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Producing the Past With the Digital: Virtual Reality as Remediation in History Museum's Presentation Practice

Ilkka Lähteenmäki[1] | Marjaana Puurtinen[2]

[1]History of Sciences and Ideas, University of Oulu, Oulu, Finland | [2]Department of Teacher Education, University of Turku, Turku, Finland

Correspondence: Ilkka Lähteenmäki (ilkka.o.lahteenmaki@oulu.fi)

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ABSTRACT

This paper examines contemporary museum practices in light of media and history theory, and understandings of representation. Through a content analysis of in-depth interviews with museum and IT professionals involved in creating a virtual reality (VR) exhibition piece, we demonstrate how theoretical concepts addressing the mediated nature of representations (remediation, immediacy, hypermediation) can be used to unpack cultural-history museum work in today's digital world. The analysis shows that our case example exhibition production process relied more on a division of labor between museum and IT experts, and on technology-driven decision-making than on joint discussions about on what grounds the different production steps are taken. Finally, we saw the urge to support museum visitors' engagement with the content and experience immediacy as one of the main goals for the whole project, and even something that overrides potential problematic issues about creating the representation itself.

1 | Introduction

The digital age has ushered in change in museums as well (see Parry 2010; Hornecker and Ciolfi 2019; Drotner et al. 2019; Black 2021): born-digital objects appear in collections (Beaulieu and de Rijcke 2016; Zuann 2021; Meehan 2022), and digital presentations appear in exhibitions (Waern and Sundnes Lovlie 2022). At the same time, museum studies have moved away from considering museums solely as transmitters of knowledge and have acknowledged the active role of the meaning-making individual in the interpretative process (Witcomb and Message 2015). In this paper, we examine such contemporary museum practices through our case example: interviews with museum and IT experts who participated in the development of a virtual reality (VR) exhibition piece.

When immersive and interactive technologies are discussed, VR is often the first to be mentioned. However, the term itself is undergoing change. In current history-related discussions, VR is often tied specifically to VR headsets and immersive visual representation. The more traditional meaning, however, is simply that "[a] virtual reality environment is an immersive, interactive, and computer-generated space" (Chalmers 2021, 189). Thus, virtual reality can also exist without any headset or visual imagery, and the level of interactivity can vary. In this paper, we focus on headset-based VR, but it is useful to keep in mind the original meaning of VR especially now that augmented reality (AR) and mixed reality (XR) technologies are also making their way to museum exhibitions. Headset-based VR has been included in cultural heritage discussions for several years. Most of these discussions have been case reports or analyses of VR projects (Schofield et al. 2018; Chang et al. 2018; Kersten et al. 2017; Baradaran Rahimi et al. 2022; Kazlauskaitė 2022), usually focusing on the reception of VR exhibitions. Some research has also examined museum professionals' views on the use of VR exhibition pieces (e.g., Shehade and Stylianou-Lambert 2020).

We wish to bring a deeper media-theoretical understanding of digital media into this discussion. To do so, we employ the concepts of remediation, hypermediation, and immediacy. While Jay

David Bolter and Richard Grusin's book "Remediation" (1999) is now more than 20 years old and could not have predicted the pervasiveness of the digital in our current media environment, it has become a stable in our understanding of media (much like Marshall McLuhan's works from the 1960s; McLuhan 1964, 1967). We follow Bolter and Grusin's distinctions between these three key concepts. Remediation has been widely applied in both theoretical and experimental works, to the extent that almost any kind of transfer of content from one medium to another has at some point been described as remediation (for history- and cultural-heritage related examples see, e.g., Copplestone 2017; Rigney 2016; Ekström 2016). However, remediation is not just the movement of content from one medium to another, but a process in which both the new and the old media affect each other and change over time. This process has widespread effects on our conception of reality and on how we think reality should be represented.

At the heart of remediation is the profound insight that the representational power of a new media is not evaluated against reality itself, but against other media. Historical representation highlights this as we cannot compare historical representations to the actual past. Thus, historical representations can only be compared to other historical representations. Note that this is a question of how effective a representation is in producing the "reality" of the represented, independently of whether the representation is historically accurate or not. Therefore, in the context of historical museums, discussing collections from the perspective of remediation offers an alternative way of thinking about museums' prime functions—preserving collections and exhibiting them—and their relationship to each other. According to this view, the representational power of an exhibition is not linked directly to the objects of the past, but to other representations of that past reality. This is not limited to museum contexts but concerns how history in general can or should be represented, and which parts (if any) of historical representation can be considered medium independent. While theorists and historians have widely discussed the role of narrative in historical writing, it has been acknowledged that not all aspects of visual forms of historical representation can be returned to textual representations. (see e.g., Rosenstone 1995, 2006; Burgoyne 1997, 2008 for historical film; Salvati and Bullinger 2013; Spring 2015; Chapman 2016; Wright 2018 for digital games; for remediation in museums see e.g., Bouquet 2013; Johnsen Bøe 2021; Perry 2017).

