analogue, documents resembles the digitization processes carried out in most of the institutional archives, the further processing – setting up the 3D scene, designing the user interface and user interaction or producing 3D objects – varies depending on the technical concept. In addition, licenses are required for software packages that are needed for production. Particular formats and quality demands may necessitate more sophisticated book or document scanners for preparing the documents. Structured storage requires data base and cloud storage systems, which are however already in use in the same or similar form in many museum institutions. Depending on the chosen digital form of the model, the visualization of the data as it were, it is very likely that the final production of the 3D scene and the other 3D assets cannot be achieved without outside assistance: often, there is a lack of appropriately skilled personnel and the necessary processor and graphics card performance.

Regarding the time and personnel required, it is difficult to make a general statement, since, as already mentioned above, the effort involved with the specific work phases of modelling can vary greatly. What can be said, though, is that the greater the amount of data to be incorporated, the more time is required, and the larger

team should be. The more interdisciplinary an exhibition is designed, the more interdisciplinary the team needs to be.

Case study

As part of the international research project *Beyond Matter* (2019–2023), the exhibition *Iconoclash. Jenseits der Bilderkriege in Wissenschaft, Religion und Kunst* (ZKM | Karlsruhe, 2002) (*Iconoclash. Beyond Image Wars in Science, Religion, and Art*), a seminal work for exhibition history, was digitally modelled. It showed art works from different periods, religious images and visual manifestations of political circumstances, but also scientific exhibits (Fig. 1).
Iconoclash was conceived by a small group of curators and scientific advisers led by Bruno Latour and Peter Weibel and produced by a large number of collaborators. In addition to archival research, the exhibition curators and other involved parties were contacted to discuss the necessary modifications, but also the intended design interventions for the digital model. Some members of the exhibition team were invited to online interviews (Fig. 2). These conversations, which were conducted on the basis of a guideline, turned out to be extremely important sources, since, having had to rely on mostly text-based archivalia, they offered a real-time reference that we had previously only been able to access via outcome reports of the planning meetings. In addition, there were materials from the institutional archive, of which the aforementioned outcome reports only constituted a fraction (Fig. 3). The archive material that had already been digitized also needs to be considered here.

Originally, *Iconoclash* was planned in a structure of cells, i.e. in areas or groupings of displays, each representing a specific thematic context. Since the exhibition was designed by several curators and consultants, the end result presented itself in a complex rhizomatic expography (Fig. 4), in which visitors could move around freely without having to follow a specific path. In addition to the discursive and educational text elements on the walls, there were banners suspended from the ceiling of the exhibition hall with declarations, quotations and questions such as "Fetishists!" or "Why are images so ambiguous?", intended to give the visitors food for thought and encourage them to adopt a critical attitude.

For the original exhibition it was essential that the visitors' path through the various thematically delimited exhibition cells was not predetermined, which is why it was decided to disregard modelling the architecture of the ZKM | Karlsruhe. This aspect was developed by implementing an algorithm that dynamically changes the layout of the exhibition based on user movement; this has the effect that not only does the visitors' path through the exhibition space change each time, but the scenography is also in motion (Fig. 5). Since this clustering algorithm, which is also used on YouTube or Spotify for personalized recommendations and suggestions, taps into

the interests of the users, the conceptual research served as a basis for the tag system that provides the parameters for setting the algorithmic dynamics in motion. For this purpose, every artwork is tagged with a series of keywords that refer, among other things, to the subject area, the curatorial selection or the original placement in the past exhibition. As a visitor, you generate, through your contact with the objects, an ever more detailed profile from one observation to the next, which is 'fed' by the interaction, i.e. entering the thematic cells and the length of time spent with the individual exhibits.

The starting point of the exhibition was originally on the first floor of the ZKM, which was reconstructed exclusively with video footage for the digital model, from the entrance door via the *sound corridor* to the iconic staircase. The texts and background information on the exhibits, originally found in the brochure, the catalogue or on the wall texts, are displayed in a HTML layer and assigned to the corresponding works (Fig. 6). Both technical and conceptual information thus contributed to transferring the curators' desired effect of an interaction with the exhibition and its elements. There was also a need for discussion with the participating artists, particularly in the case of complex spatial installations that are difficult to document, or objects that were difficult to display on digital platforms. Examples include mirrors, interactive objects or expansive artworks that depend heavily on the physical presence of the object or the viewer. Wherever possible, we attempted to adapt artworks with an interactive character in such a way that their functionality is mimicked in the digital realm. Visual information on the scenographic elements and the discursive exhibition texts were also collected and found their way into the virtual exhibition model, where they were translated into audio snippets with the aid of artificial intelligence, among other things, and thus became part of the model's soundscape.

