





## MULTI-STUDY PAPER

# Historical Time Machines: Experimentally Investigating Potentials and Impacts of Immersion in Historical VR on History Education and Morality

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Virtual reality (VR) is known for its immersive characteristics that enable users the experience of *presence* in virtual environments. However, the experience of presence in emotionally charged historical VR is controversially discussed as it might decrease the critical, cognitive reflection of the historical content and lead to strong emotional reactions. Therefore, we examined the effects of the VR content's emotionality on presence and emotional response. Following the *transportation-imagery model* and the *model of intuitive morality and exemplars*, we investigated the effects of presence and emotional response on the recipients' enjoyment, historical interest, beliefs, awareness, and moral reasoning. Moreover, we tested whether additional information after watching historical VR can support the critical reflection of the historical content. Taking different modalities into account, we conducted two experiments following a 2 (emotionality of the content) × 2 (reception of additional information)-between-subjects design in which participants were exposed to historical VR via a media player (Experiment 1,  $N = 493$ ) or VR glasses (Experiment 2,  $N = 99$ ). In line with the assumptions, the recipients' experience of presence and emotional response supported historical interest, enjoyment, and affected moral reasoning. Moreover, findings indicated that additional material promotes the critical reflection of historical VR.

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More and more frequently, historical virtual reality (VR) applications like *Inside Auschwitz*<sup>1</sup> are freely accessible on online video platforms (e.g., YouTube VR) and can be consumed anywhere at anytime (e.g., living rooms). These applications aim to offer users unique, vivid, emotional insights into the past to promote the enjoyment of and interest in historical topics (e.g., the former Auschwitz–Birkenau concentration camp; Bunnenberg, 2020).

However, such applications are viewed critically by history didactics and whether historical VR is an adequate educational tool is intensely discussed (e.g., Bunnenberg, 2020). The technological (*technological immersion*; e.g., 360° view) and narrative characteristics of VR are known for promoting the recipients' "sense of being there" (Slater & Wilbur, 1997, p. 604) described by the term *presence*: recipients' experience to be part of a (virtual) environment (e.g., Slater, 2003). In line with the *transportation-imagery model*, it is assumed that especially the recipients' experience of narrative presence, the immersion into narration, in historical VR leads to strong emotional reactions and a less critical reflection of the historical content (c.f. transportation, Green & Brock, 2002). Moreover, these

<sup>1</sup> <https://youtu.be/QwC5d75iTcA>

effects might be promoted by the contents' emotionality of historical VR, as previous research indicates that VR experiences lead to matching emotional responses (e.g., Riva et al., 2007).

In this context, history didactics emphasize the importance of *historical awareness*, describing the ability to analyze and evaluate representations of the past, to ensure an appropriate engagement with representations of the past in media (e.g., VR; Pandel, 1987, 2017). Historical awareness is defined as a multidimensional trait that changes through exposure to history and includes, among others, the awareness of the time (past, present), reality, and morality. It is argued that historical VR might affect historical awareness by blurring the boundaries between the (virtual) past and the present and promoting the attentional focus on the historical virtual environment (e.g., Bunnenberg, 2020; Lewers & Frentzel-Beyme, 2022). For instance, the awareness of reality might be reduced by the experience of presence in historical VR. On the other hand, the awareness of morality might be promoted as the *model of intuitive morality and exemplars* suggests that media content affects the moral reasoning of recipients (Tamborini, 2012). To the best of the authors' knowledge, it has not been investigated empirically until now whether the experience of presence in historical VR indeed affects the recipients' (historical) awareness. Nor has been scrutinized whether and how the critical processing of the historical content can be fostered.

In light of this, the present investigation will examine whether the recipients' experience of presence and emotional response are affected by the contents' emotionality of historical VR. Building on this, the effects of presence and emotional response to historical VR on learning objectives (e.g., historical awareness, interest, beliefs), moral reasoning, as well as enjoyment will be investigated. Moreover, it will be examined how the critical processing of the presented historical content in informal learning environments (e.g., online video platforms) can be assured by offering recipients additional information after consuming historical VR. As freely accessible historical VR on the internet can be received via different technologies (media player and VR glasses), we will conduct two studies taking both technologies into account.

## Theoretical Framework

### The Experience of Presence in Historical VR

Historical VR applications aim to make time travels real (e.g., Bunnenberg, 2020; Lewers, 2022; Yildirim et al., 2018). These applications use the emotionality of past events, narration, and the unique immersive characteristics of VR to foster the recipient's involvement, emotional engagement, and attention (e.g., Agrawal et al., 2020; Bunnenberg, 2020; Lewers, 2022): Historical VR applications aim to immerse recipients in a historical virtual environment.

The applications' narration can promote "feelings of participation, embodiment, or disembodied observation in a story world" (*narrative presence*; Rowe et al., 2007; p. 127) which can also be described by the term *transportation*, the recipients' experience of temporarily leaving the reality behind and becoming fully immersed in the narration (Green & Brock, 2000a). The experience of narrative presence inevitably includes an emotional response, attentional focus, and concentration on the story's events (Green & Sestir, 2017).

Moreover, the technological characteristics of VR applications (e.g., panoramic views, interaction opportunities; Frentzel-Beyme & Krämer, 2022; Slater, 2003, 2018) are known for promoting a similar

phenomenon describing the recipients' feeling of being part of a virtual environment: spatial presence—"the sense of being there" (e.g., Slater & Wilbur, 1997, p. 604). In this sense, previous research showed that exposure to historical VR in form of a 360° video leads to more spatial presence compared to receiving the same content in standard video format (Frentzel-Beyme & Krämer, 2022). Recipients experiencing presence perceive the mediated environment as more engaging, involving, and real than the actual surrounding environment, as they shift their attention to the mediated (historical) environment (Slater & Wilbur, 1997). To summarize, both: spatial presence and narrative presence (transportation) describe the recipients' experience of being immersed in (virtual) environments accompanied by the attentional focus on the mediated environment (Agrawal et al., 2020).

Therefore, we will refer in the following to narrative and spatial presence when describing the phenomena of being immersed in historical VR. Here, narrative presence describes the recipients' immersion into narration, whereby spatial presence describes the recipients' experience of being actually located within the virtual environment and mainly refers to location and interaction criteria. According to previous research, the experience of spatial presence is promoted by the technological characteristics of VR. On the other hand, narrative presence is grounded in the narration of VR. Considering the characteristics of historical VR applications: narration and technological immersion (panoramic view and interaction opportunities; Bunnenberg, 2020; Frentzel-Beyme & Krämer, 2022), the present investigation will focus on the effects of narrative as well as spatial presence when examining the recipients' experience of presence in historical VR.

### Emotionality of Historical VR

It is assumed that the experience of presence in any kind of emotional media content necessarily evokes (matching) emotional reactions (e.g., Green & Sestir, 2017; Kim et al., 2019; Riva et al., 2007; Visch et al., 2010). Previous research showed that the recipients' experience of presence in historical VR is strongly connected to emotional reactions (e.g., Frentzel-Beyme & Krämer, 2022). Also, Riva et al. (2007) showed in an experiment that an anxious VR (anxious park) produced anxiety within the recipients, whereby relaxing VR-(relaxing park) evoked relaxation.

As historical VR applications are usually emotionally charged because of the past event's emotionality that producers use to catch the recipients' attention and more deeply involve them in the presented content (e.g., being a prisoner in the German Democratic Republic [GDR]; Bunnenberg, 2020; Rosenwein, 2002), strong emotional reactions to historical VR could be triggered. Therefore, we suppose that the content's emotionality of historical VR positively promotes the recipients' experience of presence (narrative and spatial presence) and emotional response.

*Hypothesis 1:* The content's emotionality of historical VR applications affects the recipients' [a] experience of presence and [b] emotional response positively.

### Historical From a History Didactics Perspective

#### *Enjoyment of Historical VR*

Especially the immersive characteristics and emotionality of historical VR applications are intended to catch the recipients' attention

and make history tangible and entertaining (e.g., Bunnenberg, 2020; Lewers, 2022; Yildirim et al., 2018). Indeed, previous research already indicated that the recipients' experience of presence can promote the enjoyment of the presented topics (Green et al., 2004; Sylaiou et al., 2010). Even for the learning context, Sylaiou et al. (2010) found that individuals who experienced presence within a virtual museum reported higher feelings of being entertained. These findings suggest that recipients' experience of presence in historical VR could promote the recipients' enjoyment. As we assume that the recipients' immersion goes hand in hand with the recipients' emotional response (e.g., Green & Brock, 2002), we expect that the recipients' experience of presence and emotional response lead to the recipients' enjoyment of historical VR applications.

*Hypothesis 2:* The recipients' [a] experience of presence in and [b] emotional response to historical VR affects recipients' media enjoyment positively.