Hypermediation and immediacy differ from remediation by being the two sides of the same representational coin. Immediacy is probably the most common logic of mediation in the Western world. Its unvoiced and ultimately unattainable aim is unmediated access to reality. One of the ways immediacy-based mediation attempts to achieve this is by hiding the act of mediation. VR is a good technology for generating the immediacy effect, since there are no frames or borders inside the virtual world. Hypermediation, in turn, is the ever-existing critical commentary on immediacy-based reaching for the real. Contrary to immediacy, hypermediation highlights mediation, shows multiple representations simultaneously, frames images, and makes it obvious that the medium is affecting the representation. Nevertheless, hypermediation also attempts to reach the real. Unlike immediacy, however, it attempts to do this by making the core of the "real" visible through an increased awareness of the distinction between the media and the real. In other words, if immediacy is a door that one passes through to access reality, hypermediation is a tinted window that forces us to acknowledge that access to reality is always mediated. Remediation, in turn, consists of the transfer and transformation of content from one medium to another, and of the ways in which the use of different media affects our conception of how reality should be represented.

In this paper, we aim to unpack what producing the past with digital media consists of in contemporary museum practice. By employing the concepts of remediation, hypermediation, and immediacy, we illustrate the mediated nature of visual representation done in the museum context. Our case example is a set of interviews with a team of museum professionals and IT experts who were involved in preparing a virtual reality exhibition piece.

2 | Method

2.1 | Participants

Three museum professionals and two IT professionals involved in one museum's VR project were interviewed during the 2010s–2020s. The exact details of the museum, VR project, timing of data collection, and the interviewees are omitted from this report to protect participants' identities in accordance with research integrity ethical guidelines of the Finnish National Board TENK (TENK 2019). The guidelines operate with the minimum information principle. The findings of this study are not dependent on the exact identities of the interviewees. Thus, all identity-related information that was deemed unnecessary for this study's discussions has been omitted. All interviewees participated voluntarily and with informed consent.

2.2 | Virtual Reality Exhibition Piece

The VR project consisted of a set of spatialized black-and-white photographs from the museum's collections, presented in the middle of a black virtual space. The images changed in a predefined order and pace while an audio track played imagined sounds of the city from the given era. This kind of simplified historical VR experience, in Chalmers' (2021) terms, provides the experiencer psychological and perceptual (or, more specifically, audiovisual) immersion, but apart from the possibility to move one's head and examine the 3D images from slightly different angles, there was no other bodily way to interact with the representation. The VR project was viewed with a VR headset placed in a room with several other visual displays (projections, tableaus, etc.) of thematically interrelated material from the museum's collection. The room displayed no physical objects from the collection, only visuals, and the textual information was minimal.

2.3 | Interviews

The interviews were conducted online, individually for each interviewee, by Lähteenmäki and recorded using the recording tool of the Zoom online meeting software. The interviewer aimed to aid each interviewee in telling the story of the collaborative project from their own professional perspective. The interviewees

could influence the course of the thematic interview by freely selecting which theme to discuss next. The themes (presented in writing on the screen by the interviewer) were: How did you end up in this project?; Why were the photographs of [the photographer] chosen for this project?; How was photograph series A selected and worked on?; How was photograph series B selected and worked on?; How did the project proceed?; and "How would you evaluate the outcome of this project?". When talking about a photograph series or individual photographs used in the VR project, the interviewer shared the photograph in question on their screen; interviewees could also share materials from their own screen. When discussing a theme, the interviewer prompted the discussion typically with "why" and "how" questions or asking the interviewee to elaborate on the given answer. The length of the interviews varied from 1.5 to 3 h.

2.4 | Data Analysis

The interviews were transcribed verbatim in Microsoft Word by Lähteenmäki or Puurtinen. Transcripts were pseudonymised by deleting any information that would enable direct identification of an interviewee, and the original recordings were destroyed, as agreed beforehand with the interviewees. The final transcripts ranged from 34 to 88 pages in length.

The content analyses consisted of two main phases. Due to the exploratory nature of the study, the reliability of the analyses was grounded in the collaboration of two authors, involving continuous and critical discussion during the development of the coding scheme and culminating in a shared consensus (e.g., Saldaña 2016). The first coding cycle applied the structural coding strategy (Saldaña 2016). Its aim was to identify significant content in participants' interview responses with respect to the key concepts of remediation, hypermediation, and immediacy. This was done through a deductive, theory-driven reading of the full interviews, considering an interviewer's question or prompt and the related answer as the unit of analysis. First, Lähteenmäki and Puurtinen independently read all interview transcripts and marked whether an interview question and response included content relevant in terms of remediation and/or hypermediation and/or immediacy. As a guiding principle, all content addressing the VR project or the photographs included in it, issues related to the VR project as part of the larger exhibition space, or more general but related discussions about museum work, was considered relevant. Second, the authors discussed their markings. Each interview response marked as relevant by one or both authors was included in the later analyses (on rare occasions, and based on coder consensus, some responses were either excluded from or included in the analyses even if they did not meet these criteria). Third, the authors jointly placed the interview responses into three theory-driven categories: responses addressing remediation, hypermediation, or immediacy. At this stage, a single response could be included in more than one category.

