



Immersive Biography: Supporting Intercultural Empathy and Understanding for Displaced Cultural Objects in Virtual Reality

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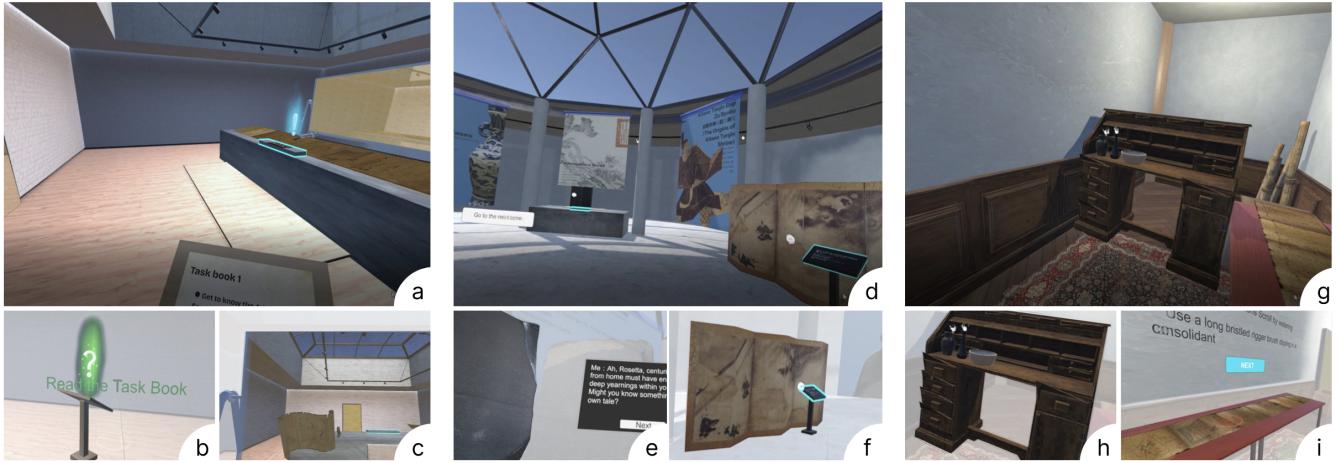


Figure 1: VR Game Screenshot of *Immersive Biography*: (a-c) Scene One: Intro - Embodied Role-Play: reading the label of the *Admonitions Scroll*, receiving a game task, and embodying the *Admonition Scroll* in front of a mirror; (d-f) Scene Two: Exhibition – Empathize with the Intercultural Itinerary: exploring the exhibition halls, checking labels of individual cultural objects, and dialogues with cultural objects; (g-i) Scene Three: Restoration – Intercultural Connection: simulating the restoration experience, performing physical restoration to the *Admonition Scroll*, and digitally recording the *Admonition Scroll*.

Abstract

Displaced cultural objects often act as mediators of intercultural understanding due to their connection between the original and host communities. This study explores how immersive embodied VR biography enhances intercultural empathy and understanding of displaced cultural objects. We took the famous Chinese painting, the *Admonitions Scroll*, housed at the British Museum as an example to design an Immersive Biography in VR. We conducted an empirical study with 24 participants from source and non-source communities. Findings suggested that interacting with biographical narratives of displaced cultural objects in a personified embodied way can effectively promote intercultural empathy and understanding. Additionally, simulated intercultural scenarios and dialogues with personified cultural objects fostered intercultural empathy in both groups, with a stronger effect observed in non-source communities due to differences in cultural identity and personal connections. Our study provided the potential and practical insights of immersive technologies to inspire intercultural communication for displaced cultural objects.

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- Human-centered computing → Empirical studies in interaction design.

Keywords

Intercultural empathy, Displaced cultural objects, Embodied narratives, Object biography, Virtual Reality

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1 Introduction

Many museums around the world house extensive collections of precious displaced cultural objects [16], which reveal the social, cultural, historical, and geographic complexities and tensions between “host” and “source” communities¹. The national heritage perspective [42] advocates returning these displaced cultural objects to their countries of origin, rooted in the belief that these objects hold immense cultural, historical, and identity-based significance as irreplaceable resources for their homelands [3]. In contrast, the world heritage view [64] holds that cultural objects belong to all humankind, proposing that such objects may be better preserved in new environments and contribute more effectively to global cultural understanding. Regardless of which heritage view researchers adopt, displaced cultural objects remain a promising

¹The cultural group from whom the museum originally received the relics is referred to as the “source community.” This term typically encompasses both groups that existed when the objects were collected and their contemporary descendants [47].

means as a vehicle for fostering intercultural dialogue because they are deeply embedded in the historical and cultural identity of their places of origin [43], and understanding a cultural object entails understanding the culture from which it originates.

Unlike the singular nature of non-displaced cultural objects, displaced cultural objects emphasize the sociocultural contexts that lead to their relocation and reflect how different communities perceive and interpret them according to the communities' preferred standards and practices [12]. Displaced cultural objects function as boundary objects [41, 57], endowed with shared meaning and value across diverse contexts, which both triggers empathy and present challenges for the original and host cultures alike. Consequently, displaced cultural objects serve as critical mediators in intercultural understanding, enabling individuals to better understand and appreciate cultures of people from different cultural identities.

Immersive representations of cultural objects simulate real-world scenarios and enable personal engagement and interactions, which can evoke empathy, moderate cultural differences, and facilitate intercultural communication [52]. In addition to providing different forms of interactions, immersive representations can objectively convey object knowledge across museums, source communities, and academic communities, thereby facilitating cultural knowledge exchange and negotiation [7, 31]. In this process, empathy plays a vital role in fostering deeper comprehension within immersive environments [38]. For instance, embodied narratives and participatory simulations in virtual reality (VR) offer powerful tools for enhancing public understanding of cultural significance because of embodied cognition, entertainment, and fluent experiences [36]. By offering embodied experiences that support perspective-taking, VR facilitates the interpretation of cultural heritage [38]. Through multi-sensory virtual embodiment, individuals can experience the emotions and perspectives of groups they might not otherwise encounter, effectively "step into the shoes" of others [25]. Further, objects' biography enriches this experience, presenting cultural objects as if they have lived histories. Thus, immersive biographies have the potential to enable individuals to empathetically engage with displaced cultural objects and to reflect on their diasporic journeys across different geographical, historical, and sociocultural contexts [17].

Despite its promises, the use of immersive, embodied interactions and biographical narratives in intercultural contexts—particularly with displaced cultural objects—remains underexplored. Moreover, while cultural intelligence can help individuals understand and engage with other cultures, differences in cultural backgrounds may undermine this process [61], thereby hindering intercultural understanding and empathy. Therefore, in this research, we aim to explore how immersive, embodied VR biography can foster intercultural empathy and understanding of displaced cultural objects between host and source communities, as well as how it functions among groups with diverse cultural backgrounds. Specifically, our research questions are:

RQ1: How can immersive embodied VR biography promote users' intercultural empathy and understanding of displaced cultural objects?

RQ2: How do users from source and non-source communities experience such immersive embodied VR biography of displaced cultural objects?

We take the famous Chinese cultural object *Admonitions of the Instructress to the Court Ladies* (hereafter referred to as the *Admonitions Scroll*), housed at the British Museum, as a representative displaced cultural object for developing VR biographical narratives—given that it is a treasure of ancient Chinese art carrying displaced historical narratives and significant intercultural value. We conducted an experiment with 24 participants from source and non-source communities and evaluated the potential of immersive embodied VR biographies for fostering intercultural empathy and understanding of displaced cultural objects through questionnaires and interviews. Our findings suggest that biographical narratives and personified embodiment interactions facilitate participants' intercultural empathy and understanding of displaced cultural objects in VR. Specifically, participants from source and non-source communities fell into the *Admonitions Scroll* through personified embodiment, driven by linguistic and cultural identity for the source community and by personal identity for non-source communities. Participants also felt with the *Admonitions Scroll* through personified dialogues in simulated intercultural situations, which effectively promoted intercultural empathy by linking VR experiences to their personal experiences in embodied interactions. Moreover, source and non-source communities generated different emotions and reflections due to different cultural backgrounds and awareness of specific historical contexts.

Immersive VR biography redefines the intercultural properties of displaced cultural objects and connects them with a global audience, facilitating broader sharing and preservation while laying a foundation for intercultural dialogue. The primary contributions of this research are as follows: (1) proposing a VR prototype and experience of displaced cultural objects through biographical narrative and embodied interaction as a means to intercultural empathy and understanding; (2) presenting empirical findings that highlight how displaced cultural objects function as intercultural bridges in VR environments, conveying cultural meanings and provoking reflections on the sociocultural dynamics behind their displacement; and (3) offering practical references to international cooperation in heritage preservation, exploring novel ways in which VR can support intercultural communication for future research.

