Media and Communication
2024 • Volume 12 • Article 8601
https://doi.org/10.17645/mac.8601

ARTICLE

Open Access Journal

Understanding Expressions of Self-Determination Theory in the Evaluation of IDEA-Themed VR Storytelling

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Submitted: 1 May 2024 **Accepted:** 30 July 2024 **Published:** 17 October 2024

Issue: This article is part of the issue "The Many Dimensions of Us: Harnessing Immersive Technologies to Communicate the Complexity of Human Experiences" edited by Nicholas David Bowman (Syracuse University), Dan Pacheco (Syracuse University), T. Makana Chock (Syracuse University), and Lyndsay Michalik Gratch (Syracuse University), fully open access at https://doi.org/10.17645/mac.i455

Abstract

This study investigates how prior experiences (personal or a close other's) influence individuals' engagement with virtual reality (VR) stories designed to promote understanding and foster prosocial behavior. Integrating self-determination theory and self–other overlap, we conducted an experimental mixed-method study with 35 participants who experienced three VR stories focused on inclusion, diversity, equity, and accessibility (IDEA): living with Alzheimer's, blindness, and in a refugee camp. Findings indicate that while participants felt some autonomy with the VR headset, they experienced a lack of autonomy, competence, and relatedness in the storytelling. Participants engaged in perspective-taking but often thought about those close to them who had similar experiences rather than themselves. Thus, a close other's experience affected whether people engaged in perspective-taking. However, prior experience with IDEA topics did not predict cognitive effort, indicating that individuals with such experience do not exert more cognitive effort than those without it. Additionally, cognitive effort did not predict prosocial attitudes or behaviors. This study highlights the complexities of how previous experiences affect engagement with IDEA-centered VR, perspective-taking, and cognitive effort and suggests directions for future research.

Keywords

diversity; equity; self-determination theory; self-other overlap; virtual reality

1. Introduction

Virtual reality (VR) technology has become an influential tool for creating immersive and engaging experiences across various domains, including education, training, therapy, and entertainment. As VR continues to evolve, there is a growing emphasis on designing content centered on inclusive, diverse, equitable, and accessible (IDEA) concepts (see Indiana Arts Commission, 2018; Krombolz, 2021). IDEA-centered content, whether designed for or adapted for VR, often features experiences of social plight. For example, VR content features people's experiences with racism (Brown, 2018), homelessness (Ogle et al., 2018), blindness (Colinart et al., 2016), and living with Alzheimer's (*The New York Times*, 2018). The expectation is that VR can "encourage empathy for understanding and addressing structural inequalities, VR can be used to simulate situations that people from marginalized groups face in the real world, such as discrimination or bias" (Richter et al., 2023, p. 575).

The immersive nature of VR has been found to elicit a greater sense of presence (or "being there") and engagement with the virtual environment than is produced by other types of media formats. This heightened experience can increase emotional engagement and attention (Cummings & Bailenson, 2016) and potentially empathy (Martingano et al., 2021). Indeed, VR is sometimes referred to as a mechanism that can evoke the ability to understand a situation (i.e., empathy) or as an "empathy machine" (Milk, 2015), although research on these effects has sometimes produced mixed results. Studies suggest that VR may be more effective in improving emotional empathy (compassionate feelings) than in enhancing cognitive empathy or perspective-taking (see Martingano et al., 2021).

Martingano et al. (2021) suggest that cognitive empathy requires "effortful mentalizing." In examining the ways that VR narratives impact perspective-taking, it is therefore important to consider the motivational and experiential factors that can impact this process. From a self-determination theory (SDT) perspective (Deci & Ryan, 1985, 2000), people's motivations to engage in the effortful mentalizing required by perspective-taking may be impacted by their ability to understand and navigate a VR experience (competence), their sense of agency or autonomy in the situation, and their sense of relatedness to those featured in the VR IDEA narrative. A key factor in the process may be users' prior experience. This can impact users' ability to imagine being in another person's situation and to understand their social plight (Batson & Ahmad, 2009). In addition, knowing a close other who has experienced social plight not only makes people more aware of those struggles, but also predicts empathetic attitudes to other's situations (Batson et al., 1997). Therefore, having experience or a close other experience may be a factor in cognitive empathy (i.e., perspective-taking). Conceptually, if the experience elicits a reminder of one's personal experience or a close other, it may evoke feelings of competence, autonomy, or relatedness and ease of perspective-taking. Alternatively, prior experiences (self or other) may evoke cognitive overload and be a negative reminder of a close other, creating the opposite desired effect of eliciting intrinsic motivation. In other words, participants may feel like they lack control of the situation (e.g., cannot help), have no agency over their actions in the experience, and feel a lack of belonging or relatedness due to the struggles based on prior experiences. If the IDEA-themed VR content is too cognitively taxing, people will not want to engage with it further. In the present study, we integrate self–other overlap and SDT to explore how IDEA-centered VR experiences elicit conversations of prior experience, perspective-taking, and components of SDT. Additionally, we examine how prior experience relates to cognitive effort.