After identifying and categorizing relevant interview responses, the analysis moved to the second coding cycle. This stage followed the In Vivo coding strategy (Saldaña 2016). In practice, the responses were segmented into smaller idea units, and these idea units were then used to construct data-driven themes within the three categories of hypermediation, immediacy, and remediation (see, e.g., Lester et al. 2020). First, the two authors independently segmented all responses in the hypermediation category, then discussed their styles of segmentation, and grouped the jointly agreed segments into initial, data-driven themes of the hypermediation category. Second, Lähteenmäki segmented 30 responses from the remediation and immediacy categories, and the authors again jointly discussed and grouped the segments into an appropriate category and initial theme within each category. Each idea unit was placed only in one category (remediation, hypermediation, or immediacy) and in one theme. Third, Lähteenmäki segmented the remaining responses of the remediation and immediacy categories. The final data set consisted of 761 segmented idea units.

The fourth and final step of the second coding cycle consisted of creating the final coding scheme. The two authors jointly discussed all idea units and created, developed, and edited main themes and subthemes to produce themes and subthemes that were as internally coherent and mutually exclusive as possible. At some points, a single author could create preliminary themes or modify existing ones for later joint discussion and approval by both authors. For the full coding scheme and data examples, see the Results and Discussion section below.

3 | Results and Discussion

Our final coding scheme is presented in Table 1. The scheme consists of the theory-driven categories of remediation, hypermediation, and immediacy, and data-driven themes within each category (for the more detailed subthemes of each theme, see Tables 2–4 in later sections).[1] For presentation purposes, and to highlight the interconnections between the three categories, we further grouped the themes under the topics of *representation*, *production*, and the *experiencer and museum context*, and discussed them below in this order.

3.1 | Representation: The Underlying Tension Between Originals and Editing

Representation was discussed in three ways: by considering the relationship between *the original image and past reality*, *image editing and past reality/original image*, and *the characteristics of a hypermediated representation* (Table 2).

To begin with the first theme, the way in which interviewees considered the relation between the *original image and past reality* was twofold. Photographs were seen both as constructions and as documents that depict a distant and different past. The link between the photographs and the reality they depict has often been attributed to the idea that photographs have a kind of materiality or indexicality that ties them to the past reality (see, e.g., Morris-Suzuki 2005; Ball 2017). The interviewees were aware of the role of the photographer and the historical context. However, the final edited VR representation was, in fact, the product of several authors: the original photographer back in the day, the one who digitized the photograph some time ago, the team members who participated in image editing, the IT company staff member, and the large companies that developed algorithms for image editing. This scope of

TABLE 1 | Main themes in the categories of remediation, hypermediation, and immediacy, divided under the topics of representation, production, and the experiencer.

	Remediation			Hypermediation	Immediacy
Representation	Original image and past reality	Image editing and past reality/original image	–	Characteristics of a hypermediated representation	–
Production	Collaboration	Technical production	Characteristics of original materials	–	Producing immediacy
Experiencer	Supporting visitors' engagement with content	Development of presentation practices	–	Considering the visitor and hypermediation	Experiencing immediacy

extended authorship was not addressed; instead, the representational content was assigned to the maker of the originals, although many actors took part in their editing (cf. Edvards and Hart 2004; Volpe 2009).

In a VR project such as the one presented here, image editing becomes a necessity: it is not possible simply to show original photographs as they originally were. This also raises the issue of *image editing and the past reality/original image*. First, the originals need to be digitized. Second, transforming 2D digital photographs into a 3D VR environment requires complementing them for the presentation to work. In practice, because users can move in VR, they need to be able to see parts of the 3D image that the 2D photograph does not contain. These can be spaces behind a chair, an open door, or any object that is closer to the viewer than some other parts of the image. The museum staff members did not find such editing problematic: "[W]e wanted to keep some humour in it. Let's not be afraid of adding a little bit of something that is not really there"(Interview 2, museum staff).

It can be argued that the influence of digitalization, including, for example, the normalization of editing and restoration of photographs, as well as digitized photography itself, is visible in the justifications for editing found in our case example. This justification appeared in downplaying the amount of editing that was done by, for instance, framing the work as extending existing data rather than editing the image itself:

> Well, basically, if you think about this from the perspective of museum data, the image data itself has not been altered that much. There are just mainly some holes that have been patched with smart tools and such.
>
> (Interview 3, IT company staff).

There is an interesting theoretical issue to be solved here: when transforming a representation into another format, how much, and on what grounds, can we (or a museum) make up their content? This issue has been brought forth in a variety of forms by, among others, Hayden White (1988), several theorists discussing historical film (see. e.g., Rosenstone 1995, 49; 2006, 12), and, more recently, in discussions of historical digital games (e.g., Chapman 2016, 13–22 & 61–83) and VR (e.g., Kazlauskaitė 2021, 2022). We see this issue underlying the variety of ways in which our interviewees justified image editing. They recognized the need to address the matter, although there seemed to be no clear-cut way to deal with it. Perhaps the tension also partially stems from museums' societal role of collecting and preserving objects, a role into which the idea of changing the visual content of an exhibited object from their collection does not easily fit (this topic will be discussed further below). This tension is highlighted today, when collection photographs are often available in digital forms for everybody to use and edit, but it also brings certain benefits: as discussed by our interviewees, the digitalization of photographic collections allows museums to leave the originals untouched while being able to exhibit photographic imagery that matches our current idea of good quality photographs (see e.g., Fackler 2019 for how photography has changed over time).