2 Background

Originally proposed by Kopytoff in anthropology research [34], **object biography** refers to the telling of an object's life history through its production, circulation, use, and significance. Building on the concept of object itineraries, object biographies help audiences grasp the cultural significance of displaced objects in their original contexts and understand how these meanings shift across different cultures by detailing their backstories and trajectories [60]. Therefore, **biographical narratives** can complement discussions of the contexts, causes, and consequences of displacement by offering a multi-perspective interpretation of multicultural information and object knowledge [23]. This approach fosters connections between displaced cultural objects and diverse audiences, making it easier to explore different aspects of the objects' characteristics and to appreciate their cultural uniqueness from multiple viewpoints [12].

The *Admonitions Scroll*² is a Chinese handscroll painting on silk, traditionally attributed by Gu Kaizhi. A version dating from the Tang dynasty now resides in the British Museum. The *Admonitions Scroll* is considered a primary milestone in Chinese painting history due to its cultural and aesthetic significance, sparking extensive research on displacement, preservation, restoration, and aesthetics by scholars worldwide [8, 21, 26, 35]. Therefore, in this work, we aim to convey both the national and world heritage perspectives as objectively as possible by integrating relevant research from scholars of diverse cultural backgrounds into the design of the *Admonitions Scroll's* VR biography. In doing so, we provide users with immersive, embodied VR experience that illustrates its cultural background and significance, displacement history, preservation, and restoration practices.

The displacement of the *Admonitions Scroll* is highly representative of broader patterns in cultural objects' relocation. Captain Clarence Johnson is widely believed to have obtained the scroll in Beijing in 1900 during the Boxer Rebellion and the subsequent occupation of the city by the Eight-Nation Alliance, although the precise means of acquisition remains unclear [39]. He brought the *Admonitions Scroll* back to London and sold it to the British Museum for £25 in 1903 [39]. Since then, the *Admonitions Scroll* has been preserved at the British Museum for over 120 years, far away from China, prompting ongoing discussions regarding its potential return to China. Moreover, cultural differences in conversation and display methods have affected the way the painting is exhibited and preserved. While Chinese scroll paintings customarily require the scroll to be unrolled in sequence for viewing, the British Museum in 1914 adopted a Japanese mounting technique, which was originally developed for multi-panel folding screens to divide the *Admonitions Scroll* into three sections and mounted them separately. This remounting disrupted the continuity of traditional inherent Chinese scroll paintings and reflects a different understanding of how art is preserved in China and other countries. The *Admonitions Scroll* is currently exhibited at the British Museum for six weeks a year, and its digitized version can also be viewed online on the institution's website.

3 Related Work

3.1 Theoretical Foundations of Intercultural Empathy

Empathy is a multidimensional concept with diverse interpretations and extensions of its connotations in different fields. The cognitive dimension involves understanding others' perspectives and emotions [33]. The affective dimension refers to emotional reactions during interactions with others [13]. Compassionate empathy encompasses both cognitive and affective dimensions, emphasising the individual's ability to comprehend others' difficulties and to provide supports when needed [19, 50]. Additionally, empathy is recognized as a behavioural skill [51], such as the term cultural empathy referring to the ability to engage cognitively, emotionally and behaviourally with the reality or world of the cultural "other" [46]. In the field of HCI, several studies have examined how VR facilitates

perspective-taking through embodiment, role-playing, and storytelling [55, 59, 63, 65]. These techniques help users gain a deeper understanding of others' subjective experiences and environments, thereby fostering empathy [38]. However, many of these studies do not address intercultural contexts. Developing empathy across cultures is particularly difficult due to varying values, beliefs, attitudes, and experiences [5].

Compared to the view of empathy into cognitive, affective, and behavioural dimensions, empathy from the communication perspective is regarded as a relational empathy [58] that simultaneously creates shared meaning through both cognition and affect during interaction [5, 14, 49]. As a central component of effective intercultural communication, intercultural empathy involves a shift from individual perspectives to a collective synthesis, where individuals deepen their understanding through the interactive process, ultimately creating a "third culture" [58]. Initially, individuals from different cultural backgrounds "feeling into" an object of perception or reflection [18]. This involves "decentering," where they temporarily set aside their own subjectivity to interpret events from new perspectives [2]. Over time, the relation of "feeling with" is described as a feeling of unity or connection with others [18]. Individuals negotiate and integrate their perspectives, leading to alternative and convergent ways of understanding and constructing meaning [2]. This process culminates in the creation of shared meaning, characterized by empathy, mutual acceptance, and cooperation—a "third culture" where understanding and support flourish [5]. Herder's concept of empathy aligns with this idea, as he describes the ability to "feel into" everything beyond oneself, including the perspectives of others. However, intercultural empathy, as a form of relational empathy, does not focus on the precise understanding of others' thoughts or emotional identification [5]. Instead, the emphasis lies on a productive approach to creating new understanding, rather than reproducing existing perceptions. Moreover, empathy here involves connecting with other people and with inanimate objects [18].

3.2 Facilitating Empathy and Intercultural Understanding in VR

Research shows that VR approaches improve people's ability to understand others' perspectives through virtual embodiment, and effectively promote empathy through immersive experiences [38]. In virtual environments, avatars are a shift in the figures, they represent users' entire identity, thus rapidly shaping new self-images, behaviors, and interactions with others [37]. Avatar-embodied users perceive the behaviors of other users as their own, gain firsthand experience of other people's subjective circumstances and experiences, and thus develop a greater capacity for understanding and empathy [56, 59]. For instance, The Displaced VR³ puts users in a specific environmental moment in the life of refugee children, and this powerful immersive embodied experience triggers users' empathy. The power of virtual embodiment enables users to naturally form the cognitive understanding of the traditional culture in the process of interaction, and faces the challenge of multicultural influences [40]. Furthermore, VR integrates various elements,

²The Admonitions Scroll. 2023. Retrieved from: https://www.britishmuseum.org/collection/object/A_1903-0408-0-1

³The Displaced VR film from New York Times VR. Retrieved from <https://www.nytimes.com/2015/11/08/magazine/the-displaced-introduction.html>

such as narrative storytelling, advanced 3D modeling, and intuitive interfaces [9]. It also includes avatar embodiment, participatory performances, game-based learning [36], biographical narratives, and multi-sensory embodiment [32]. Together, these features enhance users' understanding and foster deeper empathy. Researchers have also designed natural language conversations to offer multi-channel interaction methods that support users in exploring and understanding the contextual information surrounding cultural objects [6]. Notably, the NEOTHEMI virtual museum aims to connect individuals from different European countries, encouraging users to explore their own and other cultures while gaining new perspectives on historical and regional conflicts, such as varying interpretations across time and geography [45]. While this research has been extensively applied in language education, its effects on intercultural understanding among users have not been fully explored. Similarly, Be Our Guest reduces cultural barriers and facilitates intercultural communication among immigrants from diverse backgrounds through interactive narratives that simulate cultural rituals [52]. However, this research focuses on coping with cultural differences between people from different cultural backgrounds by experiencing various cultural rituals and less on the mediating role of cultural objects. Findings from these research approaches have shown significant potentials and effectiveness, but they remain underutilized in intercultural contexts or when applied to displaced cultural objects. Therefore, in this work, we aim to simulate an intercultural environment with embodied interactions to explore how users can enhance intercultural empathy and understanding of displaced cultural objects through immersive embodied VR biographical experiences.

3.3 VR Representation Approaches of Cultural Objects

Many studies have explored 3D reconstruction and storytelling of cultural objects in VR to enhance users' understanding. For instance, Jin et al. [28, 29] designed a 3D reconstruction of Chinese paintings using 3D visual representations, further interpretation through audio-visual information, multi-sensory and immersive environments, greatly increasing the learning effectiveness and motivation. Fu et al. [20] further combined the digital restoration of Dunhuang murals with embodied and situational experiences, significantly improving users' VR experience and knowledge learning. Mu et al. [44] effectively transformed the complex 2D Dunhuang murals into a 3D immersive VR environment, enabling users to deepen their understanding of the mural art through interactions with NPCs and narrative facilitation. Moreover, VR often incorporates narrative elements to enhance the experience, which enables individuals to explore historical scenes remotely and access information through multiple channels [11]. A prime example is the Vikings VR exhibition, which recreates a 9th-century Viking camp story and provides an engaging and immersive experience [53]. However, previous studies primarily focus on the acquisition of cultural knowledge and have not been extended to fostering deeper cultural understanding or cultural communication. Cultural communication contributes to the recognition of the uniqueness and value of each culture, thereby fostering respect for and tolerance of diversity.

