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Comparing 360-Degree Video and Immersive VR in Empathy Induction: Impact on Young Designers' Engagement and Problem Identification

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ABSTRACT

Empathy is essential in design research, yet young designers often struggle to empathize with unfamiliar user groups, such as older adults with dementia. Virtual reality (VR) has emerged as a tool for empathy induction, but the effectiveness of different VR formats remains unclear. This study compares 360-degree video and immersive virtual environments in fostering affective and cognitive empathy, user engagement, and problem identification. A total of 22 young designers were randomly assigned to experience one of the two VR modalities, depicting daily challenges faced by dementia patients. Results showed that 360-degree video significantly enhanced affective empathy and engagement compared to immersive VR, while no significant differences were found in cognitive empathy or problem identification. These findings suggest that realistic, context-rich experiences may evoke stronger emotional resonance, whereas fully virtual environments require further refinement. Future research should explore how interactive elements, embodiment, and perspective shifts in immersive VR can improve empathy induction. This study underscores the importance of media selection and contextual realism in empathy-driven design interventions.

Keywords: Virtual reality, Immersion, Empathy, Empathy induction, Empathic design

INTRODUCTION

Empathy plays a crucial role in contemporary design research and practice, emphasizing that designers should fully understand user needs from emotional, cognitive, and behavioral perspectives and translate them into design solutions. However, young designers often face challenges in engaging with unfamiliar groups, such as older adults or individuals with dementia, due to a lack of relevant life experience, pre-existing stereotypes, and negative perceptions. These limitations can restrict the diversity of their design outcomes (Hallewell et al., 2022; Smeenk et al., 2018). Developing authentic and effective empathy has thus become an important issue in enhancing design effectiveness (Chang-Arana et al., 2020). However, imagining others' experiences is often laborious and yields limited results (Oh et al., 2016).

Recent virtual reality (VR) technology advancements have opened up new possibilities for fostering empathy. Scholars have increasingly recognized VR's ability to evoke empathy, often referring to it as an "empathy machine" (Barbot & Kaufman, 2020; Bujić et al., 2020). Research suggests that VR can effectively reduce bias, enhance users' understanding of others' experiences, and stimulate creative thinking among designers (Barbot & Kaufman, 2020; Ho & Ng, 2022). These effects are largely attributed to VR's immersive nature, multisensory engagement, and interactive capabilities, which enable users to transcend their cognitive frameworks, thereby fostering original thinking and improving the practicality of design outcomes (Chang-Arana, 2022; Shin, 2018).

However, previous studies have rarely explored how different VR formats impact designers' empathy levels and design effectiveness. Therefore, this study focuses on "elderly individuals with dementia" as the primary empathetic subjects. It compares two different VR-based empathy induction methods, 360-degree real-life video, and immersive virtual environments, regarding their effects on emotional and cognitive empathy, VR user experience, and the ability to identify problems and needs.

Empathy and Empathic Design

Empathy allows individuals to understand and share others' emotions. In psychology and design research, it encompasses emotional, cognitive, and behavioral dimensions. Chang-Arana et al. (2022) synthesized multiple studies to define empathy as an emotional response influenced by the empathizer's characteristics and their relationship with the target. While this process occurs automatically, it can also be shaped by cognitive regulation. The emotional response elicited through empathy mirrors an individual's perception of emotional stimuli, whether through direct experience or imagination (affective empathy), and their cognitive understanding of others' emotions (cognitive empathy). Importantly, empathy requires recognizing that these emotions originate from another person. This definition forms the foundation for discussions on empathic tools, psychological processes, individual traits, and interaction mechanisms in the design field.

In design, empathy emphasizes understanding users' needs in context. Designers' empathetic understanding provides insight into users' behaviors and emotions (McMahon, 2021). Empathic design helps designers grasp user experiences effectively. By applying user-centered design, it enhances meaningful observations from user-environment interactions (Love, 2002), leading to solutions better suited to users' needs (Hess & Fila, 2016; Kouprie & Sleeswijk Visser, 2009).

Practically, design team members may interpret user needs differently due to personal traits and experiences. To improve alignment with user experiences and enhance consensus (Koskinen et al., 2003), empathic design often employs tools to understand users better (Suri, 2003). However, perspective-taking abilities vary among individuals (Hodges, Lewis, & Ickes, 2015). External media can lower barriers to observation, helping individuals

with varying empathic abilities adopt a user's perspective, thus improving empathy in design.