We currently do not have explicitly established norms for how the kind of editing or constructing of visual representations of the past that is required in the creation of VR environments should be carried out. What we do have is the ongoing development of practices in museums, as they deal with the issue case by case when building exhibitions and experimenting with visual media. In our case, this issue was dealt with by the IT company in a very practical manner: they relied on their self-developed algorithms, available software tools, and the existing data present in the original photographs. As described by one interviewee:

> These [items on image] have been left slightly blurry on purpose, because we do not know completely certainly what there is, but, like we have tried to replicate what is visible in the image anyway. [A]nd some elements have been picked up from other photos. [L]ike in this one [a photograph] I pointed out that one has to invent content here and then I tried to do my best to make it consistent. But of course it's not what it really would b and that was okay [for the museum]. And it's not like we try to make up a new story, but [Y]ou have to do something.
>
> (Interview 4, IT company staff)

TABLE 2 | Representation: Main themes and subthemes in the categories of remediation, hypermediation, and immediacy.

		Remediation	Hypermediation	Immediacy
Representation	Original image and past reality	Image editing and past reality/original image	Characteristics of a hypermediated representation	–
	• Considering image as a document of the past • Considering image as a construction • Considering image content in its historical context • Depicting a distant and different past that is no longer here	• Adding color • Adding sound • Building 3D: with respect to past reality/original image • Considering edited image as a construction • Considering light • Justifying image editing through extending image data • Respecting the original image • Using algorithms	• Considering interaction of media content with other representations • Considering interaction of media content within a representation • Presenting content with multiple parallel media	–

TABLE 3 | Production: Main themes and subthemes in the categories of remediation, hypermediation, and immediacy.

		Remediation		Hypermediation	Immediacy
Production	Collaboration	Technical production	Characteristics of original materials	–	Producing immediacy
	• Distributed decision making • Distributed work according to expertise • Joint planning • Making the most of limited resources • Recognition of own and others' expertise	• Assessing workload • Building a sensory experience • Building 3D: technical production • Building luminance • Building the background for the 3D image • Building on previous projects • Building soundscape • Considering headset's technical characteristics • Considering image as data • Considering technical requirements for editing images • Encountering unexpected situations	• Image metadata • Photographic quality of the original images • Recognizability of images • Selecting images from a collection about a relevant topic • Technical quality of the original images • The relevance of the original photographer	–	• Directing towards the experience • Producing sensory immediacy • Producing situational immediacy • Producing spatial immediacy • Producing temporal immediacy

TABLE 4 | The experiencer: Main themes and subthemes in the categories of remediation, hypermediation, and immediacy.

	Remediation		Hypermediation	Immediacy
Experiencer	Supporting visitors' engagement with content • Addressing different visitor groups • Bringing the past closer to today • Enabling experientiality • Enabling the experience of nostalgy • Enabling the joy of finding things out • Motivating museum visitors • Supporting engagement through interactive technologies	Development of presentation practices • Choosing between presentation strategies • Enabling collaboration between museums • Focusing on content over technology • Keeping in min museums' societal role • Maintaining a playful attitude • Recognizing the benefits of digital and visual presentation strategies • Reflecting on and learning from previous projects	Considering the visitor and hypermediation • Considering differences in visitor reception • Considering multiple representations and visitors' time use	Experiencing immediacy • Experiencing situational immediacy • Experiencing spatial immediacy • Experiencing temporal immediacy

The choices made by the IT company staff member make very good sense. If there is a chair on a floor and one has to fill in the missing visual behind a chair leg that becomes viewable in VR, the most reasonable approach is to extend the floor texture to fill the missing parts. Technically, it is not the exact floor that would have existed in the past, but for our perceptions of the quality of different representations of (historical) reality, this does not matter. As Bolter and Grusin (1999) pointed out, the representational power of media is compared to other representations rather than to actual reality. When remediation changes our perception of what counts as an adequate representation of reality, the part of reality that does not care about our opinions remains intact. What changes are our standards for what counts as adequate representation. The question that remains is how to balance constructing the 3D experience and showing respect for the original image in such a way that the 3D experience still has a perceived connection to past reality.

As a final note on this topic, we highlight *the characteristics of the hypermediated representation*. The VR presentation was placed in a room with multiple other visualizations (created on the basis of photographic materials) of the same general topic: thus, the discussion about justifying the editing of content in the VR presentation should not be separated from consideration of the immediate context of the exhibition piece. In light of our theoretical framework, we conceptualize the museum space where visitors were able to choose the order in which they viewed different visual representations of the topic as one that used hypermediation as its presentation logic. This appeared in the use of different presentation formats and in the intentionally created thematic coherence of the presented material: "We wanted that the VR content and the content of the exhibition space would discuss with each other." (Interview 5, Museum staff).