Furthermore, some studies use a biographical approach to promote users' understanding of culture and history. Shabalina et al. [54] integrate the biographies and contributions of historical figures into AR game narratives, where players learn about local history and cultural heritage as they travel through the characters' itineraries. This approach helps to provide users with a comprehensive understanding of various historical facts and events, and to discover the characteristics of cultural objects and their relationship to history and culture. Although it has been shown that object biographies are adopting a new relational approach [30], utilizing emerging technologies and digital media to extend and disseminate objects' life histories [12, 17, 66]. However, biographical narrative approaches have not yet been applied to the cultural objects in VR environments to connect the objects (especially displaced cultural objects), people and the historical context to promote cultural understanding. The biographical approaches to displaced cultural objects capture new representational meanings resulting from the movement of objects, making diverse sociocultural perspectives that are not present in non-displaced cultural objects visible, and facilitating an empathetic view of objects with the support of digital technologies to enhance dialogical collaboration and address intercultural conflicts [12, 17].

4 An Embodied VR Experience: Immersive Biography

4.1 Design Objectives and Features

Our design objectives are twofold:

- Promote intercultural empathy through embodied interaction: user as an avatar of the *Admonitions Scroll*. This interactive VR experience promotes intercultural empathy by allowing user to embody the *Admonitions Scroll* and gain a deeper understanding of its life history from a first-person perspective.
- Facilitate understanding of the displaced cultural objects: design biographical narratives. This interactive VR experience enhance user' understanding of the *Admonitions Scroll* by presenting its cultural background, significance, displacement history, preservation, and restoration through biographical narratives..

To achieve our design objectives, we implement two design features.

- Role-Play Embodiment. User is embodied as the *Admonitions Scrolls* in VR, experiencing its historical and cultural context through a first-person perspective that enhances intercultural empathy. This allows user to engage with the cultural and emotional experience of the displaced object, creating a deeper connection with its history.
- Interactive Biographical Narratives. User is embodied in the immersive experience of the *Admonitions Scroll's* displaced biography through interactions such as reading materials, bilingual audio-visual dialogues, and digital restoration to understand its interpretation in historical periods and different cultural contexts. These interactive elements actively engage the user, enabling them to explore and reflect on

the object's diverse cultural meanings and significance over time, thus fostering a deeper understanding.

4.2 The Design of Immersive VR Scenes and Biography Narratives

The Immersive Biographical experience consists of three interconnected scenes: (1) Introduction - Embodied Role-play, (2) Exhibition - Empathize with the Intercultural Itinerary, and (3) Restoration - Intercultural Connection. Each scene is designed to progressively guide user toward a deeper understanding and emotional connection with the cultural and historical significance of the *Admonitions Scroll*. Through role-play, intercultural narratives, and interactive restoration tasks, user is immersed in a rich, multi-sensory virtual environment, transitioning from passive observers to active participants. Figure 2 demonstrates the three VR scenes, user tasks, and interactions within each scene.

4.2.1 Scene One: Introduction - Embodied Role-Play. The opening scene provides user with background information and cultural values of the *Admonitions Scroll*, so they can learn and familiarize themselves with it and thus embody in its avatar fluently. The user first reads the label to gather information. Next, he uses a magnifying glass to examine the center part of the *Admonitions Scroll*. Finally, the user is embodied in the *Admonitions Scroll* by standing in front of a mirror, where he can see himself transformed into the scroll within the VR environment. In particular, at the moment of becoming the *Admonitions Scroll*, the user can see the figure of the scroll through the mirror as well as hear its own monologue voice (pale female, Chinese voice, English text) that is different from the voice-over. We design the transformation of the user' role in appearance, voice, and language to complete the identity substitution and personification of the object, allowing the user to gradually develop a sense of identity with the *Admonitions Scroll*. This approach aims to evoke a deeper level of empathy through subsequent interactions and enhance the connection between the user and the *Admonitions Scroll*.

4.2.2 Scene Two: Exhibition - Empathize with the Intercultural Itinerary. This scenario creates an immersive intercultural environment and multi-sensory experience for user to further bring them closer to the *Admonitions Scroll*, promoting multi-dimensional and deeper empathy with the biographical narrative content, and facilitating a nuanced understanding of intercultural significance. We simulate the exhibition hall of the British Museum and display well-known displaced cultural objects from China, Egypt, Japan, Polynesia, and Pakistan that are now housed in the British Museum. With a monologue from the *Admonitions Scroll*, user can explore the exhibition halls, checking the labels of the individual cultural objects for information on their provenance. Through dialogues with the Rosetta Stone, the Origins of Kitano Tenjin Shrine, and the other two parts of the *Admonitions Scroll*, user can learn about the *Admonitions Scroll*' displaced journey from China to the British Museum and the painful experience of being wrongly re-framed in the 1910s. We use Chinese to give voice to Chinese cultural objects and uniformly use English as the voice of non-China cultural objects. Through such animated dialogues and bilingual audiovisuals, user feels with the *Admonitions Scroll* and gets embodiment deepened

along with a sense of presence and immersion, which contributes to improving intercultural empathy and understanding of cultural differences and displaced history.

4.2.3 Scene Three: Restoration – Intercultural Connection. This scenario provides user with the socio-cultural context of the *Admonitions Scroll*'s displacement and preservation while simulating the restoration process. Through this experience, user can better empathize with the historical and cultural trauma and gain a deeper understanding of the importance of cultural inheritance and preservation. In this scenario, user first reads the information on the computer to further learn the socio-cultural context of the displacement and preservation of the *Admonitions Scroll* at that time (see Section 2 for details). The user then gets the key to the restoration room and goes there. In the restoration room, the user turns back into himself/herself and tries to repair the *Admonitions Scroll*. The restoration process is simplified from published research and involves mixing, consolidating, coloring, and technical imaging using containers, brushes, a water can, and a camera to operate. When finished, user can watch the video that the digitized three parts form the complete the *Admonitions Scroll*. This scenario takes advantage of VR to provide user with a restoration experience that is hard to have in real life, and to increase their interest in cultural object preservation with interactive narrative strategies. This is designed to deepen user' understanding of cultural inheritance, strengthen his/her connection to cultural objects, encourage thoughtful reflection and imagination about the future of displaced objects, and enhance intercultural empathy.

4.3 Technical Implementation

We developed the prototype of *Immersive Biography* using Unity3D⁴, using the HTC Vive Pro2 headset⁵ to provide user with an immersive visual experience. To build the VR environment and implement interactions, we leveraged Unity's packages and toolkits, including the XR Interaction Toolkit⁶ and the SteamVR plugin⁷. These tools allowed us to integrate VR-specific functionalities such as hand tracking, spatial interactions, and user input management, enabling user to interact with and manipulate objects within the VR environment, and facilitating the restoration process of the *Admonitions Scroll* through engaging hands-on interactions.