Empathy in design should go beyond need identification and user feedback. It must be rooted in the designer's ability to shift perspectives, engage with real-world contexts, and understand emotional dynamics. When designers experience users' situations firsthand, their perceptions and emotions influence design decisions, leading to solutions that better address real-world needs (Drouet et al., 2024). Enhancing empathy at different design stages—user research, concept development, and design practice—can foster inclusivity and emotional connection (Borycki et al., 2024).

Integrating empathy into design education helps students develop sensitivity toward diverse users, including cultural, physical, and cognitive differences. This fosters growth in design thinking and socio-emotional skills (Efilti & Gelmez, 2024). Particularly in multicultural contexts and professional fields requiring long-term collaboration, such as public transportation for visually impaired users, role-playing and immersive simulations can enhance understanding of challenges faced by these users. This approach leads to more innovative and inclusive products and systems (Grech et al., 2024; Cofala et al., 2024).

Empathy Development Through Virtual Reality for Special Populations

As virtual reality (VR) technology advances, individuals can use VR to simulate and experience the living conditions of special populations that they seldom encounter in daily life. For example, designers have attempted to use VR to simulate visually impaired individuals' psychological and physiological experiences, facilitating cognitive and affective empathy toward this group (Young, O'Dwyer, & Smolic, 2021). McDonagh and Reardanz (2020) suggested that VR provides a richer context that enhances users' cognitive empathy toward older adults compared to traditional aging suits. Additionally, researchers have explored VR applications for understanding the experiences of individuals with various medical conditions. For instance, dementia caregivers often struggle to comprehend patients' behavioral patterns and perceptual experiences. By simulating the world from a dementia patient's perspective, VR interventions can significantly enhance caregivers' empathy (Dyer et al., 2018).

A systematic review by Hirt and Beer (2020) indicated that VR-based training interventions can improve empathy and caregiving skills among nursing students and family members of dementia patients. Similarly, Sung et al. (2022) found that compared to a non-VR control group, dementia care workers who underwent VR-based training demonstrated significant improvements in knowledge, attitudes, caregiving abilities, and empathy over time. Moreover, Hicks et al. (2023) investigated the role of VR in raising dementia awareness among care facility workers and found that VR provided a more intuitive and immersive learning experience. Their study highlighted that VR simulations help caregivers understand the sensory and cognitive challenges faced by dementia patients, leading to increased

emotional engagement and self-reflection on caregiving behaviors. In a mixed-method systematic review, Huang et al. (2024) found that VR-based interventions enhanced dementia-related knowledge and emotion-focused coping strategies. Although quantitative evidence regarding VR's effectiveness in fostering empathy remains inconsistent, qualitative findings indicate that deeper insights into the lived experiences of persons with dementia lead to notable shifts in caregivers' attitudes and behaviors.

A recent systematic review by Lacle-Melendez et al. (2024), analyzing 37 studies conducted between 2007 and 2023, found that immersive VR environments effectively engage participants and enhance empathy within specific contexts. Their findings suggest that VR experiences not only foster positive attitudes towards prosocial behavior but also have a moderate effect on perspective-taking abilities.

METHOD

Participants and Procedure

This study recruited 22 young designers (6 males, 16 females) as participants, with an average age of 26.27 $\pm$ 4.3 years. The participants experienced the perspective of an "older adult with dementia" through a first-person viewpoint using the Meta Quest Pro virtual reality (VR) headset. The VR video used in the study was developed by Alzheimer's Research UK and called 'A walk through dementia'. It depicted the primary challenges and difficulties faced by individuals with dementia in daily life. Participants were randomly assigned to one of two groups: the 360-degree real-world video group or the immersive virtual environment group.

The 360-degree real-life video group viewed 360° panoramic video sequences, which depicted an elderly woman shopping at a supermarket with her son. On the way home, she became separated from him, struggled to find her way back, and mistakenly identified strangers as acquaintances. In contrast, the immersive virtual environment group experienced computer-generated environments, simulating the shopping experience of an elderly woman in a supermarket. This scenario illustrated the various interactional difficulties individuals with dementia may encounter while engaging in routine shopping activities. The VR content provided participants with an immersive experience, allowing them to gain a deeper understanding of the daily challenges faced by individuals with dementia.

Measures

After watching the VR, participants were given 20 minutes to reflect on and analyze the needs of individuals with dementia based on their experience. They were required to identify all observed problems and needs within the simulated scenario and any extended difficulties and demands that individuals with dementia might face in daily life. After the needs identification task, participants completed a questionnaire with two measures: the Comprehensive State Empathy Scale (CSES) and the User Experience in Immersive Virtual Environments (IVRUX) scale. The

CSES assessed empathy levels across emotional, behavioral, and cognitive dimensions, particularly in contexts involving vulnerable populations (Levett-Jones et al., 2017), using a five-point Likert scale. The IVRUX scale measured immersion, presence, and engagement with the VR content through 18 items on a five-point Likert scale (Tcha-Tokey et al., 2018).