Rather than describing the space simply as a multimedia or multisensory one, the concept of hypermediation highlights our awareness of presentation practices. In historical museums, we treat these practices as ways to approach past reality. At the same time, however, we may hope that visitors *forget* these tools and reach the past directly, without sensing the media in between, through the immediacy effect. This appeared as one key goal in our case project as well. We argue that this goal guided the production process, and we move on to discuss this topic.

3.2 | Production: Work Towards an Immediacy-Focused VR Experience

Producing the digital representation was discussed through four themes: *collaboration*, *technical production*, *characteristics of the original materials*, and *producing immediacy* (Table 3). In the larger scheme, the first three fall under remediation and focus on quite practical issues of how to make a VR experience out of historical photographs. The fourth theme focuses on the requirements for producing the effect of immediacy, or, in other words, on how to make the experiencer believe that they are seeing the past rather than a digital image on a screen. We see that producing immediacy loomed over all production-related discussions as the main selling point of VR. This goal set the tone for the collaboration between the museum and the IT company and underlay the technical production and assessment of the original materials.

In our case, *collaboration* between the museum and information technology experts from an external organization was needed to create the VR exhibition piece (see also, Vestergaard Knudsen and Rørbæk Olesen 2019). Our interviewees recognized the different expertise of the representatives of the two organizations and distributed the work accordingly. For example, some of the supporting work for the image editing was done by the museum's personnel with experience in image editing. They were, however, instructed by an IT company staff member:

> For starters, I looked through all these as to what becomes of these and what is worth doing. And then I made the instructions for cutting and sent them back, and then they then they did what they could, and I did the rest. [I] drew in colour what gets cut to which layer.
>
> (Interview 4, IT company staff).

The interviewees stressed the influence that their limited resources (both time and money) had on the project. Although the museum staff still seemed satisfied with how the VR project turned out, it was nevertheless clear how big a role the IT company played in deciding on the VR content and, most importantly, in the procedures leading to it. Digitalization has indeed challenged the epistemic authority of museums and other cultural heritage institutions (Beaulieu, de Rijcke, and van Heur 2013; Shehade and Stylianou-Lambert 2020). In our case, while initial planning was done jointly, all the actual decision-making was not. In the words of one interviewee:

> [The company] made the selection [of images] pretty independently based on the elements there are [in the images] and how the tools they had developed, like, for modeling 2D images in 3D work. And then they suggested like this, and we had nothing, like, to criticize it for. ... They [the company] evaluated them from the perspective of the technical implementation.
>
> (Interview 1, museum staff)

Relying on the expertise of IT professionals tied in with how the *technical production* of creating this VR project was given priority in decision-making. The discussion centered around the requirements of creating a 3D experience out of 2D images. The central technical requirements for the images were that they had to have a good enough resolution to look good in the headset: "The limiting quality of materials is that you don't want to look at pixels." (Interview 3, IT company staff).

In addition, the image had to be qualitatively suitable so that it could be turned into a 3D version. Its content and composition had to meet certain criteria so that the gaps that need to be filled in to make a 3D version could be filled reliably with the information found in the image data: "The technical requirement that the images can be made three-dimensional has affected the choice of images" (Interview 5, Museum staff). For example, one of the initial images was left out because it was not feasible to turn it into a 3D version, as so much new image data would have had to be created in the process. The image had vertical elements that blocked the view behind them. As there was no way to know what was "hidden" by these elements, all the background would have had to be invented, and thus the image was deemed unfeasible for the project. This issue is linked with the above-mentioned tension between editing and the original: in the end, there was a practical limit for how much of the image content could be invented, but it was a limit drawn on the basis of technical requirements. There simply was not enough data in that one image to turn it into a 3D version of itself.

The technical characteristics of the VR headsets were also related to building the background for the 3D images and the sensory experience of the experiencer. In the VR experience, the 3D images were shown in a black space for both aesthetic and practical reasons. For one interviewee, "black background gives primacy to the object itself" (Interviewee 3, IT company employee). Another characteristic, according to the same interviewee, is the black background, which also works well with black-and-white images as small gaps, which might be left in the 3D image, are not so easily recognizable. Yet another, a soundscape played through directional speakers instead of using the headset speakers. This option was chosen because, in previous projects, both the museum and the IT company had found that the headset speakers are prone to breaking down when left at the mercy of museum visitors. The use of directional speakers also primed users for the VR experience, as they began to hear the sound already before putting on the headset.

Several *characteristics of the original materials* affected which images were selected for this project. Image metadata and the recognizability of the images were considered relevant, but for rather different reasons. Image metadata (ranging from information about cameras and lenses to location and time of day) was relevant for technical production, as it can help in creating the 3D model of the image. Recognizability of the images, in turn, was discussed in relation to how audiences might recognize the content or iconic images.