5 Method

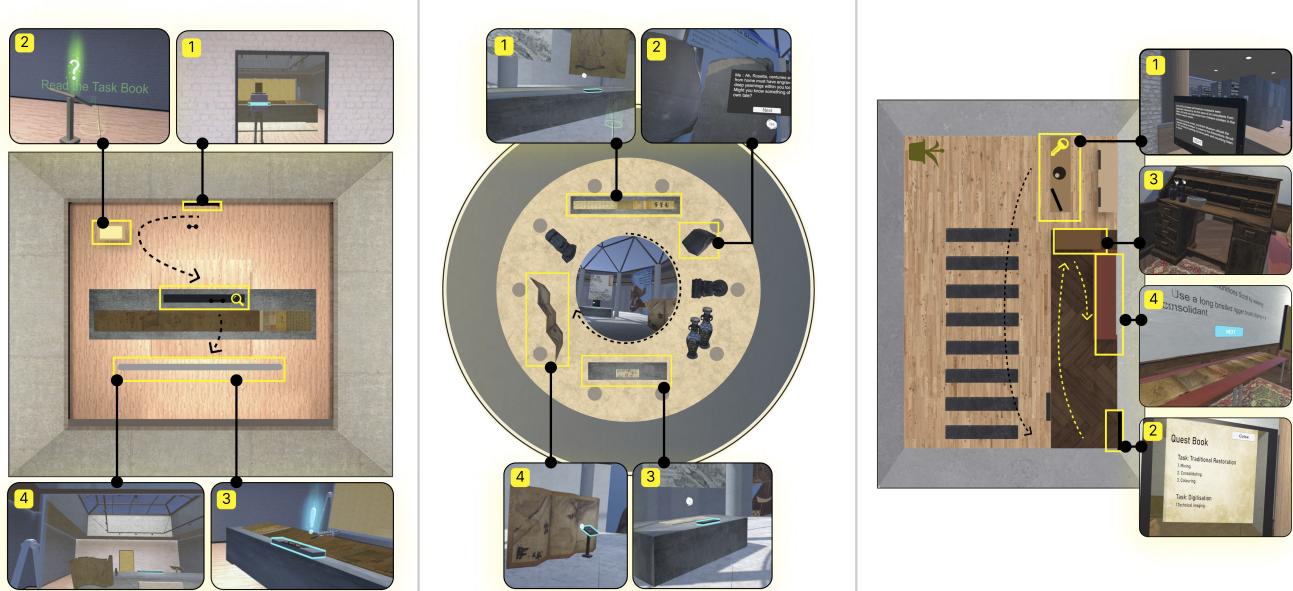
Our study aims to investigate the potential of immersive embodied VR biography in fostering intercultural empathy and understanding of displaced cultural objects from source and non-source communities. Therefore, we designed a mixed-methods study to evaluate the effects and differences of the immersive VR biography in supporting intercultural empathy and understanding. We invited participants from source and non-source communities to experience the Immersive Biography to observe and compare feedback from both groups.

⁴<https://unity.com/>

⁵<https://www.vive.com/>

⁶<https://docs.unity3d.com/Packages/com.unity.xr.interaction.toolkit>

⁷<https://store.steampowered.com/app/250820/SteamVR/>



Scene 1: Intro - Embodied Role-play

User reads the label for information.

User uses a magnifying glass to view the center part of the Admonitions Scroll. User is embodied in the Admonitions Scroll in front of the mirror.

Scene 2: Exhibition - Empathize with the Intercultural Itinerary

User has conversations with the Rosetta Stone, the Origins of Kitano Tenjin Shrine, and the other two parts of the Admonitions Scroll.

User learns about the Admonitions Scroll's displaced journey from China to the British Museum. As well as the traumatic experience of being incorrectly remounted in the 1910s.

Scene 3: Restoration - Intercultural Connection

User first reads the information on the screen to further learn the socio-cultural context, then gets the key to the restoration room.

In the restoration room, the user turns back into himself/herself and tries to repair the Admonitions Scroll.

Figure 2: The immersive biographical experience consists of three interconnected scenes: (1) Introduction – Embodied Role-Play, (2) Exhibition – Empathize with the Intercultural Itinerary, and (3) Restoration – Intercultural Connection.

5.1 Pilot Test

Before the user study, we shared the recorded VR experience with two Chinese art history experts for an online interview to ensure that the narrative content was conveyed accurately and objectively. We also conducted a pilot study with three volunteers to ensure the VR experience was well-completed and the questionnaire and interview questions were properly adapted. We observed positive results, but we needed to adjust the study design. For example, we implemented tutorials to ensure participants were familiar with the controllers and interaction methods before beginning the VR experience. We also designed different interview questions for different groups of participants in terms of cultural perception to gain insights from different perspectives.

5.2 Participants

We recruited 24 participants (source community: 9 females and 3 males, non-source communities: 6 females and 6 males) through email and social media for this study. Table 1 provides a summary of participants' demographic information, including gender, age group, place of birth, and current residence. ID C refers to participants from the source community (Chinese), and ID F refers to those from the non-source community (Foreigners/non-Chinese). Participants' ages were categorized into the following groups: 11 participants were between 23 and 27 years, 6 participants were between 18 and 22 years, 4 participants were between 28 and 32 years, 2 participants were between 52 and 59 years, and 1 participant was 60 or over. They were born in various countries, including China, Cyprus, Spain, Italy, the USA, Malaysia, and Pakistan, with

most residing in the UK at the time of the study. Half of the participants identified with an East Asian cultural background, while the remainder identified as European, Southeast Asian, South Asian, or of mixed heritage. One participant preferred not to share his cultural background. Regarding familiarity with the *Admonitions Scroll*, 10 participants had seen it in person—either at the British Museum (N=8) or the Palace Museum (N=2). Six participants had learned about it through reading or online resources, while the remaining 8 participants were unfamiliar with the scroll prior to the study. In terms of familiarity with VR, 1 participant identified as very familiar, 12 participants as moderately familiar, 7 participants as slightly familiar, and 4 participants as not familiar. Our study proposal and protocol were approved by Anonymous University. All participants were voluntary and signed a consent form before the experiment. In addition, they were informed that they would receive compensation after data collection.

Table 1: Participant Demographics

ID	Gender	Age group	Place of birth	Place of residence	Cultural background
C1	Female	28-32	China	UK	East Asian
F2	Male	23-27	Cyprus	UK	European
C3	Female	23-27	China	UK	East Asian
C4	Female	23-27	China	UK	East Asian
C5	Female	23-27	China	UK	East Asian
C6	Male	28-32	China	UK	East Asian
C7	Male	23-27	China	UK	East Asian
C8	Female	23-27	China	UK	East Asian
C9	Female	23-27	China	UK	East Asian
C10	Female	23-27	China	China	East Asian
C11	Male	23-27	China	China	East Asian
F12	Female	18-22	UK	UK	European
F13	Female	52-59	Spain	UK	European
F14	Female	23-27	UK	UK	European
F15	Female	60 or over	UK	UK	European
F16	Female	28-32	Italy	UK	European
F17	Male	52-59	UK	UK	Prefer not to say
C18	Female	23-27	China	UK	East Asian
F19	Male	28-32	USA	UK	European
F20	Male	18-22	USA	USA	Mixed heritage
F21	Male	18-22	USA	USA	East Asian
F22	Female	23-27	Malaysia	USA	Southeast Asian
F23	Male	18-22	Pakistan	Pakistan	South Asian
C24	Female	18-22	China	China	East Asian

5.3 Study Procedure

The study was conducted in both the UK and China. In the UK, participants took part in in-person sessions that involved face-to-face interviews. In China, a few participants experienced the same experimental procedure with the support of another co-author and participated in online interviews via Tencent Meeting with the first co-author. Regardless of location, all participants followed the same study process. The entire study lasted about one hour.

- **Pre-test.** Participants first signed a consent form agreeing to participate in the study and the recordings of video, audio, and photographs in the test. Then, participants completed a pre-test questionnaire with demographic questions and the Inclusion of Other in the Self Scale (IOS).
- **VR experience.** In the VR system, participants were embodied in the avatar of the *Admonitions Scroll* and explored its biographical history based on task-based storytelling. Participants were asked to complete all the tasks in the VR system.

We observed the participants in the room and recorded the entire experience. The length of each participant's experience ranged from 23 to 34 minutes. The VR experience was conducted independently by the participants. However, as everyone has a different level of familiarity with VR, we also provided tips for the very few participants who actively asked for help, mainly with the restoration operations in the last scene.

- **Post-test.** After the VR experience, participants completed a post-test survey through Google Forms. The survey included four sections: IOS, Scale of Ethnocultural Empathy (SEE), Cultural Intelligence Scale (CQE), and Immersion Experience Questionnaire (IEQ). Participants self-reported their ratings on a scale of 1-7, meaning "not at all" to "a lot" and/or "strongly disagree" to "strongly agree". Finally, participants joined a semi-structured interviews with researchers.

5.4 Measurements

We adopted qualitative and quantitative measurements to evaluate participants' intercultural empathy and VR experiences.

- **The Inclusion of Other in the Self Scale (IOS).** The IOS is a single-item graphical scale that measures the degree of inclusion and closeness of various relationships [1]. We adopted the IOS to measure the relationship between participants and the *Admonitions Scroll*.
- **The Scale of Ethnocultural Empathy (SEE).** The SEE is a self-report instrument that measures empathy toward people of racial and ethnic backgrounds different from one's own, which also provides insights into empathy and multicultural issues [62]. We adopted the SEE to measure participants' empathetic perspective taking.
- **The Cultural Intelligence Scale (CQE).** The motivational cultural intelligence reflects an individual's interest and confidence in interacting with different cultures [61]. We adopted it to measure participants' willingness to empathize and communicate across cultures.
- **Immersion Experience Questionnaire (IEQ).** The IEQ is widely used to measure the degree to which an individual feels absorbed or immersed in a particular experience [27]. We adopted it to measure participants' sense of immersion.
- **Semi-structured interview.** We asked participants to describe their general VR experiences and initial feelings or thoughts. We also interviewed them about their sense of embodiment (ownership, agency, and tactile sensations) referring to similar strategies raised in a prior work [52], which were adapted from the Avatar Embodiment Questionnaire [22]. Moreover, we asked questions about what participants liked and disliked about the design features in this VR experience, as well as their thoughts on the biographical approach to telling the story of displaced cultural objects, whether the experience generated certain emotions, perceptions of the history and culture of the *Admonitions Scroll*, and new thoughts on the issue of the displacement and preservation of displaced cultural objects. Interview guide can be found in Appendix A.3.