2. Literature Review

2.1. Perspective-Taking and Cognitive Effort in VR

VR possesses unique features that make it exceptionally well-suited for studying empathy. By immersing users in fully interactive and three-dimensional environments, VR can simulate real-life experiences with a high degree of realism (Slater & Sanchez-Vives, 2016). This immersive quality allows individuals to step into someone else's shoes and experience scenarios from different perspectives, fostering a deeper understanding and emotional connection to others' experiences (Ahn et al., 2013). Mass Communication researchers (e.g., Pan & Hamilton, 2018; Schutte & Stilinović, 2017; Ventura et al., 2020) have found that VR's capacity for creating controlled and repeatable environments is well-suited for systematically manipulating variables and observing their effects on empathetic responses.

Putting on a VR headset can mean putting oneself into another's shoes by engaging in a real-life simulated environment, experiencing the narrative of the content, and eliciting thoughts and emotions from those experiences. VR content, particularly IDEA-focused content, allows users to understand the perspectives of others' struggles, therefore it is understandable there is extensive research investigating VR and perspective-taking. Perspective-taking or cognitive empathy is the ability to understand another's point of view and to understand how someone else thinks or feels about a situation (Herrera et al., 2018; Singer & Fehr, 2005). Findings have shown that perspective-taking can be evoked with VR. For example, after engaging in a VR experience that offered first-person perspectives of a racial minority experiencing racial discrimination, people reported that VR increased their empathy (e.g., cognitive and emotional) toward racial minorities (Nikolaou et al., 2022; Roswell et al., 2020). As noted earlier, however, findings on perspective-taking through VR are not definitive. In their meta-analysis of VR and empathy studies, Martingano et al. (2021) argue that thinking about others' perspectives requires deliberate cognitive effort.

Cognitive effort refers to the mental resources and processing demands required to interact with new stimuli in an environment (Tyler et al., 1979). Although the wealth of detail available in immersive narratives can enhance users' sense of presence, it is also possible that it may require greater effort to sift through relevant elements and to understand VR narratives. It has been noted that people are cognitive misers and averse to expending cognitive effort (Wu et al., 2023). Studies have found that people are aversive to exerting cognitive effort even when offered a monetary reward (Depow et al., 2022). That said, since too much cognitive exertion may negatively impact people's engagement (Bueno-Vesga et al., 2021), people are even more reluctant when those efforts are directed towards benefiting strangers, including charities that hold personal significance to them (Depow et al., 2022). This shift in focus highlights the nuanced relationship between prior experiences and empathetic understanding.

2.2. Prior Experience and Perspective-Taking

Thinking about relative experiences may make it easier to cognitively and affectively understand someone else's experiences. As argued by Preston and Hofelich (2012), people need an anchor to engage in empathy, "When the observer really does not have any related experience with the situation, he/she cannot empathize through passive activation of shared representations" (p. 28). Therefore, finding similarities from one's prior experience may not only be a bridge to empathy but also a factor in cognitive effort. Like prior exposure to

a stimulus predicts the ease and fluency of which it is later processed, prior experiences may make it easier to empathize with people encountering an analogous event cognitively. For example, people who perceive another's situation as similar to their past experiences and reflect more deeply on similar past experiences find it easier to understand another's perspective (Gerace et al., 2013, 2015).

Therefore, identifying similarities from one's previous experiences may not only serve as a pathway to empathy but could also play a role in cognitive effort. Just as familiarity with a stimulus can predict the ease with which it is later processed, past experiences could potentially ease the process of empathizing cognitively with individuals facing similar situations. For instance, individuals who view another's circumstances as reminiscent of their own past experiences and who reflect more profoundly on these analogous past experiences find it simpler to comprehend another's viewpoint (Gerace et al., 2013, 2015). However, considering that social plight can be a traumatic experience, VR experiences that feature social plight can serve as a reminder of that experience, thus increasing one's cognitive effort. Therefore, it is unclear whether one's prior experience will increase or decrease cognitive effort. Bridging these concepts, we delve into how personal history influences our ability to connect with others.