In general, the technical and photographic quality of the original images was praised by many of the interviewees: they described "how you can get so much data out of old glass negatives" (Interview 5, Museum staff) and "how the quality of the photos is so damn good" (Interview 3, IT company staff). Thus, when the original photographs were digitized, their digital copies were also data-rich (for discussion about digital twins of collection objects, see Luther et al. 2023). This contrasts with later developments in photography. One interviewee reminded us how the contemporary way of digitizing and editing historical imagery is not equally possible for all kinds of historical visuals:

> There are exactly those awful decades in between when [laughs] we have moved from photographic plates, for goodness's sake, to badly developed films, and after that they have been digitized badly in a bad time [laughs] in the early days of scanning and then you just, you lose things. But today the digital material is again top quality.
>
> (Interview 3, IT company staff)

The original glass negatives, first digitized and later applied in the VR environment, were thus of exceptional quality. It may well be that the museum staff did not feel the need to consider the challenges related to presenting content through different media or the challenges of technical production, because of the quality of the data they worked with. Poorer quality of original materials might have forced them to do so.

The interest that the audience was expected to have in the content material was also considered. The museum had conducted visitor surveys in which they asked about interest in content related to different periods in time, and the period represented by the chosen images was among the most popular. One of the museum employees described the influence the temporal distance had on exhibition content to be "[c]lose enough, but also distant enough for present-day visitors, so it is interesting" (Interview 2, Museum staff).

Other themes related to the production process were grouped in the immediacy category. As mentioned above, immediacy is described as gaining access to "the real" (Bolter and Grusin 1999; see also Puig et al. 2020, 351; Copplestone 2017, for discussions about different understandings of "realistic" in digital historical representations). In cases where locations are shown, the feeling of being on site is usually achieved through immediacy-based representations. We see only a fine line between *producing immediacy* and the theme of *image editing and past reality/original image* discussed in the above section. Their distinction comes from this: producing immediacy is why image editing is being done. Making the observer believe in the reality of the depiction requires constant testing during production to ensure that things work in the intended way:

> A completely normal iterative process. A good plan about how things work and they should be. From there you iteratively work. You test if it works and if it produces the atmosphere which you wish to convey, because it has some narrativity in it.
>
> (Interview 3, IT company staff)

To get the feeling of being there, "there" had to be built. In our interviews, the believability of VR was connected to the operation of our senses. The visual sense should be able to operate there in the same way it does when we look at the actual world, and the depicted virtual reality should operate with a similar logic as the actual one. Walls do not simply end suddenly; architecture must make sense, the view should not suddenly curve or twist:

> We check exactly how the continuity goes, how lens distortions are, how the angle and field of view are, and how, for example, a diagonal wall gets projected in a right way.
>
> (Interview 3, IT company staff)

However, one can save large amounts of working time by not spatializing complex objects that are close to the threshold of human capacity for perceiving them as spatial objects, and instead simply showing a flat plane. The interviewees jokingly discussed how, by cheating human senses, we can save time, lower technical requirements, and simplify the production process.

The soundscape of the VR environment was also deemed important for the VR experience, as it offered content for another of our senses. By simultaneously offering visual and aural content, it was deemed that it is easier to immerse oneself in the VR experience. This sensory immediacy also supported situational immediacy, and the sounds made the images more understandable as historical representations.

Finally, one interesting aspect of producing immediacy was the priming of the experiencer for the VR experience. As immersion requires the experiencer to opt in to it, the room and the entrance to the room were discussed as something that guides (or primes) the visitor for the kind of content and style of representation they are going to engage with. This leads to our third and final topic: the experiencer in the museum.

3.3 | Experiencer in the Museum: Reaching for the Past in Exhibition Context

The interplay of the experiencer, the museum, and the digital was discussed through four themes: *supporting visitors' engagement with content*, *development of presentation practices*, *considering the visitor and hypermediation*, and *experiencing immediacy* (Table 4). In practice, considerations of the audience experience highlighted the constant need to balance representational forms, exhibition traditions, the variety of visitor groups, and the implicit immediacy goal set for the VR piece. In museums, representations are parts of larger wholes, and the museum context sets limitations—such as how much time touring an exhibition can take—which affect what kinds of representations about the past can be made. From the perspective of remediation, such exhibition-related practical limitations must be understood as factors that affect how people come to believe the past can be represented properly.

To begin, the interviewees discussed how to *support visitors' engagement with content* in a variety of ways. They recognized and addressed the needs of different visitor groups. However, this is not specific to VR exhibition pieces, but something that museums have to consider in all their exhibitions (Simon 2010; Roppola 2012; Achiam et al. 2021). Similarly, motivating visitors to engage with the exhibition, or "what would interest a present-day viewer" (Interview 5, Museum staff) was brought up. In our case, this was addressed by supporting engagement through interactive technology and by enabling the joy of discovery: it became clear in our interviews that it is not just the museum staffs' experimenting with representations, but the visitors' dealings with them that were of interest to the museum. Indeed, the interviewees considered VR a way to change the way museum visitors can experience and interact with the museum's collections:

> So, with this kind of new technology, there is always a kind of joy of finding a joy of, like, hey wait a minute, I got some of this working, when I fiddled with these

> myself. Even if the content would, in the end, be quite slim and, well, short.
>
> (Interview 2, museum staff)

The team members discussed enabling experientiality and the experience of nostalgia by bringing the past closer to today, as "[e]xperiences are what sells" (Interview 5, Museum staff). In this way, VR was seen as something that simultaneously provided a there and then experience by giving access to a past reality and offering a here and now experience in the virtual world (see also the discussion on experiencing immediacy below).