5.5 Data Analysis

5.5.1 Quantitative data. We first conducted descriptive analysis and calculated the mean and standard deviation values of the questionnaire data. Moreover, the normality of data was tested using the Shapiro-Wilk test. The statistical test was chosen according to the normality of the data, so we adopted either the independent sample t-test or the Wilcoxon signed-rank test to analyze the differences in empathy levels between participants from source and non-source communities. The results of the normality test indicated that the data on empathic perspective-taking, motivational cultural intelligence, immersion, and the inclusion of others in the self were normally distributed among participants from source and non-source communities ($p>0.05$). Therefore, we conducted a paired-sample t-test to compare the IOS scale scores across pre-test and post-test measurements for both the source community and non-source communities. We used independent sample t-tests to compare post-test scores on empathic perspective-taking (EPT) scale, motivational cultural intelligence (MCI) scale, and immersion scale between source and non-source community participants since these measurements were only collected after the VR experience.

5.5.2 Qualitative data. Before analysis, we transcribed the audio recordings of the interviews into text transcriptions. Interview data were independently reviewed and coded using MaxQDA2024⁸ qualitative data analysis software and then analyzed and discussed using thematic analysis methods [4]. After getting familiar with the data, two co-authors manually coded the data. The two co-authors then shared and discussed the initial coding and proposed themes. Initial coding included avatar, dialogue, restoration, user experience, cultural differences, emotion, biographical narratives, VR. Both authors then reviewed the raw data again to confirm the accuracy and consistency of the coding and theme classification. Following the review, the classification and exact content of the themes were identified and shown in the results.

6 Results

6.1 Quantitative Findings: IOS, Empathy, Cultural Intelligence, and Immersion

We conducted a paired-sample t-test to compare the IOS scores between the pre-test and post-test for both the source community and non-source communities. As shown in Fig 3, results indicated that the post-test IOS score (Mean = 3.71, SD = 1.25) was significantly higher than the pre-test IOS score (Mean = 2.58, SD = 1.04) for the source community ($t = -2.315$, $p < 0.05$). Similarly, the post-test IOS score (Mean = 3.75, SD = 1.44) was also significantly higher than the pre-test IOS score (Mean = 2.04, SD = 0.72) for non-source communities ($t = -3.69$, $p < 0.01$). The results indicated that the VR experience significantly enhanced both groups of participants' perceptions of the inclusion of others in the self, with greater increases in non-source communities compared to the source community.

Then, we used independent sample t-tests to compare post-test scores on empathic perspective-taking (EPT) scale, motivational cultural intelligence (MCI) scale, and immersion scales between source and non-source community participants since these measurements were only collected once after the study. The results

⁸<https://www.maxqda.com/new-maxqda-24>

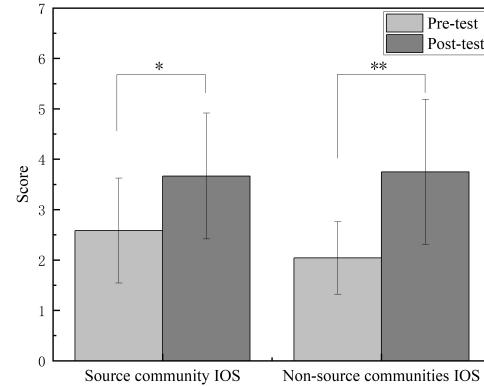


Figure 3: Mean and SD values of Inclusion of Other in the Self (IOS) scale between the source community and non-source communities in pre-test and post-test (* indicate $p < 0.05$ and ** indicates $p < 0.01$).

revealed no statistically significant differences between the two groups for EPT ($t = 0.45$, $p = 0.66$), MCI ($t = -2.11$, $p = 0.05$), and immersion ($t = -1.72$, $p = 0.10$). As shown in Fig 4, participants from non-source communities demonstrated slightly higher post-test scores across two of these three scales and IOS scale compared to the source community. Specifically, for MCI, non-source communities exhibited a mean score of Mean = 6.23 (SD = 0.51) compared to Mean = 5.88 (SD = 0.87) for the source community. In terms of EPT, non-source communities scored Mean = 3.34 (SD = 0.28) compared to Mean = 3.38 (SD = 0.45) for the source community. Similarly, for immersion, participants from non-source communities reported a mean score of Mean = 4.94 (SD = 0.58), slightly higher than Mean = 4.74 (SD = 0.59) observed in the source community.

Thus, participants from both the source and non-source groups did not reveal any significant differences in empathic perspective-taking, motivational cultural intelligence, and immersion after the VR experiences, which indicated that the intervention facilitated comparable improvements across both groups in these dimensions. Next, qualitative interview findings in Section 6.2 provided additional contexts to further interpret these results.

6.2 Qualitative Findings from Semi-structured Interviews

6.2.1 Enhanced Cultural Understanding through the Immersive Embodied VR Biography. Findings showed that both groups learned about the historical knowledge of the *Admonitions Scroll*, such as the creator, the context of creation, and the content, and gained a more in-depth understanding of the cultural background and significance, displacement history, and preservation events through biographical narratives and embodied interactions in immersive VR.

Biographical narratives improved comprehensive understanding of displaced cultural objects. Immersive VR biography

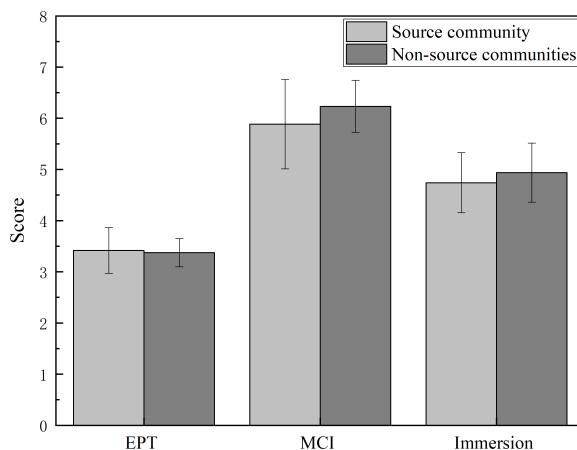


Figure 4: Mean and SD values of empathic perspective taking (EPT) scale, motivational cultural intelligence (MCI) scale, and immersion scales between source community and non-source communities.

introduced the creation background, content, displacement history, preservation, and restoration of the *Admonitions Scroll*, offering a comprehensive understanding and exploration of cultural values. All participants ($N=24$) learned about the cultural and historical values of the *Admonitions Scroll*, and even 2 participants were able to give complete and detailed descriptions. Half of the participants ($NC=5$, $NF=7$) felt that the attention paid to the invisible biography enhanced their understanding of the significance of displaced cultural objects. All participants from non-source communities stated that although they had learned about the biographical history of the *Admonitions Scroll*, they wanted to know more, particularly about the Chinese view of it and how it relates to Chinese culture. F15 also suggested providing a handout to deeper understand its significance. Museums usually display objects physically with profile labels, but the provenance and various historical facts and events are not visible. VR technology visualized invisible information and brought new understanding perspectives and interactive immersive experiences to participants. An example is F19 mentioned below.

"I think like object biographies are a really hard thing to capture. So in one sense, I had the VR in a really nice way because it's not the way that I'm used to interacting with museum objects. It kind of unsettles everything I'm expecting about it. So it was a really useful way to get into the idea of kind of the journey of the displacement journey or the object biography."

- F19

Thus, Immersive Biography made up for the lack of representation in physical space and provided a fuller story of displaced cultural objects. Immersive Biography created a holistic picture for users by presenting the multi-layered artistic value, cultural significance, and historical memory of displaced cultural objects, improving the breadth and depth of understanding.

In brief, for source community participants, the biographical narrative enhanced the overall understanding of the historical details of the displaced cultural objects. For non-source community participants, the biographical narrative approach stimulated curiosity about the original culture and significance of displaced cultural objects and looked forward to the application of the invisible biographical narratives enabled by VR to the physical space, such as museums.