2.3. Prior Experience and Self–Other Overlap

Interestingly, people take on others' past experiences when they are close to them. Self–other overlap is a psychological construct that assesses perceived closeness and one's feeling connected to another (Aron & Fraley, 1999). Self–other overlap posits that when we feel close to another so much, we include the other in our self. Additionally, the more self–other overlap, the more likely people are willing to help express prosocial attitudes and behaviors and engage in perspective-taking (Myers & Hodges, 2012). Therefore, self-other overlap is an excellent framework to explore how prior experience indicates perspective-taking, whether people use a close other's experience as a perspective-taking strategy, and how prior experience relates to cognitive effort. In examining perspective-taking strategies, the integration of SDT's core tenets—relatedness, autonomy, and competence—emerges as a nuanced factor in the discourse.

2.4. SDT

Correspondingly, SDT (Deci & Ryan, 1985, 2000) is a framework often applied to motivation studies that distinguish whether people are motivated to engage with a task by their volition for the enjoyment of the task rather than a reward (i.e., intrinsic motivation) or engaging in a task for a reward like money or praise (i.e., extrinsic motivation). Additionally, the SDT framework explains how social and cultural factors can either bolster or undermine individuals' sense of volition, well-being, and performance quality. Components of SDT include autonomy, relatedness, and competence.

Relatedness refers to the inherent desire to feel connected to others, belong, and experience meaningful relationships within one's social environment (Deci & Ryan, 2000). Relatedness is crucial for fostering intrinsic motivation, as it provides individuals with a sense of social support and validation, which can positively impact their engagement, making it a significant factor in designing and implementing IDEA-focused VR content. Competency relates to feeling like one has the skills to effectively engage in one's environment (Ryan & Deci, 2002). Lastly, autonomy involves having a sense of agency or control over one's actions. When individuals are autonomous, they perceive their actions as true expressions of themselves; thus, even when external

factors shape their actions, they align with these influences, feeling both a sense of initiative and value (Ryan & Deci, 2002). Moreover, SDT posits that individuals have intrinsic needs for autonomy, competence, and relatedness, which drive their motivation and behavior (Deci & Ryan, 1985). When these needs are supported, individuals experience greater intrinsic motivation, enhancing engagement, performance, and well-being (Ryan & Deci, 2002).

In VR, SDT offers a valuable framework for understanding how users' psychological needs influence their engagement in immersive experiences. Previous studies have demonstrated the impact of intrinsic motivation across various VR applications. For example, studies have suggested that VR can enhance users' autonomy (Ijaz et al., 2020; Kosa et al., 2020), and competence (Kosa et al., 2020), increasing gaming enjoyment. In educational settings, experiences of autonomy and relatedness in VR have been positively associated with intrinsic motivation for learning (Huang et al., 2019). Additionally, findings suggest that teachers who perceive high levels of autonomy and competency are more likely to utilize virtual learning environments in their teaching (Hew & Kadir, 2016). In other words, people who are intrinsically motivated (i.e., having autonomy, relatedness, and competency) are more likely to engage with that task (e.g., VR) of their own volition and have an increased likelihood of doing that task in the future. Conversely, individuals may be less inclined to engage in prosocial attitudes or behavior when they feel less connected to the recipients of their help (Depow et al., 2022). Taken together, this practical application of SDT in the context of VR content and storytelling can provide valuable insights into users' likelihood of intrinsic motivation, future use, and well-being.

Taking this into account, we propose the following research questions:

> RQ1: How do participants express autonomy, competence, and relatedness among three IDEA-themed 360° VR videos?
>
> RQ2: How do prior IDEA experiences elicit VR users' perspective-taking (i.e., cognitive empathy)?
>
> RQ3: To what extent is there a relationship between prior IDEA experiences and cognitive effort?
>
> RQ4: Is there a relationship between cognitive effort and prosocial attitudes and behaviors?

3. Methods

3.1. Research Design and Participants

This experimental study employs an explanatory mixed methods design with sequential data collection to investigate how IDEA-centered VR experiences elicit conversations of prior experience, perspective-taking, and SDT. In addition, we examine how prior experience relates to cognitive effort. This design integrates quantitative survey and psychophysiological data with qualitative interview data to address our research questions.