### ***Support of Historical Interest***

Besides the entertainment factor, historical VR applications are intended to support the interest in historical topics and convey historical knowledge (e.g., Yildirim et al., 2018). However, it has not been investigated empirically whether the recipients' experience of presence as a unique characteristic of historical VR fulfills these aims. Previous research showed that VR applications support content-related interests by showing an increase in participants' interests in science after using an immersive VR laboratory simulation (Makransky et al., 2020). However, the impact of the recipients' experience of presence and emotional response to historical VR is still not examined in detail. Based on the first investigations, we assume that the recipients' experience of presence and emotional response to historical VR supports the recipients' interest in context-related topics (e.g., GDR).

*Hypothesis 3:* The recipients' [a] experience of presence in and [b] emotional response to historical VR increase historical interest.

### ***Impacts on the Recipients' Moral Reasoning***

Moreover, promoting the awareness of morality, describing the awareness of whether something is right or wrong, is one aim of history education and is strongly connected to the development of morality (Brauer & Lücke, 2013; Pandel, 1987). Since historical VR offers the opportunity to experience the past and gain unique impressions, the recipients' morality may be influenced. Moreover, previous research indicated that media usage affects the recipients' moral values (video games, movies, series; e.g., Eden et al., 2014; Grizzard et al., 2017; Grohmann et al., 2021; Holl & Melzer, 2021). Also, in his *model of intuitive morality and exemplars* (MIME) Tamborini (2012) suggested that media content can influence the temporary and persisting salience of moral values. The model is grounded on the *exemplification theory* (Zillmann, 2002) and the *moral foundations theory* (MFT; Haidt & Joseph, 2004). The MIME suggests that the presentation of moral exemplars (e.g., helping behavior) in media increases the salience of related domains (e.g., care) in memory, which can in turn influence the individual's moral reasoning (Tamborini, 2012). As the MIME addresses the MFT, it

refers to the social-intuitionist perspective of the individual's moral judgment (Haidt, 2001). According to the MFT, a moral judgment is mainly reached intuitively and emotionally based on five innate, modular moral foundations: care, fairness, loyalty, authority, and sanctity (Haidt & Joseph, 2004). Thereby, care includes cherishing and protecting others; fairness describes the value of rendering justice according to shared rules; loyalty depicts the value of standing with individual groups, including family and nation; authority describes the value of legitimation of authorities and traditions, and sanctity refers to religious notions of striving to live in an elevated, more noble way. The MIME suggests that exposure to highly moral or immoral events in media that match these specific moral domains will activate intuitions related to the moral domains (Tamborini, 2012). Previous research showed that the consumption of moral content can prime the reasoning about related moral values by asking participants to expose themselves to moral media content (serial drama) over 8 weeks (Eden et al., 2014).

As previous research showed a stronger influence on the recipients' beliefs supported by the recipients' experience of presence in the virtual environment (e.g., Bujić et al., 2020), we assume that the experience of presence in historical VR promotes the effect of media on content-related moral foundations. Moreover, we expect that the experience of presence and emotional response to historical VR support the illusion of unique "real" experiences and the attentional focus on the presented content which, in turn, promotes the effects of the media content on the content-related moral foundations.

*Hypothesis 4:* The recipients' [a] experience of presence in and [b] emotional response to historical VR applications positively affects the recipients' salience of moral foundations.

Contrary to the social-intuitionist perspective of the individual's moral judgment of Haidt and Joseph (2004), the rationalist approach of Kohlberg (1958) suggests that a moral judgment is reached more rationally by a process of methodological thinking based on perspective-taking and empathy. In his stage model, Kohlberg (1958) assumes that the individual's moral orientation develops in six successive steps, leading from the orientation toward punishment and obedience on Stage 1 to the orientation toward universal ethical principles on Stage 6 (Kohlberg, 1958). The moral orientation develops based on an everlasting process of perspective-taking and empathy which implies that the opportunity to take another perspective can support the individual's moral development (Walker, 1980). As historical VR applications often offer recipients the opportunity to take a unique perspective of the past (e.g., being a prisoner in the GDR), previous research indicated that perspective-taking through historical VR can support the individual's moral development which is supported by the recipients' immersion into the historical virtual environment (Frentzel-Beyme & Krämer, 2022). Therefore, we assume that immersion and emotional involvement in historical VR support the illusion of "real" experiences, which, in turn, affects the recipients' moral development according to Kohlberg (1958).

*Hypothesis 5:* The recipients' [a] experience of presence in and [b] emotional response to historical VR applications affect the recipients' moral orientation.

### Historical VR as Educational Tool

However, the experience of presence and emotional response to historical VR is controversially discussed by history didactics (e.g., Bunnenberg, 2020; Lewers, 2022). They criticize that the recipients' affective responses might decrease the critical, cognitive reflection of the historical content which is one aim of history education. In line with this, Parong and Mayer (2021) recently showed that viewing a history lesson in VR supports emotional processing which distracts from the cognitive processing of the information given in the VR history lesson and leads to lower learning outcomes. Also, the *transportation-imagery model* of Green and Brock (2002) suggests less critical processing of the presented information, when being transported in narration (i.e., narrative presence). In an experiment, the researchers asked participants to read a story that dealt with a rampage in a mall and was either classified as fictional or nonfictional. Afterward, they had to indicate their agreement with story-related attitudes. The experiment's results showed more story-consistent beliefs when participants were highly transported into the story which was not influenced by the fictionality of the story. Moreover, analyses point out that the resulting persuasiveness of narratives is supported by the extent of evoked emotions.

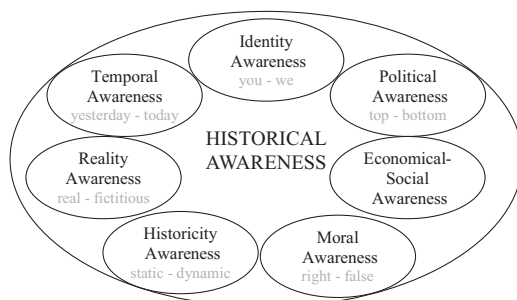
Therefore, we assume that the experience of presence and emotional response to historical VR promote less critical processing of the presented content expressed in the recipients' story-consistent beliefs.

*Hypothesis 6:* The recipients' [a] experience of presence and [b] emotional response to historical VR applications lead to story-consistent beliefs of the presented historical content.

Moreover, history didactics emphasize historical awareness as the main ability that enables the critical, cognitive processing of computer-mediated historical information (Völkel, 2013). Historical awareness is a multidimensional concept that describes the ability to analyze and evaluate the representations of the past (see Figure 1; Pandel, 1987; Seixas, 2017).

As historical VR aims to blur the boundaries between the (virtual) past and present (physical environment; e.g., Green & Brock, 2000a; Slater & Wilbur, 1997), historical awareness in terms of the awareness of the time (present, past) and reality might be challenged. We assume that the recipients' experience of presence and emotional response to historical VR decreases historical awareness, as the experience of presence in the historical virtual environment

**Figure 1**  
*Dimensions of Historical Awareness According to Pandel (2017)*



creates the impression that the historical content is more real and true than the actual surrounding environment.

*Hypothesis 7:* The recipients' [a] experience of presence in and [b] emotional response to historical VR applications negatively affect historical awareness.

**Critical Processing of Historical VR.** Since VR applications aim to educate recipients about the past, we ask from a history education perspective how an adequate critical, cognitive reflection of the historical (virtual) content can be assured (e.g., Bunnenberg, 2020). History education in general aims to promote the consideration of past events from different perspectives (Brauer, 2013). Therefore, when dealing with atrocities of the past it is desirable to not only focus on the fates of the affected but also to look at the circumstances of the perpetrators at any time. Media that only shows one perspective on the past that many historical VR applications do (e.g., being a prisoner in the GDR) is perceived to be inappropriate and insufficient (Bunnenberg, 2020). As additional information has been proven to support the critical, cognitive reflection and a multiperspective view on past events (e.g., Kansteiner, 2009; Schwarz, 2014), we will investigate whether additional information after receiving historical VR might be able to decrease story-consistent beliefs and the emotional response and thereby might prevent the loss of historical awareness to mitigate the effects of the experience of presence and emotional response as explained beforehand.

*Research Question:* Can additional information after consuming historical VR applications prevent [a] emotional overload [b] adoption of story-consistent beliefs and [c] the loss of historical awareness?