Embodied interactions facilitated immersion and intercultural empathy towards displaced cultural objects. Embodied interactions in the intercultural VR environment enhanced participants' sense of immersion, which makes it easier to empathize with, understand, and absorb the cultural connotations and historical context of the *Admonitions Scroll*. Almost all participants praised VR for providing an immersive and interesting experience of interacting with displaced cultural objects. Most participants ($N=19$) derived their immersion from multi-sensory embodiment, intercultural dialogue, and participatory restoration. As participants became familiar with the VR environment and interactions, more information was acquired, higher level of immersion was felt, and the empathetic effect became stronger. For instance, some participants mentioned that the more they learned the closer they got to the *Admonitions Scroll* and then they became the scroll. In addition, several participants suggested augmenting representations to enhance embodiment, e.g., imaginative scenarios, time-travel-like perspective switching, and restored sensory responses. Our Immersive Biography primarily used text, sound, and object modeling elements to construct interactive narratives. Younger and more VR-familiar participants were likely to expect a refreshing and stimulating experience, engaging more deeply on visual, auditory, and emotional levels. For example, C9 suggested that participants could feel the visual impact and excitement of the painting being divided by looking up above them. Thus, breaking the traditional viewing angle may enhance participants' immersion and provoke empathy.

The results indicated that participants from both source and non-source communities enhanced immersion and intercultural empathy through sustained embodied interactive experiences. This finding aligns with the IOS measurements, which revealed improvements in both groups after the VR experience. Although the post-test data showed no significant differences between the two groups in terms of overall experience, there may be some underlying factors not captured by the questionnaire that led to some differences in the results between the two groups. The next section further analyses the specific processes and factors of intercultural empathy in immersive embodied experiences. Additionally, future work on the intercultural dialogue simulation in Scene 2 could utilize the spatial design of VR with impactful experiential views to inspire immersion and empathy.

6.2.2 Intercultural Empathy Development through the Immersive Embodied Experience.

In Immersive Biography, participants feel into the *Admonitions Scroll*'s history through a personified embodied experience and feel with it through intercultural and participatory interactions, ultimately facilitating an understanding of cultural differences and generating diverse emotions and new thoughts.

Personified experience prompted intercultural empathy for both groups. Almost all participants experienced Immersive Biography from an avatar and/or first-person perspective, but this VR experience was essentially an embodied empathy brought about by the personification of cultural objects. Most participants substituted themselves into the role of the *Admonitions Scroll* in varying forms and degrees. Eight participants successfully embodied into the avatars, believing themselves to be the *Admonitions Scroll*. Some participants from the source community felt a change in their personal identity, but none from non-source communities. People might feel identified with their own culture and have more difficulty shifting their personal cultural identity. Three participants from the source community noted that their perceptions came from the initial monologue in Chinese in an aging female voice, with comments of "shock" and "fitting in." Most participants from non-source communities could identify the Chinese language, but this recognition had little effect. This outcome may be due to the cultural-linguistic differences failing to enhance participants' empathy, or the presence of English text may have been a distracting factor. Participants who were not embodied (NC=7, NF=9) may not have been used to being transformed directly from a person to an object, and the scroll avatar was "quite new" (F13) to participants from non-source communities. C7 suggested adapting the narrative and giving the user enough characterization and cues at the beginning to establish a foundational connection to facilitate perspective-taking. F19 suggested adding opportunities to feel the avatar during the dialogue session to solidify the connection. Some participants indicated that although they did not understand the figure of the avatar, they experienced it from the first-person perspective. Moreover, three participants identified the personification of the *Admonitions Scroll*, which added to the level of understanding and evoked empathy. As F14 felt that, "it kind of allows them to identify within themselves, like, oh, I wouldn't like to be taken and displaced". This perception of personification can also be seen in most participants' responses, such as F2's description that "she was a Chinese person, interacting with another Western person".

To sum up, the first-person embodied perspective helped most participants from source and non-source communities put individuals into the perspective of the *Admonitions Scroll*, and the personification of the avatar played an important role, with the avatar's figurative effect acting weakly. This might be due to differences in the object itself in terms of people and things, and the design of the narrative experience of the avatar in Scene 1 requiring improvements. Moreover, participants from the source community were more likely to take the perspective of the *Admonitions Scroll* through language and cultural identity with the culture to which they belonged. Since participants from the non-source communities were not familiar with the original culture of the displaced cultural object, they felt a personal identity connection to the object through personified embodiment, thus putting the *Admonitions Scroll* into their own perspective. Participants from non-source communities put the *Admonitions Scroll* into their perspective by feeling personal identity through the personified embodiment. Thus, during the initial experience phase participants from source and non-source communities fell into the *Admonitions Scroll* through personified embodiment due to linguistic and cultural identity or personal identity.

Intercultural dialogue and participatory restoration strengthened connections with participants and fostered intercultural empathy among both groups. Findings revealed that personified embodied interactions were deepened during the dialogue and restoration experience, which supported participants in exploring similarities and differences in a multi-sensory, intercultural environment that fostered understanding and empathy. Almost all participants were impressed by the dialogue with different cultural objects, and seven participants would like to have richer dialogue content and options. Some participants praised the realistic features of the scenarios and models, stating that the many displaced cultural objects displayed together in the gallery created a strong visual effect, which inspired empathy. For instance, C18 mentioned,

"I think I felt it most strongly when I was in the second scene. It was the other British Museum artifacts surrounding me as they stared at me, and then telling me about how I came to be, and then their connection to me, and it was a time when I was very much feeling that I was indeed the painting, and that I was learning about the perspective that I was having with other people, and understanding my own past." - C18

This approach allows participants to know what is different and what is special, because "*it gives you the cultures of scroll, but it puts it in the context of the world*" (F23). When displaced cultural objects from around the world spoke in the virtual Museum and told the history story of the *Admonitions Scroll* in dialogue with participants, participants were immersed in the experience, which strengthened the connection with the scroll and evoked strong empathy. F13 also suggested adding the voice of the institution as the host in the dialogue.

Moreover, most participants felt that bilingual audiovisuals brought a greater sense of immersion due to the difference. However, some participants felt that it was not impactful in cases where both languages were intelligible. As mentioned in the previous section, the immersion brought by language varies from person to person, such as language level. It is worth noting that participants related their personal experiences to the *Admonitions Scroll*, which fostered empathy. For instance, C9 empathized with it, noting that, like the painting, they too had traveled across the ocean and faced many challenges both during the journey and upon arrival in a new place. Similarly, some participants with a closer connection to the British Museum also were more empathetic. The sense of relationship suggested that participants were better enabled to feel with the *Admonitions Scroll* through embodied interactions, and intercultural empathy was further developed.

However, all participants more or less pointed out that the system had issues with VR technology such as teleportation, guidance, textual UI, and interactive manipulation, especially in the third restoration room scenario. This may be due to the varying familiarity of users with VR, but also reflects the disadvantages of VR in accessibility.

In brief, simulated intercultural situations and personified cultural objects dialogues in Scene 2 had a stronger effect on intercultural empathy for both groups, and the differences between the two groups are further analyzed in Section 6.2.3. Participants

strengthened their connection to their personal experiences in the embodied interactions, effectively facilitating intercultural empathy. Although the user experience in Scene 3 was limited by the VR technology, participant feedback indicated that this had less effect on intercultural empathy.

6.2.3 Different Emotions and Productive Meanings of Participants from Source and Non-source Communities. Findings suggested that source and non-source communities generated different emotions and reflections due to different cultural backgrounds and historical specificities.

Participants from non-source communities developed more diverse and stronger emotions than source communities. Almost all participants from the source community were originally more concerned about the Chinese displaced cultural objects and already had certain cognitive, such as cultural object repatriation. Half of the participants from the source community felt pity about the experience of the painting, the others felt sad, shocked, helpless, and angry. C3 thought that “*it’s great that it’s still being preserved and that people have the opportunity to see it.*” Three participants demonstrated a stronger curiosity about the cultural and historical context of the *Admonitions Scroll*, while all participants from non-source communities expressed a desire to learn more about the information. Participants from non-source communities were mostly Westerners, who had less exposure to issues of the displacement of cultural objects due to historical reasons. As a result, their attention to and understanding of displaced cultural objects are relatively limited. Six participants from non-source communities felt sad after the experience, and the others felt unfortunate and unfair. On the other hand, the historical injustices behind displaced cultural objects triggered new perceptions and caused the emotional impact. Participants from non-source communities also reported stronger emotions, such as heartbroken, terrible, and disheartening. In addition, participants from non-source communities whose cultural backgrounds were mostly related to the UK were more connected to the British Museum and seemed to have a better understanding of historical injustices, resulting in emotions that were different from those of the source community, such as ignorance, innocence, condescending, and ironic.