Upon approval by the institutional review board, 35 participants were recruited from a private university in the United States using convenience and snowball sampling through flyers and word of mouth. On average,

participants were 25.6 years old (SD = 7.45), ranging from 19 to 51. Of the participants, 34.2% (N = 12) identified as White, 25.7% (N = 9) Asian, and 14.2% (N = 5) Black/African-American. Approximately 48.5% (N = 17) identified as male, 48.5% (N = 17) as female, and 2.8% (N = 1) as transgender male. Detailed demographic information, including a full breakdown of participants' racial/ethnic identity, political orientation, and education, is presented in Table 1.

Table 1. Demographic information of participants.

Variable		*N* (%)
Age	M = 25.6 (SD = 7.45)	
Gender	Male	17 (48.5%)
	Female	17 (48.5%)
	Transgender male	1 (2.8%)
Race/Ethnicity	White	12 (34.2%)
	Asian	9 (25.7%)
	Black/African-American	5 (14.2%)
	White—Latin/Hispanic	3 (8.5%)
	Latin/Hispanic	1 (2.8%)
	White—Indian	1 (2.8%)
	White—Korean	1 (2.8%)
	Caribbean—American	1 (2.8%)
	White—Persian/Middle Eastern	1 (2.8%)
	Middle Eastern—North Africa	1 (2.8%)
Political orientation	Democrat	14 (40%)
	No preference	8 (22.8%)
	Independent closer to democrat	6 (17.1%)
	Don't know	3 (8.5%)
	Others	2 (5.7%)
	Independent closer to Republican	1 (2.8%)
	Republican	1 (2.8%)
Education	Some college but no degree	10 (28.5%)
	Master's degree	9 (25.7%)
	Bachelor's degree in college (four-year)	8 (22.8%)
	Highschool graduate	5 (14.2%)
	Associate degree in college (two-year)	2 (5.7%)
	Doctoral degree	1 (2.8%)

3.2. Procedure

This study is a part of a larger research project. The materials and procedures outlined pertain solely to what was evaluated within this specific study. Therefore, once participants entered the lab, they read the

informed consent form and were instructed to complete a demographic questionnaire and a series of self-reports. Then, researchers fitted participants with the HP Reverb G2 Omnicept Edition (Omnicept) VR headset. The Omnicept VR headset displays VR experiences and measures participants' heart rate, eye tracking, and cognitive load.

Once fitted with the Omnicept VR headset, participants' baseline cognitive effort data was collected. Subsequently, participants engaged in three IDEA-themed VR experiences. After each VR experience, researchers removed the Omnicept VR headset, and participants were briefly interviewed about their experiences. Then, researchers offered participants a break before starting the next experience. This sequence repeated until participants completed all three experiences. After completing their final IDEA-themed VR experience, participants engaged in a semi-structured interview lasting approximately 15 minutes. Researchers randomized the presentation of the VR experiences to reduce order effects. The entire study took approximately one hour to complete.

3.3. VR Stimuli

We selected three 360° VR videos of similar length as stimuli. *Notes on Blindness* (Colinart et al., 2016), presented in first-person, inspired by John Hull's experiences after losing his sight in 1983, immerses users in his experience of navigating environments like parks and streets through computer-generated imagery (see Figure 1a). *Coping with Alzheimer's, Together and Apart* (hereafter *Coping with Alzheimer's*; *The New York Times*, 2017), shot in the third-person, presents how an Alzheimer's patient, Aline Zerrenner, and her husband are managing her memory loss (see Figure 1b). *My Home, Shatila* (van Apeldoorn & Tan, 2019), shot in third-person, follows Fadia, a 14-year-old Palestine-Syrian refugee living in the Shatila refugee camp in Beirut, Lebanon, presenting her challenges and her resilience (see Figure 1c). Researchers classified these VR experiences as IDEA-themed because they each showcased experiences with social plight and centered on issues of IDEA. All 360° VR videos were approximately four-and-a-half minutes long.

3.4. Measurements

Prior experience was measured using three 5-point Likert scale questions about their previous experience with Alzheimer's disease, living with blindness, or living in a refugee (e.g., "I or someone close to me has or has had exposure to refugee experiences"). In addition, researchers assessed interview responses for mentions of personal or a close other's experiences with the observed IDEA situations. Participants were not explicitly asked in interviews if they or a close other has had experience with IDEA situations. Yet, during interviews many participants chose to discuss experiences they or close others had that they felt were similar or relevant to the VR story content.