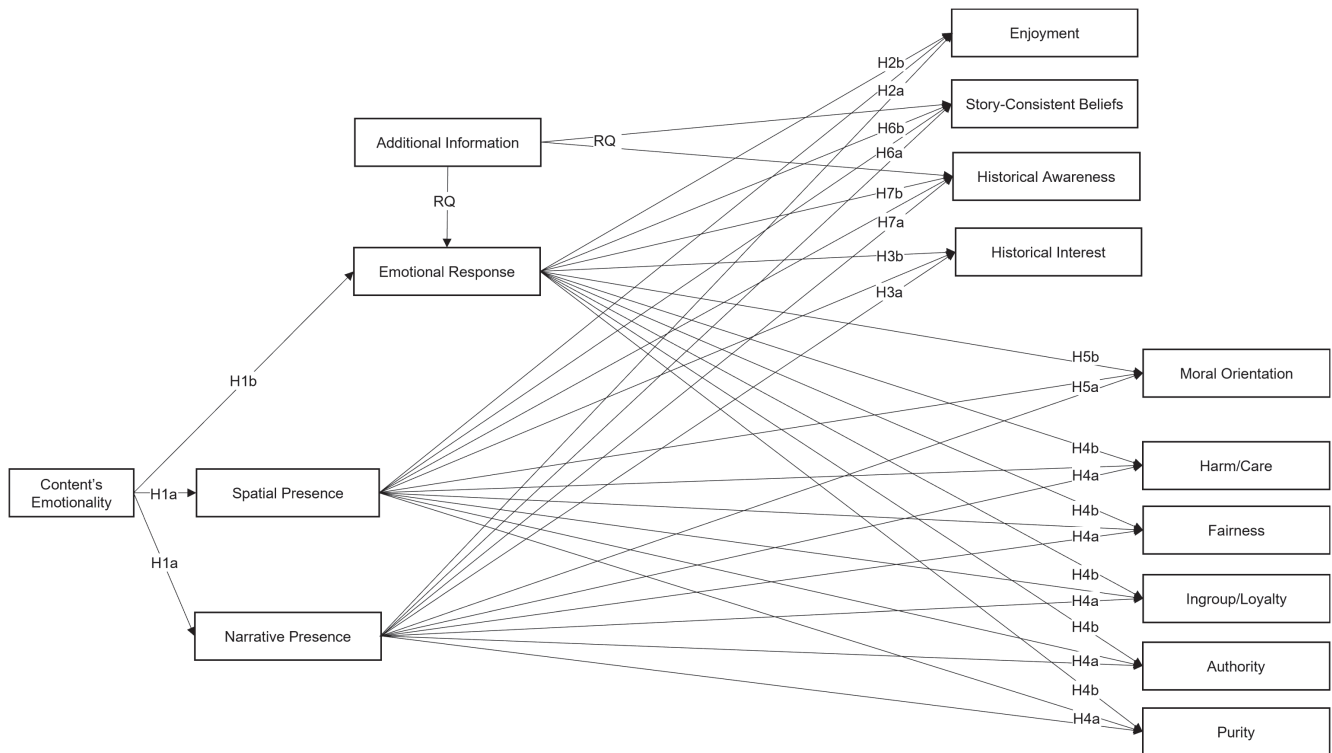
### Research Model

The present investigation aims to examine how historical VR applications were processed. Therefore, we ask whether the contents' emotionality of historical VR promotes the recipients' experience of presence (spatial and narrative presence), as well as the emotional response (Hypothesis 1). Building on this, we ask whether this attentional and emotional focus on the historical virtual environment (Agrawal et al., 2020) supports the recipients' enjoyment of historical VR, as well as the historical interest, morality, and story-consistent beliefs (H2–H6). Moreover, we assume that the experience of presence in a historical virtual environment decreases historical awareness, as the boundaries between the virtual past and reality get blurred (H7). Additionally, we ask whether additional information after consuming historical VR can promote adequate processing of the historical virtual content and, therefore, promote historical awareness and decrease story-consistent beliefs and emotional responses research question (RQ). The hypotheses and research questions suggest the following integrative model (Figure 2).

Moreover, as freely accessible historical VR applications can be consumed via different technologies: the online platform's media player or VR glasses; we ask whether the recipients' experience of presence and emotional response depend on the used technology. Previous research showed that immersive technological characteristics (e.g., panoramic view, interaction opportunity; Slater & Wilbur, 1997) promote the recipients' experience of presence (e.g., Frentzel-Beyme & Krämer, 2021). Therefore, we assume



**Figure 2**  
*Integrative Research Model Including the Relations Assumed in the Hypotheses (1–7) and the Research Question*



Note. RQ = research question.

that wearing VR glasses significantly increases the recipients' immersion compared to watching the historical VR application via the platforms' media player.

*Hypothesis 8:* The technological immersion of the medium positively affects the recipients' experience of presence.

## Method

### Design

To examine the hypotheses and research question, we used a 2 (content's emotionality) × 2 (additional information)—between-subjects design. We conducted two studies following the same design to take the different technologies of historical VR (360° videos) into account (media player vs. VR glasses). In the online study ( $N = 493$ ; media player [MP]) participants watched the historical VR through the video platform's media player. In the laboratory study ( $N = 99$ ; VR glasses) participants used the integrated cardboard modus and watched the same historical VR with VR glasses created by a cardboard holder and a smartphone (see Figure 3). Watching the historical VR through the platform's media player offers the opportunity to get a 360° view of the virtual environment by using the mouse or keyboard, using VR glasses offers the opportunity to naturally look around by moving the head.

Each of the studies contained four experimental groups: Emotional content and additional information (MP:  $n = 131$ , VR:  $n = 26$ ); emotional content and no additional information (MP:  $n = 119$ ,

VR:  $n = 25$ ); less emotional content and additional information (MP:  $n = 133$ , VR:  $n = 25$ ); less emotional content and no additional information (MP:  $n = 110$ , VR:  $n = 23$ ).

The study design was approved by the local ethics committee and was preregistered on open science framework (OSF) in advance of data collection (data and material can be found on OSF as well; Frentzel-Beyme & Krämer, 2021).

### Independent Variables

#### *Content's Emotionality*

To manipulate the content's emotionality of the historical VR, we used two different parts of the 360° video of the memorial site Berlin Hohenschönhausen (Germany).<sup>2</sup> The 360° video deals with the perspective of a prisoner in the former state security service (Stasi) prison in the GDR in the 1980s.

The GDR was a socialist state from 1949 to 1990 in the nowadays eastern part of Germany. We used two parts of 2 min of the 360° video, that were evaluated in a pretest ( $N = 58$ ) as emotional ( $M = 7.8$ ,  $SD = 1.2$ ) and less emotional ( $M = 6.7$ ,  $SD = 2.3$ ) on a 10-point Likert-scale,  $t(56) = 2.03$ ,  $p = .048$ ,  $d = .524$ . Although the emotionality values of both parts were relatively high and differed not that much, it was decided to use these parts because of the statistically significant difference and the effect size (medium effect; Cohen, 1992). The content of both parts is described in Table 1.

<sup>2</sup> <https://youtu.be/ZKP54B0yu3M>

**Figure 3**  
*Overviews of the Technologies Used in the Experiments*

A



B



*Note.* (A) 360° video displayed in the online platform's media player. Screenshot reproduced from IntoVR.com with permission. Copyright by IntoVR.com. (B) Cardboard holder including cardboard holder displaying the 360° video in the integrated cardboard modus.

A content analysis based on Holl and Melzer (2021) identified the moral foundations triggered by the different scenes of the historical VR (Table 1).

Furthermore, based on a previous study dealing with the same content, we could evaluate that most of the recipients (ca. 70%) perceived the content as morally relevant and stated that they got the impression that the video is addressing different moral topics (e.g., fairness; OSF<sup>3</sup>). Although the content of the different parts differed to some extent, the main content can be classified as equal as it includes similar scenes (e.g., interrogation; Table 1), triggers similar moral foundations, and takes place in the same location (former GDR prison).

### **Additional Information**

As additional information news articles were given to the recipients after watching the 360° video. The news articles were created in interdisciplinary cooperation with history didacts. The news article for the "additional information" condition dealt with the used 360° application of the memorial site Berlin Hohenschönhausen (Germany) and includes fixed historical-didactic criteria: multiperspectivity, controversy, plurality, historical reference, deconstruction, media reflection, location-/perspectivity-boundedness (548 words). Detailed information on the criterion can be found on OSF (Frentzel-Beyme & Krämer, 2021). The news article for the "no-additional-information" condition dealt with VR in general and outlines application areas of VR (550 words). Both articles were uploaded in the OSF project in the originally used German version (Frentzel-Beyme & Krämer, 2021).

### **Measures**

*Emotional response* was measured by a modified version of the Differential Affect Scale (M-DAS; Renaud & Unz, 2006). We used 11 of the originally 16 subjective sensitivities fitting to the object

of study, each represented by three adjectives/nouns (Table 2). Participants indicated how much they experienced the subjective sensitivities on a 6-point Likert scale, ranging from 1 = *not at all* to 6 = *very much* (MP:  $M = 3.0$ ,  $SD = 0.8$ ; VR:  $M = 3.2$ ,  $SD = 0.7$ ).

*Enjoyment* was measured based on Reinecke et al. (2011). We used five adapted items (e.g., "The video was interesting."). Answers were given on a 6-point Likert scale, ranging from 1 = *not at all* to 6 = *very much* (MP:  $M = 3.4$ ,  $SD = 1.3$ ,  $\alpha = .84$ ; VR:  $M = 4.7$ ,  $SD = 0.9$ ).