Immersive embodied VR biography enhanced source and non-source communities thought to varying degrees from different angles. Participants from the source community were more interested in strengthening cultural exchange and collaboration to support the preservation, restoration, dissemination, and repatriation of their cultural objects. The Immersive Biography allowed participants to experience the journey of the *Admonitions Scroll*, increasing their awareness and engagement with preservation efforts.” Some participants could understand the significance of Chinese cultural objects playing a cultural promotion role in the outside world, but “*the British Museum does not promote Chinese cultural objects sufficiently*” (C18) remained a challenge. The effectiveness of preservation and dissemination was questioned by participants from the source communities, and many of them called for the return of cultural objects due to particular historical facts and cultural identity. Participants from non-source communities believed it was more important to tell and show what the content was, such as telling a more comprehensive narrative of cultural objects,

like this VR biography. It is likely that many Western participants from non-source communities were familiar with museums housing cultural objects from all over the world and preferred global sharing.

Furthermore, some participants from both groups agreed that VR is a revolutionary and powerful tool that helps to make up for the lack of performance in physical space from virtual space. Furthermore, half participants (N=12) perceived issues with cultural communication (NC=4, NF=5) and cultural sensitivity (NC=3, NF=1) between the source and non-source communities, thus were able to better understand the *Admonitions Scroll*’s historical encounter. For instance, F14 pointed to bringing one culture to another, but not quite understanding how to mix well. Or, as F17 mentioned, people might don’t know how best to preserve something new in Europe in the nineteenth and twentieth centuries. Thus, the consequences of such cultural differences were understandable and, as mentioned by C18’s quote below, it is expected that Chinese culture will better reach out to the world.

“It was based on the composition, the figures in one, then the inscriptions in one, and the landscape in one. I thought that if I were a Westerner, I might find it understandable. Because after all, they were also doing this based on their own understanding.” - C18

In summary, the qualitative results indicated that both source and non-source communities enhanced intercultural empathy and understanding, with non-source communities showing stronger and more diverse emotional responses. This finding aligns with the IOS measurements, which showed that participants from both communities significantly increased their perceived inclusion of others in the self. Qualitative findings related to scenario design and user experience revealed that simulated intercultural scenarios and dialogues with personified cultural objects fostered intercultural empathy in both groups, with a stronger effect observed in non-source communities. Specifically, personified embodiment played a key role in facilitating perspective shifts. Participants from the source community reported that their cultural identity primarily influenced their perspective shift, as they engaged with familiar historical and artistic elements. In contrast, non-source participants described experiencing perspective shifts through personal identity connections, relating their immersion in the VR experience to their own life experiences. These insights complemented the post-test data, which showed no significant differences between the two groups in terms of EPT, MCI, and immersion.

7 Discussions

Our research aims to apply the concept of relational empathy to explore how immersive embodied VR biography can prompt intercultural empathy and understanding of displaced cultural objects among participants from source and non-source communities. Specifically, it investigates how immersive embodied VR biography facilitates users in stepping away from their personal viewpoints to experience displaced cultural objects from new perspectives, enabling them to “feel into” the objects. Additionally, it examines how users emotionally “feel with” the objects during interaction, adjusting their perceptions through new insights, and ultimately deepening their understanding. Thus, intercultural empathy in VR

experiences is a coherent and gradually deepening process, but different groups have diverse and varied degrees of cognitive understanding and emotional empathy due to different perceptions of the interactive experience. Findings suggested that biographical narratives and personified interactions significantly contributed to participants' intercultural empathy and understanding of the *Admonitions Scroll*, especially for the simulated intercultural situations and personified cultural objects dialogues in Scene 2. Source and non-source communities participants made emotional connections to the cultural object through their respective cultural or personal identities, and generated different emotions and reflections during the interaction. In this section, we will discuss in depth the use of immersive embodied VR biography to tell the life history of displaced cultural objects as a method of intercultural empathy and understanding, and its broader takeaway.

7.1 Bridging Cultural Differences and Fostering Empathy

Users from different cultural backgrounds may not fully understand the historical and cultural values of the displaced cultural objects [15], affecting their feelings and empathy for objects' displacement journey. Our study findings in Section 6.2.1 showed that multi-layered biographical narratives and personified embodied interactions can facilitate participants' intercultural empathy. As results shown in Section 6.1, participants from source and non-source communities possessed non-significant different level of empathy, cultural competence, and immersion ratings after the VR experience. According to results in Section 6.2.2, the source community participants' established sense of cultural identity was better able to adopt the perspective of the displaced cultural objects and empathize with them, even if they did not have much information and knowledge about the objects. Moreover, findings in Section 6.2.2 also showed that, for non-source community participants, the first-perspective embodied narrative provided an intuitive experience, the telling of the cultural objects' displacement history helped users to understand its cultural connotations fully, and the situational simulation enhanced users' understanding of and emotional empathy to the displaced cultural objects. Hence, immersive biographies are widely applicable to all different types of displaced cultural objects distributed all over the world and create customized life stories that tell the story of their creation, displacement, current status, and future life journeys. It can present the multi-layered artistic value, cultural significance, and historical memory of displaced cultural objects, creating a holistic picture for users to enhance their understanding. In addition, we conveyed the national heritage and the world heritage view as objectively as possible based on research from scholars from different cultural backgrounds. By introducing a multicultural perspective approach, we hope to avoid biases arising from opinionated guidance when analyzing participants' cognitive differences. The results in Section 6.2.3 showed that both groups held different views after the VR experience, but the exact reasons for this need to be further investigated in the future.

Previous research explored the ways in which interactive apps can reduce cultural differences and promote intercultural communication between immigrants and host communities, as well as

between immigrants of different backgrounds, using cultural rituals as targets [52]. Similarly, we used displaced cultural objects as a vehicle to connect people and objects through experiences to cope with cultural differences and promote intercultural empathy, adopting a strategy that focuses more on personified embodiment and intercultural design methods, which also proved to be effective. Future work could further explore ways to design more inclusive and educational intercultural experiences in VR for users who are unaware of the native culture.

7.2 Mechanism of Emotional Empathy and Cognitive Understanding

Intercultural empathy theory suggests that individuals can shift their personal perspectives and form new views through cognition and emotion during interactions [5]. Our findings showed that immersive biographies fostered greater empathy and inclusion of self in others among participants from non-source communities compared to those from the source community. Beginning with avatars, participants from the source community were more likely to put individuals into the *Admonitions Scroll*'s shoes due to cultural identity. In contrast, participants from non-source communities used the personified avatar to put the *Admonitions Scroll* into their own perspective, connecting through personal identity. During embodied interactions, non-source community participants also found themselves brought closer as their personal experiences deepened their connection to the scroll. Ultimately, both parties co-construct new meanings through cooperation and interaction, promoting global cultural empathy and identity, and promoting cultural democratization and globalization [24].

In the process of intercultural empathy, emotional responses play a dual role. First, emotional responses promoted participants' deep engagement with the cultural experience [48]. By evoking empathy, participants became more engaged in experiencing and feeling the cultural content, thus enhancing their sense of cultural engagement. As shown in Section 6.2.2, participants were increasingly able to empathize with the *Admonitions Scroll* and learned about its life history as the embodied interaction continued. Further, emotional responses promoted cognitive understanding of culture. Emotional empathy made it easier for participants to focus on and understand the sociocultural context. As shown in Section 6.2.3, participants from the source communities tended to have a better understanding of the impacts of cultural differences, and thus they might develop mildly negative emotions such as regret, while at the same time recognizing the importance of facilitating cultural communication. Whereas participants from non-source communities experienced stronger emotions, such as heartbreak, ignorance, or satire, due to the shock of cultural differences, and exclaimed about historical power inequalities. However, this phenomenon is not absolute. Due to differences in individual perceptions, some participants from source communities hold a world heritage view, while some participants from non-source communities hold a national heritage view. When individuals empathize on an emotional level, they are more likely to actively explore and digest new information [10], leading to a deeper understanding of cultural contexts and values. Ultimately, the interaction between emotional resonance and cognitive understanding enables users to understand and perceive cultural

objects more fully, driven by both rational analysis and emotional experience.