RESULTS AND DISCUSSION

This study employed the Mann-Whitney U test to compare two different VR-based empathy induction methods—360-degree real-world video and immersive virtual environments—in terms of their effects on affective and cognitive empathy, VR user experience, and problem and need identification. The results in Table 1 indicate that 360-degree real-world video significantly enhanced affective empathy compared to immersive virtual environments, whereas no significant difference was observed in cognitive empathy. Additionally, in the VR user experience assessment, there was a significant difference in engagement between the two groups, while no significant differences were found in sense of presence and immersion.

Table 1: Comparison of 360-degree video and immersive VR on empathy and user experience (Mann-Whitney U test results).

	VR_Type	N	Mean Rank	*U*	*Z*	*p*
Affective empathy	360	11	14.23	30.5	−2.047	0.041
	VR	11	8.77			
Cognitive empathy	360	11	11.09	56.0	−0.297	0.766
	VR	11	11.91			
Presence	360	11	13.64	37.0	−1.55	0.121
	VR	11	9.36			
Immersion	360	11	13.14	42.5	−1.189	0.234
	VR	11	9.86			
Engagement	360	11	14.23	30.5	−2.002	0.045
	VR	11	8.77			

The results in Table 2 show that problem and need identification did not differ significantly between the two groups, suggesting that although 360-degree real-world video enhances emotional resonance and engagement, it does not lead to greater identification of problems and needs.

Table 2: Effect of 360-degree video and immersive VR on problem and needs identification (Mann-Whitney U test results).

	VR_Type	N	Mean Rank	*U*	*Z*	*p*
Observed problems and needs	360°	11	10.14	45.5	−0.988	0.323
	Virtual	11	12.86			
Extended difficulties and demands	360°	11	10.91	54.0	−0.430	0.667
	Virtual	11	12.09			

These findings align with existing literature on the mechanisms through which VR and other media facilitate empathy. Lacle-Melendez et al. (2024),

in a systematic review, highlighted that VR and AR technologies can enhance affective empathy through immersive experiences, but their effectiveness depends on scenario design and application context. Lara and Rueda (2021) further emphasized that the primary function of VR is to help users adopt another person's perspective rather than fully replicate their identity, with its effects primarily driven by emotional connections rather than cognitive mechanisms. This finding supports the significant increase in affective empathy observed in the present study.

Furthermore, in the fields of social innovation and experience design, Sleeswijk and van Erp (2023) underscored the importance of engagement and the recreation of real-life contexts in fostering emotional resonance, which is consistent with the higher engagement levels reported for 360-degree real-world video in this study. Similarly, Chen and Ibasco (2023) found that the effectiveness of VR perspectives is primarily driven by affective empathy rather than cognitive mechanisms, which aligns with the non-significant difference in cognitive empathy observed in this study.

Overall, this study further supports the importance of contextual realism and media selection in fostering affective empathy, while highlighting differences in engagement and empathy activation across different VR technologies. These findings suggest the need for further exploration, particularly regarding how scenario design can optimize emotional resonance and user engagement. Moreover, preliminary evidence suggests that virtual embodiment (sense of body ownership) and agency (sense of control over actions) are key predictors of empathy changes. Barbot and Kaufman (2020) found that subjective VR experience quality, particularly a high sense of presence and immersion, explains empathy enhancement more effectively than content alone. Therefore, designing VR experiences that enhance presence and engagement—such as implementing visuomotor synchrony to strengthen body ownership—may be a critical direction for future optimization. Future research should investigate how to balance technological immersion, emotional connection, and cognitive mechanisms to enhance empathy induction in applied settings (Barbot & Kaufman, 2020; Chen & Ibasco, 2023; Lacle-Melendez et al., 2024; Lara & Rueda, 2021; Sleeswijk & van Erp, 2023).

CONCLUSION

This study compared 360-degree video and immersive VR in fostering empathy among young designers. Results showed that 360-degree video significantly increased affective empathy and engagement, while no significant differences were found in cognitive empathy or problem identification. This suggests realistic, context-rich experiences evoke stronger emotional responses than fully virtual environments. Although immersive VR did not enhance empathy as effectively, its interactive potential could be further developed. Future research should explore how interactive storytelling, perspective shifts, and embodiment can improve empathy induction. In conclusion, this study highlights the importance of media selection and contextual realism in designing for empathy. Further research

should refine VR-based approaches to enhance user understanding and design innovation.

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