Cognitive effort is measured through the amount of mental effort being utilized to complete this experiment which is often referred to as the cognitive load (Chen et al., 2011; Sweller, 2011; Sweller & Chandler, 1991). Based on Siegel et al.'s (2021) research on the multimodal inference engine for detecting real-time mental workload, the real-time cognitive load can be effectively and reliably calculated by combining the measurement of eye tracking and pulse plethysmography via a trained machine learning model. Each of the real-time cognitive load scores is normalized to a range of [0–1].

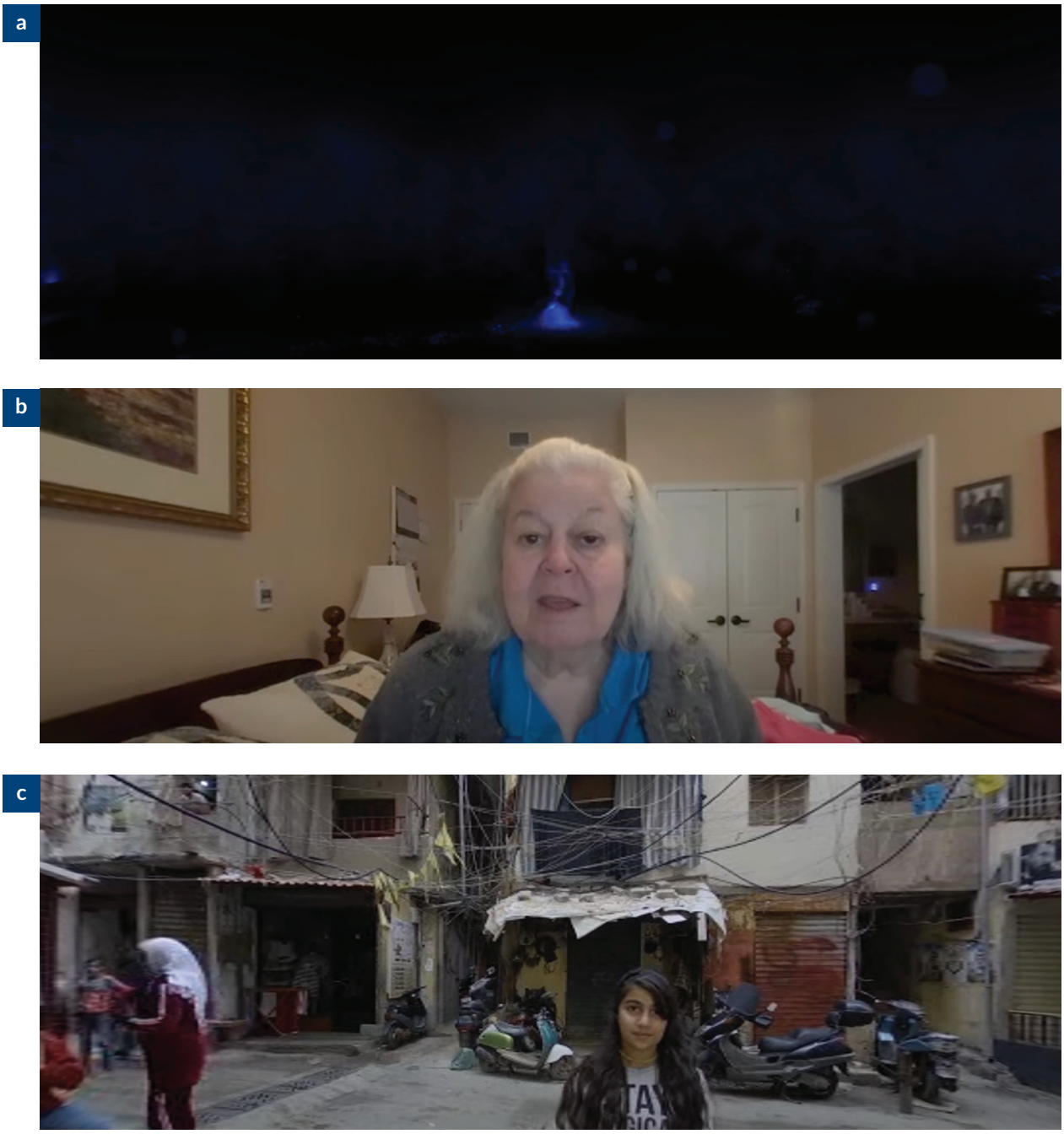

Figure 1. Example scenes of VR stimuli from: (a) *Notes on Blindness*; (b) *Coping with Alzheimer's, Together and Apart*; and (c) *My Home, Shatila*.