In general, the exhibition was seen as having two different functions. First, it offered a highly visual, immersive experience of finding out what the past looked like. Second, "it primes the visitor to what kind of museum they are and how history is being told" (Interview 2, museum staff). As pointed out by one of the anonymous referees (we are grateful to her/him for doing this), this raises the question of how, in our case, a VR exhibition piece affects the meanings that visitors attach to other exhibitions in the museum. In other words, how do different exhibition pieces and functions communicate and affect each other? In our case, the idea of priming the visitor seems to be based mainly on the physical location of the VR exhibition in the museum. The VR exhibition piece was set up in the first room that most visitors enter in the museum exhibition spaces. As this was the visitor's first contact with the museum exhibitions, it was considered to be a piece that they could use to orient their expectations for the rest of the exhibitions. This leads to the second theme, the *development of presentation practices*. The VR project was described as a learning experience, in which previous VR projects were reflected upon in the planning phases of the project. The motivation that generated the wish to learn was tied to the museum's ability to communicate and connect with its audiences. The way our interviewees expressed their understanding of what kind of content should currently be produced reflected the participatory and communal aspects of museum exhibitions. As one of the museum employees described the attitude towards the museum's social role that they were aiming for, "I like it when museums bravely play around with their materials, as the kind of too serious, and businesslike, and from the top-down viewpoint is from the past world." (Interview 2, museum staff).

By invoking playfulness in visitors in the first exhibition piece they encounter in the museum, it was seen as a way of signaling what kind of museum the visitors are entering. More generally, it is not only the contents or topics of exhibitions that relate to each other, but also the ways in which the contents are exhibited. In our case, it seems that this playfulness and down-to-earth perspective was an expanded understanding that incorporated the way in which a museum exhibits its collections and engages with the public, rather than being limited to, for example, the exhibition topics. However, this was not without any epistemological concerns. The museum's societal role as provider of knowledge was seen as the central element that differentiates it from pure entertainment providers:

> We can't just say whatever. In the end, we are an expert organization. ... If we start to make up all kinds of things, then it's not okay anymore. There's museum law... and museums have a mission for which they exist.
>
> (Interview 5, Museum staff)

Although this was seen as a hard limit, it was still perceived to give a lot of space for playing around with exhibitions. Interestingly, what seemed to grant permission to be more playful with exhibition presentation practices was precisely the fact that they were producing digital content. This is interesting from both preservation and presentation perspectives. From a preservation point of view, the ability to exhibit materials without the worry that they might be damaged is paramount to the museum's exhibition practices. From this requirement stems the tradition of how museum's exhibit their collections, why objects are in cabinets, and so on. Without the fear of objects being damaged, exhibition practices can be reconsidered to accommodate ways of presenting them that simply were not possible before. This shifts the focus more to thinking about what is the best way to convey information, as the requirement for preservation is no longer inhibiting the options. From a presentation point of view, the wish for playfulness can be understood as stemming from the museum's social role shifting more towards engagement, egalitarian values, and being part of society rather than being an external storage of knowledge (e.g., Hooper-Greenhill 2000). However, it should not be forgotten that in digital media, playfulness is a very common way of engaging with content and communicating (see, e.g., Frissen et al. 2015). So, it is not surprising that the lack of fear for damaging objects, wishing to engage with the community, and using digital ways of exhibiting content promotes the perception that it is permissible to play around a bit more with the exhibition contents and ways of presentation than what has been done in physical exhibitions.

On a more general level, however, this also shifts the focus away from the objects themselves to the direction of audience experience. For example, our analyzed case was highly oriented towards visual information and included almost no explanations about the exhibited content. This was meant to support free interpreting and experiencing of the content (see, e.g., Witcomb and Message 2015):

> In these kinds of visual [exhibitions], it's very nice that we don't strongly guide the interpretation of the visual contents. Visitors might get a wider and freer viewpoint to do their interpretations.
>
> (Interview 5, Museum staff)

The development of these kinds of multimedia and visual presentation strategies is restricted by many practicalities, some of which may seem self-evident, but still play a significant role in deciding how the past is presented to museum visitors. Some of these practicalities were apparent in how our interviewees *considered the visitor and hypermediation*. Indeed, the museum context sets several limitations on the VR experience that are not usually considered when VR is discussed as a way to represent the past: "We wanted to keep the VR short, so that no one would be there for a long time. It is straightforward and practical. Simple enough" (Interview 2, Museum staff).