*Historical awareness* was measured with a self-developed questionnaire consisting of fourteen items building on Pandel's (1987) model of historical awareness. The results of the exploratory analysis revealed four dimensions of historical awareness: the awareness of the past (e.g., "In the past, there were prisoners in the prison of the Ministry of State Security in Berlin-Hohenschönhausen."; four items;  $\alpha = .86$ ), the awareness of the present (e.g., "Prisoners are treated in prisons in Berlin today as shown in the video." [R]; four items;  $\alpha = .46$ ) the awareness of reality (e.g., "The video shows the events in the prison of the Ministry of State Security in Berlin-Hohenschönhausen as they happened."; three items;  $\alpha = .84$ ), the awareness of changes (e.g., "The events in the prison of the Ministry of State Security Berlin Hohenschönhausen are unchangeable."; three items;  $\alpha = .79$ ). Items were answered on a 6-point Likert scale (1 = *I strongly disagree* to 6 = *I strongly agree*; MP:  $M = 4.0$ ,  $SD = 0.4$ ; VR:  $M = 5.2$ ,  $SD = 0.7$ ). All items and the results of the explanatory factor analysis can be found on OSF (Frentzel-Beyme & Krämer, 2021).

*Historical interest* was measured in two ways: General and topic-specific interest. General history interest was assessed based on an adapted version of the Short Scale of Political Interest (Otto and Bacherle, 2011). To measure general historical interest, we used a modified version consisting of five items (e.g., "For me history is an exciting topic."). To measure topic-specific history interest, we

<sup>3</sup> <https://doi.org/10.17605/OSF.IO/T7S3Q>

**Table 1**

*Overview of the Content of Each Scene and Triggered Moral Foundations (MFs) of the Different Parts of the 360° Video of the Memorial Site Berlin Hohenschönhausen (Germany)*

Scene	Triggered MFs
Less emotional part (0:00–2:11 min)	
1. Welcoming of three prison guards in front of the prison Berlin Hohenschönhausen	Ingroup/loyalty, authority/respect
2. Handing over of prison clothes, body search	Ingroup/loyalty, authority/respect, harm/care
3. Interrogation by two officers	Authority/respect, harm/care
4. Taking off the identification photo by two other officers	Authority/respect, harm/care
5. Placement in the prison cell	
Emotional part (2:12–4:26 min)	
1. Interrogation by two officers, with one of the officers walking up to the person, yelling at him or her, and blowing cigarette smoke in the person's face	Purity/sanctity, authority/respect, harm/care, fairness/reciprocity
2. Placement in the prison cell and encounter with cell neighbor who tries to persuade the person to cooperate with the Stasi	Harm/care, fairness/reciprocity

adapted the items to the topic (GDR; e.g., “For me, the GDR is an exciting topic.”) and furthermore used a modified version of the dimension “exploration intention” of the Situational Interest Scale of Cheng et al. (1999; e.g., “I want to analyze the GDR to have a grasp on it.”). All items were answered on a 6-point Likert scale (1 = *I strongly disagree* to 6 = *I strongly agree*, MP:  $M = 3.5$ ,  $SD = 1.5$ ,  $\alpha = .97$ ; VR:  $M = 3.9$ ,  $SD = 1.1$ ).

*Moral foundations* were assessed based on the Moral Foundations Questionnaire (MFQ; Graham et al., 2011), which assessed based on 30 items the five moral foundations: harm/care (MP:  $M = 5.0$ ,  $SD = 0.8$ ,  $\alpha = .68$ ; VR:  $M = 4.9$ ,  $SD = 0.7$ ), fairness/reciprocity (MP:  $M = 5.0$ ,  $SD = 0.7$ ,  $\alpha = .61$ ; VR:  $M = 5.1$ ,  $SD = 0.96$ ), in-group/loyalty (MP:  $M = 3.6$ ,  $SD = 0.8$ ,  $\alpha = .57$ ; VR:  $M = 3.3$ ,  $SD = 0.7$ ), authority/respect (MP:  $M = 3.6$ ,  $SD = 0.9$ ; VR:  $M = 3.5$ ,  $SD = 0.9$ ), purity/sanctity (MP:  $M = 3.4$ ,  $SD = 1.0$ ,  $\alpha = .68$ ; VR:  $M = 3.0$ ,  $SD = 0.8$ ) each represented by six items. Answers were given on a 6-point Likert scale (1 = *I strongly disagree* to 6 = *I strongly agree*).

*Moral orientation* was measured using a questionnaire that assessed moral orientation according to Kohlberg's theory of moral development (1958; Frenzel-Beyme & Krämer, 2022). After reading a moral dilemma about a family mother (Antonia) in a totalitarian state who is asked for help by a persecuted homosexual couple, the participants rated 10 statements referring to the six stages of moral orientation according to Kohlberg (1958). The questionnaire includes three factors: Factor 1 represents Stages 1–4 (e.g., “Antonia should not help them because their friends and acquaintances might not approve that.”;  $\alpha = .75$ ). Factor 2 represents Stage 5: social contract orientation (e.g., “Antonia should not help them because it is always right to protect the family.”;  $\alpha = .81$ ). Factor 3 represents Stage 6: orientation toward universal principles (e.g., “Antonia should help them because it would be selfless.”;  $\alpha = .81$ ). Answers were given on a 6-point Likert scale (1 = *I strongly disagree* to 6 = *I strongly agree*, MP:  $M = 2.56$ ,  $SD = 1.4$ ; VR:  $M = 2.8$ ,  $SD = 1.0$ ).

*Spatial presence* was assessed by the Spatial Presence Experience Scale of Hartmann et al. (2015) consisting of eight items reflecting two dimensions of presence: users' self-location ( $\alpha = .94$ ) and possible actions ( $\alpha = .88$ ). Answers were given on a 6-point Likert scale (1 = *I strongly disagree* to 6 = *I strongly agree*; e.g., “I felt like I was actually there in the environment of the presentation”; MP:  $M = 3.3$ ,  $SD = 1.4$ ; VR:  $M = 3.6$ ,  $SD = 1.0$ ).

*Story-consistent beliefs* were measured based on Green and Brock (2000a). Participants indicated their agreement to six items that

represented assumptions conveyed in the historical VR application (e.g., “The employees of the Ministry of State Security have threatened prisoners”) on a 6-point Likert scale (1 = *I strongly disagree* to 6 = *I strongly agree*, MP:  $M = 4.9$ ,  $SD = 0.6$ ,  $\alpha = .53$ ; VR:  $M = 5.0$ ,  $SD = 0.6$ ). All items can be found on OSF.

*Narrative presence* was assessed by the Transportation Scale of Green and Brock (2000b). We used 10 of the 11 general items of the scale and adjusted them to the given context (e.g., “While I was watching the 360° video, I could easily picture the events in it taking place”). Participants indicated their agreement with the statements on a 6-point Likert scale, ranging from 1 = *I strongly disagree* to 6 = *I strongly agree* (MP:  $M = 3.7$ ,  $SD = 0.8$ ,  $\alpha = .68$ ; VR:  $M = 4.0$ ,  $SD = 0.7$ ).

### Further Measurements

To get insights into the recipients' prior knowledge of the GDR, we asked them how they would estimate their prior knowledge of the GDR on a 10-point Likert scale (1 = *very low* to 10 = *very high*). Furthermore, we asked them whether they had ever visited a museum or memorial site that deals with the GDR and if they know someone who lived in the GDR. Additionally, we assessed the participants' perceived relevance to the topic by two items: “How important/relevant do you consider this topic?” on a 6-point Likert scale from 1 = *not at all* to 6 = *extremely* based on Carpenter's (2019) questionnaire assessing ego involvement.

### Manipulation Checks

To check whether the participants watched the historical VR application attentively, we asked them to indicate what did not happen in the VR application and gave them two options to choose from: interrogation or a visit from relatives. Consequently, they had to select the second option. Furthermore, we asked the participant of the online study if they used the 360° function of the video.

### Procedure

The whole procedure and order of the questionnaires are displayed in Figure 4. While participants were asked to watch the historical VR application (360° video) or read the news article it was ensured that they did not skip it by forwarding them only after an amount of time to the next page of the questionnaire (e.g., 2 min). It took on average about 15 min to participate in the online experiment.