For this study, the Omnicept VR headset was employed to gather eye-tracking and pulse plethysmography data. These data were processed in real time by an integrated machine-learning model to calculate cognitive load scores. The real-time cognitive load scores were then displayed via the Omnicept Overlay software. All cognitive load scores were calculated using Omnicept's internally trained machine learning model. Screen capturing was conducted using OBS Studio to video record the experimental sessions with real-time sensor display information (see Figure 2). Each video was segmented into second-by-second screen captures, displaying the cognitive score for each second, which will be utilized for data analysis. Additionally, as each

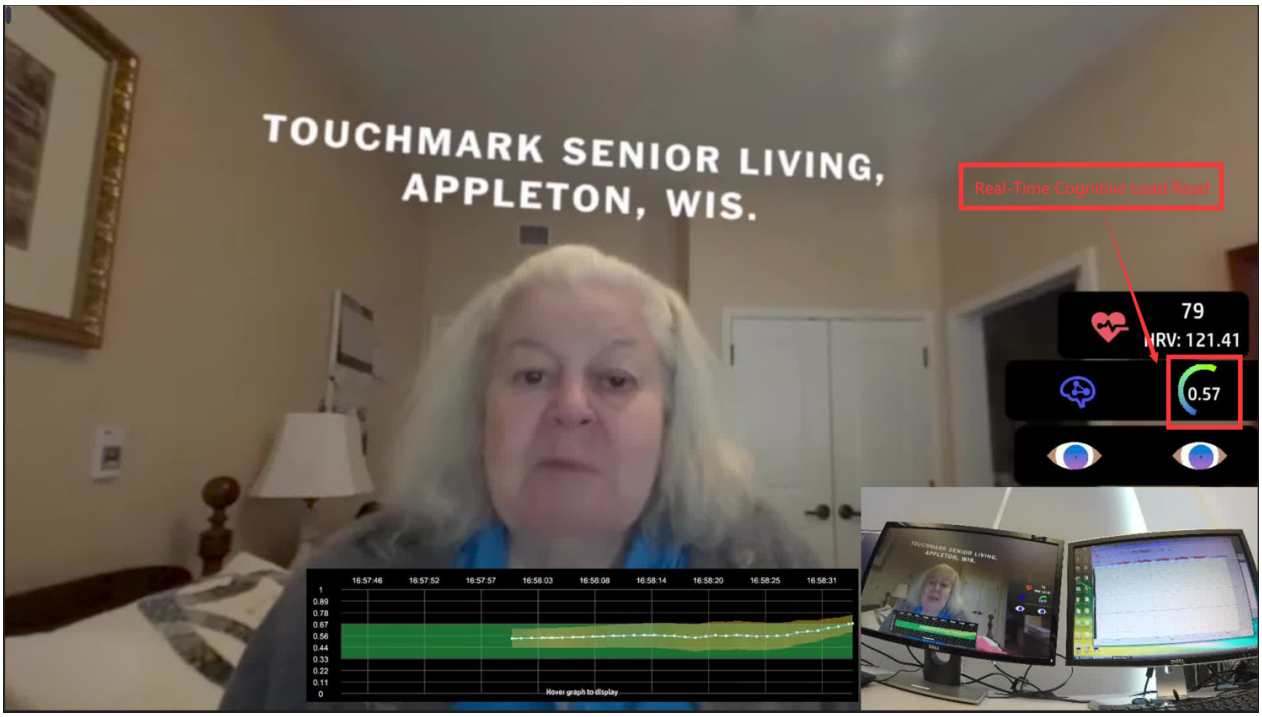

Figure 2. Real-time sensors display information on VR stimuli.

screenshot captures what the participants were viewing at any given second, the data can be further coded and analyzed in depth.

The cognitive load score from the data collection screen capture was processed and extracted using a custom-developed Python script. Text extraction from the processed images was performed using Tesseract OCR. The script extracted numerical data, which were then parsed to retain only numeric characters and decimal points. Cognitive load experienced by individuals can vary significantly (Engle & Kane, 2004; Oberauer et al., 2007). Therefore, it is not practical to directly compare cognitive load scores between subjects in this study. Instead, cognitive effort was operationalized by using the ratio of high cognitive load scores to total cognitive load scores, where a high cognitive load score indicates a greater exertion of cognitive effort. This percentage ratio represented the proportion of cognitive effort dedicated to each experience.