Unlike many VR experiences, our analyzed case did not have an external monitor on which others could see what the person using the VR headset was seeing. Thus, visitors could not know what to expect when they picked up the headset. This also meant that there was no way for visitors to engage with the VR experience without using the headset (apart from hearing the sounds). This was a conscious decision by the team. They wanted visitors to use the headset to find out what was available in the VR, as they considered the spatialized images to be quite a different experience from looking at 2D images. The room where the VR was available also contained different kinds of other digital and non-digital visualizations of the same general topic as the spatialized 3D images. The team provided a variety of ways to interact with the digital content, while keeping all of the interactions intuitive. The idea being that: "You can get a variety of inspirations, experiences, and knowledge from different elements in the exhibition space." (Interview 3, IT company staff).

As for the final theme, we discuss the aim of the whole VR project: the wish to have an effect on the museum visitor. We conceptualize this aim through the concept of remediation. In practice, the above-mentioned experimentation with representations necessarily affects how the past is experienced. This was well put to words by one interviewee:

> [A]nd especially if you have both. You have looked at the photos, and you have experienced the [VR] experience. Afterwards, it's almost impossible to differentiate them from each other because you have the engram, slash, feeling of being there attached to the photo.
>
> (Interview 3, IT company staff).

With VR, the effect aimed at was the *experiencing of immediacy*. This was discussed in three modes: temporal, spatial, and situational. Temporal immediacy was discussed as traveling in time, while spatial immediacy was conceptualized through gaining access to a space—a room or a building. Situational immediacy was characterized by delving into the experience to such a degree that the experiencer feels they were present in the photographed event. Notable here are the different conceptualizations of experiencing the different immediacies: temporal is understood through travel (in time), spatial through gaining access to a location or space, and situational by experience or feeling of being there. The aim of providing the experience of immediacy with the old photographs was also verbalized through spatial language, such as: "Could we somehow get closer to the center?" (Interview 1, Museum staff). While this spatial language was used to describe what the project was striving for, the discussed closeness should not be understood as simply spatial proximity, but more as a metaphor for gaining access and generating the feeling of being there. The reason for this is that when spatializing photographs into VR scenes, spatial closeness can also be a problem for making the VR scene feel real: "Here [referring to a VR scene] we are very close. That wall is less than a meter from our body. You can break the image quite easily" (Interview 3, IT company staff).

The issue here is that the user can accidentally break the illusion of past reality. Simply by moving, the angle from which the VR world is viewed can change drastically in relation to objects that are close to the user. In itself, this is not generally a problem for VR. However, for historical VR that uses original historical photographs, this manifests a challenge, as the old photographs do not contain the information needed to fill the gaps that appear because of user movement. For entertainment products, this is not a problem, but, as discussed above, museums need to make conscious decisions about how much visual material they are willing to invent for these kinds of exhibits. With this, we circle back to the first topic we began with: the representation itself.

4 | Conclusions

In this paper, we have unpacked what producing the past with the digital consists of in contemporary museum practice, in light of the concepts of remediation, hypermediation, and immediacy. Our case example was a set of interviews with a team of museum professionals and IT experts who were involved in preparing a virtual reality exhibition piece. In sum, our analysis brought up tensions between original photographs and their digitized and edited counterparts when creating digital representations based on archival materials. The production process was based on a division of labor between museum and IT experts, as well as on technology-driven decision-making more than on joint discussions about the grounds on which different production steps were taken. Finally, we saw the urge to support museum visitors' engagement with the content and experience immediacy as one of the main goals of the whole project, and even something that, at times, overrode concerns about potential problems involved in creating the representation itself.

Through our analysis, we hope to have demonstrated that remediation is not only a theoretical issue, but also a useful concept for explicating very practical dealings with representations in historical museums. This perspective makes us more aware of how the choice of media affects our conceptions of past reality. It also forces us to consider a network of media rather than a single representation when evaluating the representational power of a museum exhibition, a literary work, or a game. The representational value of any historical representation cannot be understood without considering the other media that we constantly use. With digitalization and new media formats, it is not always the actual museum collection items that are on display but their digitized counterparts, and this affects our relationship with the objects (see, e.g., van den Akker 2011). Thus, the epistemic and representational issues related to encounters with such formatted representations should be more critically discussed, and we propose remediation as a useful concept for that purpose—we believe the concept can add awareness of the role media play and would enable museum staff and educators to view museum exhibitions and collections in a new light.

One interesting question that arises from this is how the visitors received the VR content. How do they regard the immersive experience, its authenticity (or inauthenticity), and the edited visual content in museum exhibition settings? These questions should be addressed systematically, but unfortunately, it is beyond the scope of this paper, as we did not collect visitor responses for this study.

In sum, VR exhibitions might become a permanent part of the museum ecology, or they might fade away, but the fact remains

(and will remain) that our standards for evaluating the representational power of media change over time, and thus an updated understanding of how people interact with representations of the past is needed. Even though the arguments and examples in this paper are mostly discussed in the context of two visual and closely linked media—3D VR images that were created on the basis of 2D digitized photographs—we believe that remediation, as discussed here, can be of use in wider discussions about historical representations, the interpretations made of them, and, finally, about how we come to think of past reality.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Endnotes

[1] The theme "Other comments" of the remediation category is left out of this presentation; the theme included directly prompted segments about assessing the final VR product and segments about other projects than those discussed.

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