**Table 2**  
*Descriptive Statistics and Internal Validity of the Emotions of the M-DAS*

Emotion	Media player						VR glasses					
	<i>M</i>		<i>SD</i>		$\alpha$		<i>M</i>		<i>SD</i>		$\alpha$	
	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2
Pleasure	1.5	1.4	1.0	1.0	.96	.97	2.3	2.1	1.2	1.2	.91	.92
Happiness	1.4	1.4	0.8	0.9	.89	.95	2.2	1.9	1.1	1.0	.93	.91
Fascination	3.1	3.2	1.4	1.4	.83	.86	3.8	3.8	1.2	1.3	.84	.85
Arousal	3.7	3.8	1.3	1.4	.82	.86	3.8	3.8	1.2	1.2	.86	.87
Interest	4.5	4.3	1.2	1.3	.92	.94	4.8	4.6	0.8	0.9	.83	.83
Surprise	2.8	2.8	1.3	1.3	.84	.83	3.5	3.5	1.2	1.2	.84	.83
Sorrow	3.0	2.7	1.3	1.4	.82	.88	2.9	2.8	1.2	1.2	.80	.87
Anger	3.5	3.3	1.5	1.6	.91	.93	2.8	2.8	1.4	1.5	.89	.91
Disgust	3.7	3.4	1.6	1.8	.91	.95	3.2	3.0	1.5	1.5	.92	.93
Contempt	3.1	2.8	1.3	1.4	.75	.80	3.1	2.9	1.5	1.3	.79	.82
Fear	3.1	2.8	1.5	1.6	.87	.92	2.8	2.7	1.3	1.3	.85	.85

Note. M-DAS = modified version of the Differential Affect Scale; VR = virtual reality.

## Samples

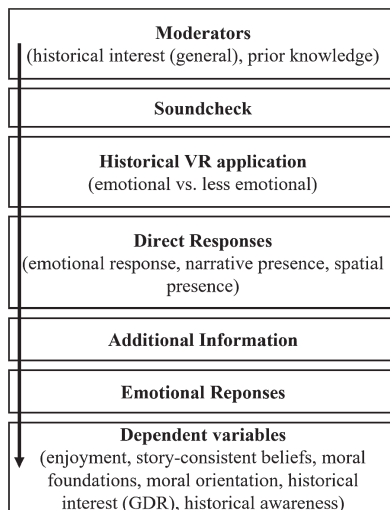
### Online Experiment

In the online experiment, 522 participants were recruited via different channels: an Online-Access-Panel (respondi.com), advertisements on social media, and other online platforms (e.g., <https://surveycircle.com>) to syncretize a sample that is as representative and heterogeneous as possible. Respondents recruited via the online panel were paid appr. 10 Euros for their participation.

To ensure a reliable data set, we excluded participants that did not pass the soundcheck (one data set), tick the right answer option of the control items (two data sets), and pass the manipulation check (26 data sets; no noticeable differences between the groups). Furthermore, we conducted a long string analysis based on the answers given to 21 successive items and did not identify any additional inattentive participants through this procedure (Landers, 2020).

### Figure 4

*The Procedure of the Experiments*



Note. GDR = German Democratic Republic; VR = virtual reality.

After excluding the data sets according to the previously mentioned criteria, it ended up in a data set containing 493 participants including 256 women and 236 men aged between 18 and 75 years ( $M = 45.9$ ,  $SD = 16.2$ ). Most of the participants had a university degree (34%), a university entrance qualification (30%), or a secondary school certificate (27%) and were employees (55%), or students (19%). Furthermore, participants indicated a moderate general interest in history ( $M = 4.1$ ,  $SD = 1.4$ ), and a moderate prior-knowledge ( $M = 5.3$ ,  $SD = 2.4$ ), perceived relevance ( $M = 4.4$ ,  $SD = 1.3$ ), and importance ( $M = 4.4$ ,  $SD = 1.4$ ) to the historical topic (GDR). Moreover, some stated that they lived in the GDR (15%) or know someone who lived in the GDR (36%).

### Laboratory Study

In the laboratory study, 99 people including 74 women, 24 men, and one person who did not identify with any gender participated. The participants of the convenience sample were aged between 17 and 54 years ( $M = 22.5$ ,  $SD = 5.3$ ). They had a university entrance qualification (85%), a university degree (13%), or a secondary school certificate (2%), and were either students (91%) or employees. Participants indicated a moderate general interest in history ( $M = 3.5$ ,  $SD = 1.2$ ), and prior knowledge ( $M = 4.7$ ,  $SD = 1.9$ ), perceived relevance ( $M = 4.2$ ,  $SD = 1.3$ ), and importance ( $M = 4.4$ ,  $SD = 1.2$ ) to the historical topic (GDR). Moreover, some stated to know someone who lived in the GDR (22%), whereby no one in this sample lived in the GDR.

## Results

### Impacts of Technology on the Recipients' Immersion

To test whether the recipients' experience of presence differed depending on the extent of technological immersion (VR glasses vs. MP) as Hypothesis 8 (H8) assumed, we conducted an analysis of variance. To investigate differences in spatial presence in more detail, we examined the differences in subdimension of spatial presence: self-location and possible action. Therefore presence self-location, possible action, and narrative presence were included as dependent variables in the analysis. As the sample sizes were very different



(MP:  $N = 493$ ; VR:  $N = 99$ ), and the Levene test of variance homogeneity revealed that the variances between the two groups differed significantly,<sup>4</sup> we used a more robust test method: Welch tests (Ruxton, 2006).

Regarding the differences in presence self-location between the media player and VR condition, the analysis revealed a significant higher presence self-location values in the VR condition ( $M = 4.0$ ,  $SD = 1.1$ ) compared to the media player condition with small effect sizes ( $M = 3.4$ ,  $SD = 1.5$ ),  $F(1, 590) = 11.46$ ,  $p = .001$ ,  $\eta^2 = .019$ , (Cohen, 1988; Lakens, 2013). Concerning spatial presence possible action, the analysis showed no significant differences between the media player and VR condition,  $F(1, 590) = 0.37$ ,  $p = .542$ .

When taking a look at the differences in narrative presence between the media player and VR glasses condition, the analysis showed significant higher narrative presence values in the VR glasses condition ( $M = 4.0$ ,  $SD = 0.7$ ) and media player condition with small effect sizes ( $M = 3.7$ ,  $SD = 0.8$ ),  $F(1, 590) = 2.04$ ,  $p = .042$ ,  $\eta^2 = .014$ , (Cohen, 1988; Lakens, 2013). Therefore, Hypothesis 8 was accepted for spatial presence self-location and narrative presence.

## Integrative Model

To test the relations assumed in the Hypotheses (H1–H7) and research question we used structural equation modeling analysis with observed variables using maximum likelihood estimation. We calculated separate analyses for both data sets as the preliminary analysis shows that the recipients' immersion differed depending on the used technology (VR vs. MP; using R Version 4.0.3; Figure 5). The experimental groups (content's emotionality and additional information) were included as dichotomous variables in the path model.

The originally hypothesized model revealed a poor model fit according to frequently used fit indices:  $\chi^2(23) = 67.05$ ,  $p < .001$ ,  $\chi^2/df = 1.01$ , comparative fit index = 0.86, Tucker–Lewis index = 0.37, root-mean-square error of approximation = .14 (90% CI from .10 to .18), standardized root-mean-square residual = .09 (Hu & Bentler, 1999). Therefore, according to modification indices and the theoretical assumption that presence and emotional responses are necessarily related (e.g., Green & Brock, 2002), we added two paths from narrative and spatial presence to emotional response (Figure 5).

After the adjustments have been made, the model provided an acceptable fit according to frequently used fit indices: online study (media player):  $\chi^2(20) = 31.82$ ,  $p = .045$ ,  $\chi^2/df = 1.2$ , comparative fit index = 1.00, Tucker–Lewis index = 0.97, root-mean-square error of approximation = .04 (90% CI from .01 to .06), standardized root-mean-square residual = .02; laboratory study (VR glasses):  $\chi^2(20) = 17.28$ ,  $p = .30$ ,  $\chi^2/df = 0.9$ , comparative fit index = 1.00, Tucker–Lewis index = 1.04, root-mean-square error of approximation = .00 (90% CI from .01 to .07), standardized root-mean-square residual = .04 (Hu & Bentler, 1999).

The calculated path models can be found in Figure 5 including the explained variance of each construct. Bivariate correlations between all included constructs can be found in Table 3.

## Effects of the VR Content's Emotionality

Hypothesis 1 (H1) assumed a higher recipients' experience of presence (H1a) and emotional response (H1b) when watching the

emotional part of the historical VR. Independently of the type of technology, the analyses revealed that the content's emotionality does not affect spatial presence (MP:  $\beta = .00$ ,  $p = .937$ ; VR:  $\beta = .13$ ,  $p = .180$ ), narrative presence (MP:  $\beta = .00$ ,  $p = .950$ ; VR:  $\beta = .02$ ,  $p = .848$ ) and emotional response (MP:  $\beta = .00$ ,  $p = .914$ ; VR:  $\beta = -.04$ ,  $p = .579$ ). Therefore, Hypothesis 1 (H1) was rejected.