Each participant's baseline cognitive load score was established by calculating the mean score across the entire session. From scores exceeding this mean, a median was calculated. The total cognitive load scores above the mean were then tallied and divided by the aggregate cognitive load scores to form a cognitive effort score. This method provides a normalized measure of cognitive effort exerted during VR experiences.

3.5. Data Analyses

Quantitative variables included cognitive load scores, transformed prosocial attitudes and behaviors data, and merged prior experiences data, which researchers assessed in a series of simple linear regression analyses and a repeated analysis of variance to address RQ3 and RQ4 using Statistical Product and Service Solutions version 29.

Qualitative data consisted of 35 semi-structured interviews, including brief interviews after each IDEA-themed experience and the interview to assess each participant's overall experience. Complete interviews ranged from 9 to 36 minutes. Following Saldaña's (2015) method of thematic coding, researchers explored both latent and manifest interpretations. Using NVivo 14 software, researchers initially used open coding, applying an SDT and self–other overlap framework. After several iterations of cycles of coding, researchers refined codes into overarching themes and organized codes and subcodes into overarching themes.

To assess one's prior experience with the observed IDEA topics, researchers merged quantitative (survey items) and qualitative (interview responses) data to cross-reference one's previous experience. Additionally, to understand whether there was a relationship between cognitive effort and prosocial attitudes and behaviors, several simple linear regression coefficient test analyses were conducted to test the relationship between cognitive effort and prosocial attitudes and behavior engagement. The prosocial attitudes and behavior engagement scores were transformed from the prosocial engagement reported in interviews.

4. Results and Discussion

4.1. Qualitative Findings

Five themes emerged through the analysis of qualitative findings. First, participants felt a sense of autonomy, enjoying their ability to navigate and explore the VR environments. Second, they experienced a lack of competence and relatedness, noting that they sometimes failed to connect to the VR content or understand the stories fully. Third, some participants successfully adopted the perspectives of the VR subjects. Fourth, many participants projected their own or a close others' experiences onto the VR content rather than fully immersing themselves in the subjects' perspectives. Finally, participants reported gaining valuable insights from the VR experiences and expressed a heightened desire to be more considerate and empathetic in their everyday lives.

4.1.1. RQ1: Autonomy in Observation

In exploring how participants express autonomy, competence, and relatedness within three IDEA-themed VR experiences, the findings reveal a strong sense of autonomy but limited perceptions of competence and relatedness. Participants mentioned autonomy, a component of SDT, in relation to the medium (Omnicept VR headset) and with respect to the IDEA-themed content. Specifically, participants expressed a sense of agency using the headset. For example, participant E, a 25-year-old, described her reaction to *My Home, Shatila*, "I was like looking all over, and it really gave you a sense of what it looked like in the space and made you really feel for her and get a personal perspective on her life."

In addition, 22-year-old participant H explained his overall experience with the VR, noting how he chose to focus most on "a carousel playing" and "when people were walking" during *Notes on Blindness*. Further, Fadia's movements during *My Home, Shatila* required that viewers "choose which [elements] to focus on." Participants felt a notable degree of agency and control while interacting with the VR medium and content, as evidenced by their engagement and focus on specific elements within the experiences.

4.1.2. Challenges in Competence and Relatedness

However, they struggled with feelings of incompetence and relatedness, particularly when the VR stories lacked background information that participants felt they needed and hindered their understanding and connection. This was particularly true when participants did not have prior experience or knowledge of the IDEA topics. For example, participant FF noted how in *My Home, Shatila*, "It was very early on, her talking about how she wanted to be a lawyer in the future. I definitely want to, you know, get to know that element more." Moreover, Participant E, a 25-year-old, who recounts her experience with *Notes on Blindness*, explained, "I think it didn't, you didn't get a whole lot of personal information about him or like what was difficult about that experience."

My Home, Shatila, meanwhile, elicited the most discussion about the background story and context. Participants mentioned they did not know enough about conflicts in Syria to understand what led Fadia and her family to live in a refugee camp. Moreover, the lack of competence and relatedness could be due to participants' desire for interactivity during the 360° VR experiences. As 21-year-old participant Z described, *Coping with Alzheimer's* "felt more like a video I was watching rather than being physically there." As these were 360° VR videos, participants did not make decisions during their experiences that extended beyond where they decided to look.

The experiences left some participants feeling like observers rather than active participants, diminishing their sense of relatedness and immersion. Participants said they felt like they were the third wheel and an observer of the subject's situations, which stunted their ability to engage in perspective-taking. For instance, 19-year-old participant M described his thoughts about *Coping with Alzheimer's*, "The third wheel. That's what I felt like." Similarly, 21-year-old participant Z noted, "This felt more like a video I was watching rather than being physically there."