The manner in which the various aspects of the exhibition were to be conveyed was decided in collaboration with 3D and UI designers, also taking into account how the media would be archived. In this way, the temporary scenography was translated almost entirely into digital form in its 'original' constellation, in the interest of the overall visual impression. With over 400 exhibits and an exhibition publication of more than 800 pages, *Iconoclash* was an extremely large-scale exhibition project. In our case, more than twenty people from the most diverse areas of expertise were involved in the development and production of the digital model of *Iconoclash* over a period of two and a half years. In addition to art historians, the team that collaborated on the realization included archivists, web and user interface designers and software developers. They were joined by research assistants, interns and scholarship holders, who, also coming from a range of different fields, supported practically every area of work.

Method reflection

The process of digital modelling is a new methodological approach to exhibition analysis, the results of which can be both a methodological tool and a form of research report. Through the possibilities of interactivity, filtering and relational presentation of data, it is possible to re-examine in particular past exhibitions. Programming varies here and depends on various project-specific factors, such as personnel or financial capacities, accessibility of archival material or expertise. Assembling an interdisciplinary team requires both coordinative and professional skills, the lack of which may necessitate appointing a personnel manager. In addition to the time required, contracting external labour and the associated purchase of technical equipment can be a costly undertaking. With regard to external contracting, the support and maintenance of the digital model beyond the project runtime can become a problem and cause additional costs due to necessary maintenance contracts with the external web agency. If the model is published on the internet, license fees may be incurred for temporary user rights, as 3D models of art works are still a grey zone in terms of performing rights at collecting societies such as the VG Bild-Kunst.

The great virtue of digital modelling is that it allows different dimensions of research to be combined into a holistic framework through the cross-linked representation of very diverse data material in the digital model, such as audio and video recordings, various archival materials and photographs. The virtual exhibition experience could be further expanded by combining it with digital re-stagings of accompanying events, such as artistic interventions, film programmes, workshops, conferences, keynote speeches etc. As such, they can also contribute insights into the atmosphere of an exhibition from a visitor's perspective. As museums increasingly evolve into sensory systems that are able and willing to collect more and more data from and about their visitors groups, ever richer data material is becoming available, which in the future should further increase the need for multidimensional archiving of past exhibitions using digital modelling methods.

Fig. 1: Exhibition view Iconoclash, *ZKM | Center for Art and Media Karlsruhe 2002, © Photo: ONUK.*

Fig. 2: Video interview with the curators of the Iconoclash *exhibition, Bruno Latour and Peter Weibel (screenshot), ZKM | Video Studio 2023, © Screenshot: Felix Koberstein.*

Fig. 3: View of one of the ZKM | Archive 2022 storage rooms, © Photo: Thomas Meyer.

Fig. 4: Mapping of the thematic cells on the floor plan of the Iconoclash *exhibition, ZKM | Center for Art and Media Karlsruhe, © Screenshot: Felix Koberstein.*

Fig. 5: The clustering algorithm in the digital model of Iconoclash *is activated, © Screenshot: Felix Koberstein.*

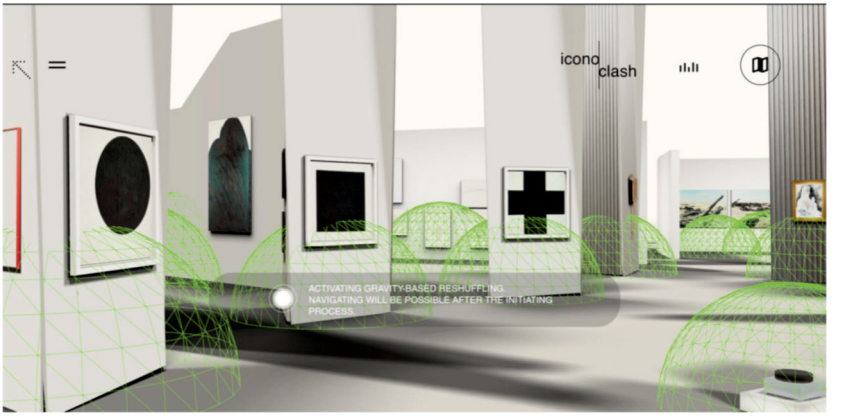

Fig. 6: HTML layer of a digital exhibit. © Screenshot: Felix Koberstein.

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