## Effects on Media Enjoyment

Concerning Hypothesis 2 (H2) which assumed positive effects of the recipients' experience of presence (H2a) and emotional response (H2b) on media enjoyment, the analyses revealed positive relationships between spatial presence (MP:  $\beta = .31$ ,  $p < .001$ ; VR:  $\beta = .20$ ,  $p = .018$ ) and media enjoyment for both conditions. When taking a look at the relationship between narrative presence and media enjoyment, we found that in the media player condition narrative presence was positively related to media enjoyment (MP:  $\beta = .29$ ,  $p < .001$ ), whereby in the VR glasses condition we could not find any relationship between narrative presence and media enjoyment (VR:  $\beta = .26$ ,  $p = .075$ ). Moreover, there was no significant relationship between emotional response and media enjoyment when watching the historical VR in the media player ( $\beta = -.03$ ,  $p = .636$ ), whereby the analysis showed a positive relationship between emotional response and media enjoyment when using VR glasses ( $\beta = .25$ ,  $p = .002$ ). Therefore, Hypothesis 2a was accepted regarding spatial presence and partly accepted for narrative presence, as we only found a relationship in the media player condition. Moreover, Hypothesis 2b was only accepted in the study using VR glasses.

## Effects on Historical Interest

Concerning Hypothesis 3 (H3) which assumed a positive effect of the recipients' experience of presence (H3a) and emotional response (H3b) on historical interest, the analysis showed for both technologies a strong positive effect of narrative presence on historical interest (MP:  $\beta = .31$ ,  $p < .001$ ; VR:  $\beta = .46$ ,  $p < .001$ ). However, no effect of spatial presence on historical interest was found for both technologies (MP:  $\beta = .02$ ,  $p = .701$ ; VR:  $\beta = -.08$ ,  $p = .573$ ).

Therefore, Hypothesis 3a was only accepted for narrative presence.

Moreover, the analyses revealed different effects of emotional response on historical interest (MP:  $\beta = .14$ ,  $p = .009$ ; VR:  $\beta = -.04$ ,  $p = .755$ ). Consequently, Hypothesis 3b was only accepted in the media player condition, which revealed a positive effect of emotional response on historical interest.

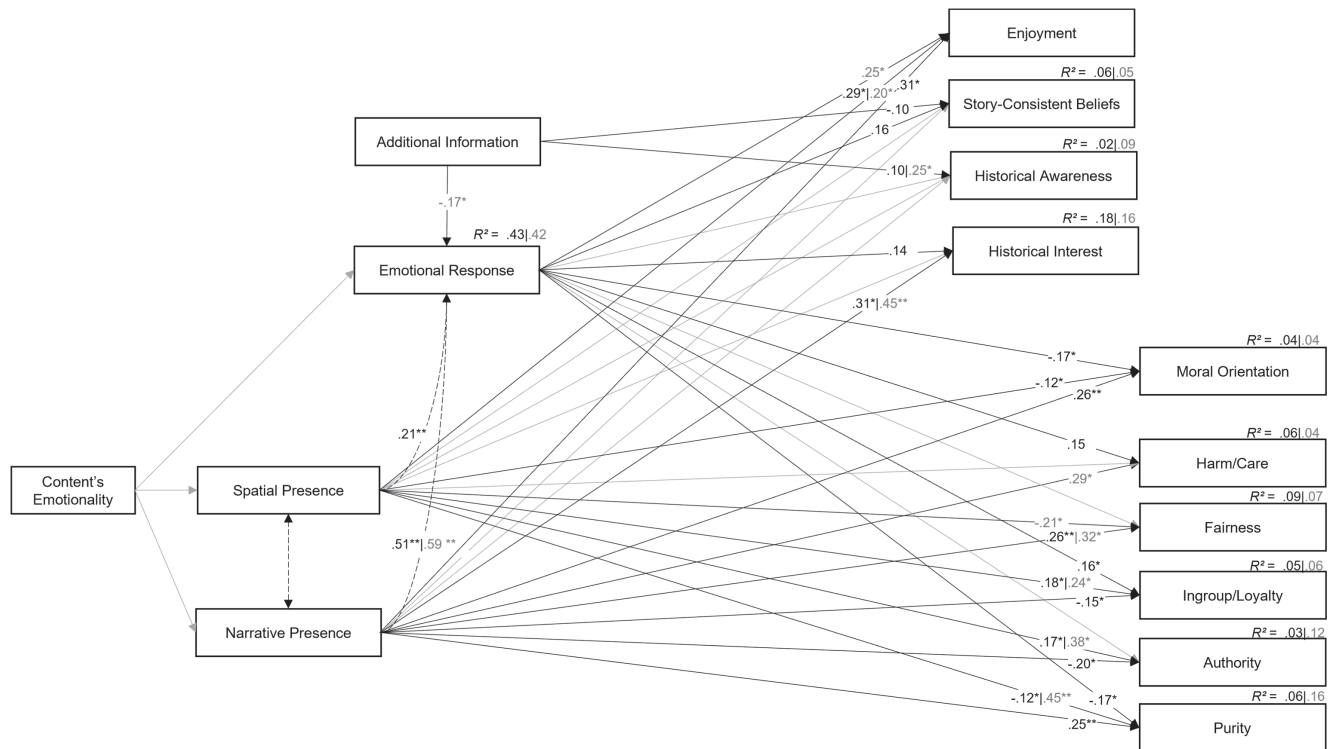
## Effects on the Recipients' Morality

Hypothesis 4 (H4) assumed positive effects of the recipients' experience of presence (H4a) and emotional response (H4b) on the salience of the moral foundations. The analysis revealed different relationships for both technologies of the recipients' experience of presence and emotional response on the different moral foundations.

When taking a look at those who watched the historical VR via the platform's media player, regarding narrative presence the analysis showed mixed effects on the moral foundations: fairness ( $\beta = .26$ ,

<sup>4</sup> spatial presence possible action:  $F(1, 590) = 5.53$ ,  $p = .019$  spatial presence self location:  $F(1, 590) = 13.74$ ,  $p < .001$  narrative presence:  $F(1, 590) = 4.70$ ,  $p = .031$

**Figure 5**  
*Integrative Model Examining the Relations Assumed in Hypotheses 2–7 and the Research Question*



*Note.* Beta values (β) are shown in black digits for the video condition and gray digits for the VR glasses condition. Gray lines represent nonsignificant paths and dashed paths added paths based on the modification indices. VR = virtual reality.  
 \*  $p < .05$ . \*\*  $p < .001$ .

$p < .001$ ), in-group/loyalty ( $\beta = -.15, p = .021$ ), authority ( $\beta = -.20, p = .001$ ), purity ( $\beta = -.25, p < .001$ ) and no effect on the foundation harm/care ( $\beta = .10, p = .108$ ). Regarding spatial presence, the media player condition showed positive effects on the moral foundations: in-group/loyalty ( $\beta = .18, p = .002$ ), authority ( $\beta = .17, p = .004$ ), purity ( $\beta = .19, p = .001$ ), while no effects on the foundations: harm/care ( $\beta = .02, p = .644$ ) and fairness ( $\beta = -.06, p = .244$ ) emerged. Taking the recipients' emotional response into account, the media player group showed mixed effects on the moral foundations: harm/care ( $\beta = .15, p = .017$ ), in-group/loyalty ( $\beta = .16, p = .009$ ), purity ( $\beta = -.17, p = .001$ ) and no effects on the moral foundations: fairness ( $\beta = .10, p = .114$ ) and authority ( $\beta = .11, p = .076$ ). Summarizing the results obtained in the study which employed the media player, H4 was only partly accepted, as the analyses only revealed effects of spatial and narrative presence on fairness, loyalty, authority, purity (H4a), and the emotional response affected harm, loyalty, purity (H4b) but not all five moral foundations.

When watching the historical VR via VR glasses, the analysis showed regarding narrative presence mixed effects on the moral foundations: harm/care ( $\beta = .26, p = .035$ ), fairness ( $\beta = .32, p = .007$ ) and no effects on the foundation in-group/loyalty ( $\beta = .056, p = .650$ ), authority ( $\beta = -.10, p = .436$ ) and purity ( $\beta = -.20, p = .081$ ). Also, regarding spatial presence the analysis showed mixed effects on the moral foundations: fairness ( $\beta = -.21, p = .045$ ), in-group/loyalty ( $\beta = .24, p = .030$ ), authority ( $\beta = .38, p = .001$ ), purity ( $\beta = .45,$

$p < .001$ ) and no effect on the foundation harm/care ( $\beta = -.11, p = .307$ ). Moreover, regarding the recipients' emotional response, the analysis showed no effects on the moral foundations: harm/care ( $\beta = -.14, p = .218$ ), fairness ( $\beta = -.14, p = .259$ ), in-group/loyalty ( $\beta = -.18, p = .119$ ), purity ( $\beta = -.04, p = .769$ ), and authority ( $\beta = .01, p = .963$ ).

Therefore, H4b was partly accepted as the analysis showed mixed effects of narrative and spatial presence on harm, fairness, loyalty, authority, and purity when using VR glasses. However, H4b was rejected as the analysis showed no effects of emotional response on the moral foundations when watching the historical VR via VR glasses.