7.3 Limitations and Future Work

This study has the following limitations and will be targeted for future improvements. We did not use a control group to determine whether VR enhances empathy or content alone. Future research is necessary to evaluate the performance of the system compared to only reading the biographical information of displaced cultural objects with no VR. We also acknowledge that the number and cultural background of the participants collected was limited. With more users and demographic variety, we may gain further or different insights. For the design, VR narratives have too much textual content and the UI design is not friendly enough, which affects the user's reading experience. We will improve the interface design and visualize the text as much as possible. Also, we will try to use more imaginative and dramatic representation strategies to propose design improvements for non-source community participants to develop empathy in the absence of cultural background. Furthermore, VR interactivity is too high, which requires a certain level of user operation. We will try to unify the interaction and improve the consistency of user flow.

8 Conclusion

We proposed the approach of immersive embodied VR biography to provide new ways of interpreting and representing displaced cultural objects and recognize the importance of promoting intercultural empathy and deepening the understanding of historical and cultural significance. In intercultural contexts, a personification of displaced cultural objects is helpful for enhancing empathy. During VR experiences, dialogue with different displaced cultural objects and participatory virtual restoration can effectively promote empathy and understanding among users. Users from non-sourced communities develop stronger empathy for displaced cultural objects than those from sourced communities. Thus, VR biographies of displaced cultural objects not only provide users from the source community with novel perspectives on history and culture, but also open windows for participants from non-source communities to further understand other cultures. Moreover, intercultural empathy for displaced cultural objects is not only concerned with the processes of user empathy and understanding to cope with cultural differences, but more importantly with the generation of productive meaning. Users' comments about the revolutionary power of VR biographies and their curiosity to understand more about the culture of displaced cultural objects are exactly what we expected.

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A Appendices

A.1 Pre-test Questions

A.1.1 Demographic Questions.

- (1) Which of the following best describes how you think of yourself?
 - Male
 - Female
 - Other
- (2) Which age group do you belong to?
 - 18–22
 - 23–27
 - 28–32
 - 33–37
 - 38–42
 - 43–46

- 47-51
 - 52-59
 - 60 or over
 - Prefer not to say
- (3) Which country were you born in?
- (4) Which country is your place of residence?
- (5) Which of the following best describes your cultural background?
- East Asian
 - South Asian
 - Southeast Asian
 - Middle Eastern/North African
 - African
 - European
 - Latin American
 - Caribbean
 - Pacific Islander
 - Indigenous
 - Mixed heritage
 - Other
 - Prefer not to say
- (6) What is your level of education?
- Undergraduate
 - Postgraduate
 - Postgraduate Research
 - PhD
 - Other
- (7) What is your profession?
- Student
 - Teacher/Educator
 - Healthcare professional
 - Engineer
 - Business/Finance professional
 - Sales/Marketing
 - IT/Technology
 - Artist/Creative professional
 - Government employee
 - Entrepreneur/Business owner
 - Skilled trade worker
 - Retired
 - Unemployed
 - Other
- (8) For students, what is your field?
- Arts and Humanities
 - Social Sciences
 - Natural Sciences
 - Engineering and Technology
 - Health Sciences
 - Business and Management
 - Media and Communication
 - Agriculture and Environmental Sciences
 - Other
- (9) What is your proficiency level in English?
- Basic
 - Intermediate
 - Advanced
 - Native or bilingual proficiency
- (10) How familiar are you with virtual reality (VR)?
- Not familiar
 - Slightly familiar
 - Moderately familiar
 - Very familiar
- (11) What is your level of interest in cultural heritage or galleries, libraries, archives, and museums?
- Not interested at all
 - Not very interested
 - Somewhat interested
 - Very interested
- (12) Do you know about the Admonitions Scroll of the Court Ladies?
- Seen in the British Museum
 - Seen at the Palace Museum
 - Learned about it on the internet
 - Read related papers or books
 - Heard about it
 - Never learned about it
- (13) How do you view the displaced cultural objects held in overseas museums?
- Cultural Appreciation: Admiration for showcasing diverse histories and cultures.
 - Controversy: Concerns about how the objects were acquired and if they should be returned.
 - Educational Value: Valued for educating the public about global cultures.
 - Cultural Diplomacy: Seen as a tool for cultural exchange between countries.
 - Preservation and Research: Recognized for the conservation and study of the objects.
 - Return of Objects: Support for returning items taken under contentious circumstances.
 - Other
- (14) First Name:
- (15) Last Name:
- (16) Mobile Phone Number:
- (17) Email Address:
- A.1.2 The Inclusion of Other in the Self Scale (IOS).** These questions are asked both before and after the test.
- (1) Please circle the image below that best describes your (self) relationship with the Admonitions Scroll (other).
-
- Figure 5: Inclusion of Self with the Admonitions Scroll**
- (2) Please circle the image below that best describes the relationship between the various interpretations of displaced

cultural objects in source communities (self) and host countries (other).

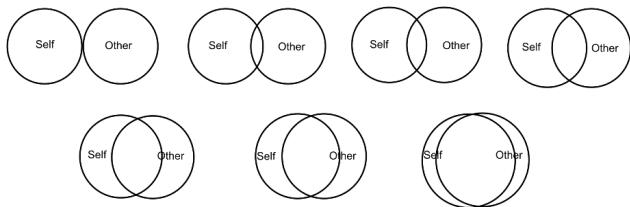


Figure 6: Inclusion of Self with Interpretations of Displaced Cultural Objects

A.2 Post-test Questionnaire

All participants were asked to complete this questionnaire using a seven-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7) or "not at all" (1) to "A lot" (7).

- (1) It is easy for me to understand what it would feel like to be a cultural object from a background different from my own.
- (2) It is difficult for me to relate to stories where cultural objects reflect the cultural significance they hold in their societies.
- (3) It is difficult for me to put myself in the context of a cultural object from a culture different from mine.
- (4) I know what it feels like for a cultural object to be the only representation of its culture in a collection of diverse objects.
- (5) I feel uncomfortable when engaging with a significant number of cultural objects from cultures that are different from mine.
- (6) I don't know much about the historical and cultural importance of cultural objects from cultures other than my own.
- (7) I enjoy interacting with cultural objects from different cultures.
- (8) I am confident that I can engage with cultural objects from a culture that is unfamiliar to me.
- (9) I am sure I can handle the stresses of adjusting to cultural objects from a culture that is new to me.
- (10) I enjoy experiencing cultural objects from cultures that are unfamiliar to me.
- (11) I am confident that I can adapt to the contextual significance of cultural objects in a different culture.
- (12) To what extent did you feel that you were interacting with the environment of your experience?
- (13) To what extent did you feel as though you were separated from your real-world environment?
- (14) To what extent did you find the experience challenging?
- (15) Were there any times during the experience when you just wanted to give up?
- (16) To what extent did you feel motivated while experiencing the environment?
- (17) To what extent did you find the interaction easy?
- (18) How well do you think you performed in the experience?
- (19) To what extent did you feel emotionally attached to the experience?

- (20) To what extent were you interested in seeing how the events would progress?
- (21) To what extent did you enjoy the graphics and the imagery?
- (22) How much would you say you enjoyed the experience?
- (23) Would you like to experience it again?

A.3 Interview Questions for Post-test

- (1) How much did you learn and understand about the displacement journey (historical biography) of the Admonitions Scroll through the VR experience?
 - Follow-up: Can you share any initial feelings or thoughts about it?
 - Follow-up: Did you perceive any cultural differences (e.g., being purchased by the British Museum, being divided into three sections, the restoration process)?
- (2) What do you think about the virtual Admonitions Scroll in the mirror representing your identity in VR?
 - How easy did you find it to control the virtual Admonitions Scroll and move together with it?
 - How do you perceive the touch sensations experienced by the virtual Admonitions Scroll?
 - How connected did you feel to the virtual Admonitions Scroll?
- (3) What design features of this VR experience did you like or dislike (e.g., avatar, dialogue, visuals, sound, tasks, interactions, scenes)?
- (4) In your opinion, what are the most significant benefits and disadvantages of using VR to tell the biography of displaced cultural objects?
- (5) What emotions did you feel after the VR experience? How did it influence your understanding and empathy toward the cultural and historical context of the Admonitions Scroll?
 - For participants from the source community: Were there any specific aspects of the VR experience that made you feel a stronger connection to your own cultural object? Can you give an example?
 - For participants from non-source communities: Were there any specific aspects of the VR experience that helped you understand the culture from which the object originated and changed your perceptions of its cultural significance? Can you give an example?
- (6) How did this VR experience impact your understanding of the broader issues surrounding cultural object displacement and preservation?