Concerning the effects of the recipients' experience of presence (H5a) and emotional response (H5b) on the moral orientation as Hypothesis 5 (H5) assumed, the analysis revealed for the media player condition a positive effect of narrative presence ( $\beta = .26, p < .001$ ) and negative effects of spatial presence ( $\beta = -.12, p = .039$ ) and emotional response ( $\beta = -.17, p = .004$ ) on the recipients' moral orientation. When watching the historical VR via VR glasses the analysis showed no effects of narrative presence ( $\beta = .05, p = .707$ ), spatial presence ( $\beta = -.20, p = .1332$ ) and emotional response ( $\beta = .15, p = .251$ ) on the recipients' moral orientation.

Therefore, H5 was rejected for the VR condition. Still, H5a was partly accepted as the analysis showed a positive effect of narrative presence on moral orientation.

**Table 3**  
*Bivariate Correlation Between All Constructs Included in the Integrative Model*

Construct	Narrative presence	Spatial presence	Emotional response (+)	Emotional response (-)	Enjoyment	Story-consistent beliefs	Historical awareness	History interest	Moral foundations
Spatial presence	.555**/.480**								
Emotional response (+)	.194**/.556**	.199**/.358*							
Emotional response (-)	.087/.444**	.041/.163	.067/.240*						
Enjoyment	.442**/.530*	.485**/.406*	.081/.581**	.011/.231*					
Story-consistent beliefs	.170**/.134	.175**/-.084	.063/.061	-.059/.137	.129**/.160				
Historical awareness	.183**/-.237*	.042/-.171	-.018/-.180	-.027/-.077	.115**/.003	.294**/.029			
History interest	.410**/.393**	.262**/.129	.078/.232*	.039/.130	.407**/.217*	.091**/.117	.188**/-.028		
Moral foundations	.115**/.126	.203**/-.270**	.118**/-.075	.095**/.038	.088/.037	.176**/.093	.092**/-.038	.156**/.267**	
Moral orientation	.091**/.048	-.053/-.125	.017/-.046	-.150**/.205*	.082/.061	.179**/.294**	.313**/.263**	-.004/.032	.000/-.094

*Note.* The first values represent the correlations in the online study using the media player. Values after the slash represent the correlation of the laboratory experiment using VR glasses. VR = virtual reality. \*  $p < .05$ . \*\*  $p < .001$ .

**Processing of Historical VR**

Addressing Hypothesis 6 (H6) which assumed a positive effect of the recipients’ experience of presence (H6a) and emotional response (H6b) on story-consistent beliefs, the analysis showed a positive relationship between emotional response and story-consistent beliefs ( $\beta = .15, p = .006$ ) and no relationship between spatial presence ( $\beta = .09, p = .116$ ) nor narrative presence and story-consistent beliefs ( $\beta = .03, p = .656$ ) when watching historical VR via the media player. When focusing on those who watched the historical VR via VR glasses the analysis did not show any effects of emotional response ( $\beta = .08, p = .558$ ), spatial presence ( $\beta = -.19, p = .086$ ), and narrative presence ( $\beta = .18, p = .180$ ) on story-consistent beliefs. Therefore, Hypothesis H5a was rejected and H5b was only accepted for the media player condition.

Moreover, the analysis showed for both technologies no effects of spatial presence (MP:  $\beta = -.02, p = .745$ ; VR:  $\beta = -.10, p = .440$ ), narrative presence (MP:  $\beta = .02, p = .687$ ; VR:  $\beta = -.21, p = .103$ ) and emotional response (MP:  $\beta = -.07, p = .180$ ; VR:  $\beta = .17, p = .199$ ) on historical awareness. Therefore, Hypothesis 7 (H7) was rejected.

**Effects of Additional Information**

Following the research question, which asked whether additional information after watching the historical VR decreases the recipients’ emotional response, story-consistent beliefs and increases the historical awareness, the model revealed different depending on the technology (360° MP vs. VR glasses) the additional on the emotional response (MP:  $\beta = .01, p = .714$ ; VR:  $\beta = -.17, p = .029$ ) and story-consistent beliefs (MP:  $\beta = -.10, p = .017$ ; VR:  $\beta = -.03, p = .748$ ) and a positive effect of additional information on historical awareness (MP:  $\beta = .10, p = .018$ ; VR:  $\beta = .25, p = .002$ ).

**Discussion**

In two studies we investigated the effects of the recipients’ experience of presence in historical VR by taking different technologies into account to cover the various possibilities of reception (VR glasses vs. media player). First, we investigated whether the recipients’ experience of presence (narrative, spatial) and emotional response are affected by the content’s emotionality of historical VR. Building on this, the effects of presence and emotional response on learning objectives (knowledge, historical awareness, interest), as well as enjoyment and morality were examined. Additionally, from a historical education perspective, the investigations gave first empirical insights into the recipients’ processing of historical VR applications and offer practical implications to ensure the critical processing of the presented historical content.

**Effects of Content’s Emotionality**

Against expectations, the study’s findings showed that the content’s emotionality does not support the recipients’ engagement (presence and emotional response) in historical VR. Participants who received the part of the historical VR that was evaluated as more emotional did not report feeling more present or emotionally aroused afterward. However, these findings could be explained by the general high extent of contents’ emotionality of historical VR applications as they mainly address atrocities of the past (e.g., Second World War,

GDR; Bunnenberg, 2020; Rosenwein, 2002). Previous studies mainly compared applications that were perceived as neutral with emotional ones or different kinds of emotional content (e.g., relaxing vs. anxious; Riva et al., 2007). Moreover, the conducted prestudy already indicated that both parts of the historical VR were perceived as emotional. Therefore, the question arises whether the extent of contents' emotionality or whether emotions were addressed or not is decisive for the effects on the recipients' experience of presence or emotional response. However, the findings showed that the recipients' reported in general more negative feelings like anger or disgust more often than positive feelings like happiness. These findings highlight the relationship between the media content and "matching" emotions (e.g., Riva et al., 2007).

### **Potentials of Historical VR for History Education**

The investigation showed several impacts of the recipients' experience of presence in and emotional response to historical VR concerning aspects of history education.

#### ***Impacts on Historical Interest and Enjoyment***

The recipients' experience of presence and emotional response turned out to increase the recipients' enjoyment and historical interest which are, in turn, promoted by the typical narrative and immersive characteristics of historical VR. These findings are in line with previous research which mentioned that narrative and spatial presence are important indicators for the enjoyment of different media applications (movies, texts; Bilandzic & Busselle, 2011; Green et al., 2004) and topic-related interest (Yildirim et al., 2018). Nevertheless, the current findings could expand these relations to historical VR. Moreover, as the investigations showed that wearing VR glasses instead of watching a 360° video via the website's media player leads to a more experienced spatial and narrative presence, receiving historical VR via VR glasses might promote historical interest and enjoyment more strongly. These are important findings in the ongoing debate about the usefulness of historical VR (e.g., Bunnenberg, 2020), as we could strengthen the argument that such applications can support an interest in historical topics empirically.

The positive relationships between spatial presence and enjoyment as well as narrative presence and historical interest were found for both technologies (VR glasses and media player), whereby emotional responses were only positively linked to enjoyment in the VR glasses condition and narrative presence only positively related to enjoyment in the media player condition. These are interesting findings as previous research indicated that the recipients' emotional response might have been stronger when wearing VR glasses compared to receiving the same historical VR applications via the media player (e.g., Frentzel-Beyme & Krämer, 2022). Therefore, the findings lead us to assume that this relationship might be moderated by the immersive technological characteristics of VR.

#### ***Impacts of Historical VR on Moral Reasoning***

Moreover, the investigation provided different findings regarding the impacts of the recipients' experience of presence and emotional response to historical VR on moral reasoning by considering two

perspectives on morality: the social-intuitionist (MFT; Haidt & Joseph, 2004) and the rational perspective (Kohlberg, 1958).

First, the investigation showed different findings concerning the effects of the recipients' experience of presence and emotional response to historical VR on the salience of the five moral foundations (Haidt & Joseph, 2004). In the first place, the findings indicate that the MIME might be transferrable to (historical) VR (Tamborini, 2012), as we found effects of presence and emotional response to historical VR on different moral foundations. Moreover, the studies' results emphasize that besides the media content the engagement (narrative and spatial presence) in the content characterized by the attentional focus on the virtual (historical) environment supports the impact of media on the salience of content-related moral foundations. Indeed, the study could not show the effects of the recipients' experience of presence and emotional response on each foundation. However, the results revealed the effects of the recipients' engagement (presence and emotional response) on content-related foundations (e.g., authority/reciprocity, fairness/cheating). For instance, the study showed positive effects of presence and emotional response on the foundation fairness for both technologies examined in the studies. Recipients who were strongly emotionally touched and experienced presence in the historical VR perceived fairness to be more important when deciding whether something is right or wrong afterward. This highlights the impact of the recipients' engagement in media content when focusing on the impacts on the recipients' moral reasoning.

Moreover, the current investigation revealed different findings concerning the effects of spatial, narrative presence, and emotional response to historical VR on the individual's moral orientation according to Kohlberg (1958). When watching the historical VR via the online platform's media player, presence turned out to promote moral orientation which is in line with previous findings indicating a positive indirect effect of narrative presence in historical VR on the individual's moral orientation (Frentzel-Beyme & Krämer, 2022). It was found that becoming transported into historical media supports the individual's empathy and in turn leads to an increase in moral orientation according to Kohlberg (1958). However, effects on moral orientation could not be found when recipients wore VR glasses. Based on the findings of previous research one could speculate whether the additional technological properties might have shifted the recipients' attentional focus from the content itself to the general exploration of the historical virtual content, as "technologies do not inherently draw audiences any closer to story content" (Pressgrove & Bowman, 2021; p. 9). Nevertheless, the findings are surprising as wearing VR glasses instead of watching the historical VR via a media player might have promoted the impression of perspective-taking which is considered to promote the recipients' moral orientation (e.g., Frentzel-Beyme & Krämer, 2022).

However, the present findings indicate that the experience of spatial presence in historical VR decreases the rational moral reasoning suggested by Kohlberg (1958), whereby effects on the affective, intuitive moral reasoning (MFT) were found. These findings highlight the differences between the two approaches to moral reasoning.

#### ***Critical Processing of Historical VR***

Moreover, against the assumptions of the *transportation-imagery model* (Green & Brock, 2002), we did not find any relationship



between the recipients' experience of presence and story-consistent beliefs. However, indirect positive effects of the recipients' experience of presence mediated by the recipients' emotional response could be found when receiving the historical VR via the media player. Thus, recipients who were emotionally touched by historical VR tend to take the content of the application more at face value. These findings move the focus to the persuasiveness character of VR more to the elicitation of emotions than the recipients' experience of presence. However, the findings showed that the recipients' emotional response is also promoted by the recipients' experience of presence in historical VR. Consequently, one could speculate whether less emotionally charged historical VR would have effects on story-consistent beliefs at all.

Moreover, as the investigation did not show any effects on story-consistent beliefs when wearing VR glasses the assumption of the transportation-imagery model (Green & Brock, 2002) could be questioned. Against the expectations of history didactics assuming that the experience of presence and emotional involvement in historical VR decreases historical awareness (e.g., awareness of fictionality of historical VR), we can speculate, based on the present findings, whether the type of reception via VR glasses might promote historical awareness to some (minor) extent. Instead of receiving historical VR on an online video platform where also nonfictitious videos can be found, the conscious putting on of VR glasses might have forced the reflection of the historical VR content and separated it from reality.

Additionally, against expectations, the results revealed no effects of presence and emotional response on historical awareness. This indicates that recipients of historical VR are still aware of the mediated experience and have still the awareness of reality and the past, even if they get highly immersed in the historical VR. Nevertheless, these findings give a contribution to the discussion of history didactics regarding the usefulness of historical VR as an educational tool (Bunnenberg, 2020).

### **Impacts of Additional Information**

Moreover, the studies' results indicated that additional context-related information, can enhance historical awareness and reduce story-consistent beliefs. These are essential findings in light of the ongoing debate on the deployment of historical VR as a history education tool (e.g., Bunnenberg, 2020). The findings showed that recipients who read further information about the specific historical VR application did process the historical content more critically by not accepting all conveyed information as inevitably true. Consequently, providing an opportunity to further inform oneself could be an appropriate approach to support the critical, cognitive reflection of the content of historical VR. Especially, when individuals consume historical VR randomly on the internet, offering additional information through additional links could be an appropriate way from a historical didactics' perspective (e.g., Bunnenberg, 2020).

### **Experience of Presence and Emotional Responses to Historical VR**

Moreover, the investigation highlights the connection between the recipients' experience of presence in virtual (historical) environments and the arousal of emotion triggered through the content and atmosphere of the (historical) VR. This connection was already

found in previous research that examined the relationship between the experience of presence, transportation, and the arousal of emotions transported through the virtual environment (e.g., Frentzel-Beyme & Krämer, 2022; Kim et al., 2019; Visch et al., 2010). Recipients who became immersed in the virtual historical environment in terms of feeling located in the environment (spatial presence) and immersed in the narration of the historical virtual environment (narrative presence) reported more often specific emotions triggered by the virtual environment. For instance, recipients reported experiencing emotions like anger, fear, disgust, and sorrow more often than pleasure and happiness. It can be assumed that these emotions were especially triggered by the virtual historical environment in which recipients perceived themselves as prisoners in the GDR in the 1970s and were blamed by state officials. Therefore, the present study highlights this strong relationship between narrative, spatial presence, and "matching" negative emotions, which is especially of high interest when focusing on historical VR applications which often deal with atrocities of the past (e.g., Bunnenberg, 2020). Consequently, the evocation of (negative) emotions promoted by the immersive characteristics of VR should not be left unnoticed, as especially those applications could promote negative associated feelings within recipients like disgust and anger. Moreover, from a theoretical perspective, the investigations underline the connection between the experience of presence and the elicitation of content-related emotions.

### **Technological Characteristics Supporting Immersion in Historical VR**

Furthermore, the findings showed that recipients reported higher narrative presence when using VR glasses instead of the platforms' media player. These findings are contrary to previous research which found no relationship between technological immersion and transportation (e.g., Frentzel-Beyme & Krämer, 2022; Pressgrove & Bowman, 2021). However, these investigations mainly compared media that differed in technological immersion to a greater extent (360° video vs. video; Frentzel-Beyme & Krämer, 2022). Therefore, one could speculate whether wearing VR glasses supports the attentional focus on the historical VR by physically blocking the surrounding environment and though, promoting narrative presence. Moreover, technological immersion improvements that do not distract from the content of the virtual environment by offering too many interaction opportunities (like Head Mounted Displays) might promote the recipients' experience of narrative presence while too strong technological immersion improvements do not affect the recipients' experience of presence (e.g., Frentzel-Beyme & Krämer, 2022).

Furthermore, the investigation replicated findings of previous research by founding differences in the experienced spatial presence between those who watched the historical 360° via the website's media player and VR glasses (e.g., Frentzel-Beyme & Krämer, 2022). These findings highlight the relationship between technological characteristics and spatial presence. Moreover, in line with the theoretical assumptions, we found higher reported values for the spatial presence subdimension self-location when watching the historical VR via VR glasses (e.g., Slater & Wilbur, 1997). However, we found no higher values for the subdimension "possible action" since none of the technologies offered more interaction opportunities. Nevertheless, the study highlights that even slight technological changes in terms of using VR glasses instead of using

the online video platforms' media player support the recipients' experience of being actually located in the historical virtual environment.

### Limitations and Further Research

The generalizability of the findings is limited as the samples were not representative, as they contain a high number of female and highly educated individuals. Moreover, we have to note that we could not ensure that participants watched or read the stimulus material attentively in the online experiment and did not control for prior experiences with VR technology which can affect the recipients' experience of presence (Sagnier et al., 2019). Furthermore, we have to mention that the content's emotionality did not differ that much to answer whether the content's emotionality compared to nonemotionality leads to different impacts. Also, the content itself was not equal between the experimental groups and differed a bit. Of course, the ideal would have been to compare VR applications that dealt with the same content and only differed in their extent of emotionality. Future research should focus on that. Moreover, we have to mention that we used a cross-sectional study. Consequently, we cannot make any assumptions about causal implications despite the manipulations. In the end, we would like to emphasize that especially the examined relations for the VR glasses condition should be viewed by caution as the sample was quite small (Kline, 2016). However, the consistency of the data and results between both studies underpin the present results and analysis methods. Nevertheless, further research examining the relations in a greater sample using VR glasses would be preferable.

### Practical Implications

From a history didactic perspective, the study's results showed that additional information designed according to history didactic criteria can effectively accompany the critical reflection of historical VR. Additional information turned out to support historical awareness (e.g., reality awareness). The studies' results indicate that recipients who received additional information about the specific historical VR application were more often able to make a conscious distinction between reality and virtual. Furthermore, additional information turned out to decrease the recipients' emotional response. Especially in the light of the ongoing discussion about the emotionality of historical VR, as history didactics fear that those applications could lead to an emotional overload within recipients (e.g., Bunnenberg, 2021), these findings highlight that additional information could reduce these concerns. When looking at the didactic embedding of historical VR in informal learning contexts (e.g., on video platforms on the internet) this means that the availability of further information can have a positive effect on the reflective attitude of the users. This could be realized in the digital space via further links to content-related news articles or in classrooms via news articles that are handed to students.

### Conclusion

The present investigation shows that historical VR in informal learning environments could be an effective and useful way to support the individual's historical education, including morality.

We demonstrated that especially the experience of presence in historical VR accompanied by an emotional response supports the enjoyment of historical VR, interest in historical topics, and the salience of content-related moral foundations. Moreover, the study's findings give rise to the question of whether the experience of presence in historical VR is indeed problematic in the way history didactics assumed, as the findings did not indicate that presence leads to less critical processing of the historical content by reducing historical awareness or promoting story-consistent-beliefs. On top of that, we found that additional information after consuming historical VR might be a promising approach to ensure the critical, cognitive reflection of the presented historical content.

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