Specifically, the lack of extensive background information and interactivity in the VR experiences contributed to these perceptions, leaving some participants with a sense of detachment and discomfort during intimate moments depicted in the VR content. Thus, they felt they did not belong or feel a sense of relatedness during these experiences. This was primarily reported for *My Home, Shatila* and *Coping with Alzheimer's*.

4.1.3. RQ2: Immersive Empathy

The influence of prior IDEA experiences on perspective-taking (cognitive empathy) is multifaceted. Participants with no prior experience with the IDEA topics found that the immersive nature of the VR content forced them into a more empathetic engagement and gained perspective by placing them in scenarios that were markedly different from their daily lives:

> Being in that scenario really forces you to like feel….Like for the refugees, like, this is how they're living. Like you can't really refute the fact because you're standing in their home…[which], like, sort of like forces you to, like, feel, like, some amount of empathy. Just because you are there. (J, 23-year-old, describing *My Home, Shatila*)

Similarly, a lack of competence and autonomy, or a lack of control and the skills to change the environment, was also attributable to participants gaining an understanding of the VR content's subject's situations. For instance, in the case of *Notes on Blindness*, participants reported feeling a sense of helplessness when the visuals and audio cut out, as they had to rely solely on their hearing, just as John, the VR content's subject, had to when his sight disappeared:

> [When it] cuts out like at the end…the idea that like the world doesn't exist….And then all of a sudden there's a point where I was thinking about, like, what if you lost your hearing, too? And like how devastating that would be. (A, 42-year-old, describing *Notes on Blindness*)

Furthermore, participants reported experiencing perspective-taking and connecting with the subjects in the 360° videos on a human level even if they lacked a full understanding of the subject's circumstances:

> I don't really know um like the geopolitical difference between Syria and Lebanon. So, like I can't say like, "Oh, this is like a stance on this country, stance on that country"….And like the significance, you know, it doesn't really matter, because at the end of the day…they're just trying to go through their day as much as I'm trying to go through mine…that's how they go about their day and they're just people. (II, 21-year-old, expressing his connection with Fadia in *My Home, Shatila*)

4.1.3.1. Projecting Instead of Perspective-Taking

However, perspective-taking differed depending on whether participants had previous experience (personal or close other) with IDEA-related topics. Specifically, of the participants, few verbally expressed having first-hand experience with the IDEA situations. Instead, participants mentioned either working closely with or having a close other (e.g., spouse) who experienced a similar situation to those that were presented in the 360° videos such as poor living conditions or experiencing blindness through simulated classroom exercises. Their knowledge of the situations came from witnessing or hearing reports of a close other's experiences. For example, as 28-year-old participant GG reflected on all three VR experiences, "I'd worked with blind people before and that has stuck with me, too, through these many years. And today again, I got to experience…similar stuff. And definitely, it has got, that feeling has gotten stronger." Furthermore, the IDEA VR experiences activated memories and reminded participants of those close to them who had experienced or are experiencing similar situations.

The IDEA-themed VR experiences evoked participants to project their close others' (i.e., a significant person in their lives) social plight and struggles into the VR content. This projection sometimes limited their ability to adopt the perspective of the VR subjects directly, focusing instead on how the content resonated with their own or their close others' experiences. For instance, as 51-year-old participant N discussed *My Home, Shatila*, she explained "I had a friend in school. She was from Lebanon, so it made me think, is that what, how she grew up?"

Often, participants related specific hardships depicted in these experiences with similar hardships of a close other. Participants spoke of their grandparents or family members' plight. For example, 35-year-old G explained, "The lady said, 'I wish I am able to remember what I have forgotten.' I think my grandmother was a, she just listened to mostly, but she was recognized with this Alzheimer's" while discussing *Coping with Alzheimer's*. Similarly, 23-year-old W described her father's experiences after engaging with *My Home, Shatila*:

> My dad's from Iran. It's like, it's kind of a similar environment…stuff is not as like stable as it is here, like a water source or even like electricity and things that we take for granted. That just kind of takes me back to reality. Like, that's not everywhere in this world.

Additionally, participants who expressed projections of a close other's situations in the VR content also expressed imagining themselves as their close other's caretakers or supporters. Participants focused more on how certain circumstances depicted within the narratives would impact their lives if they were faced with the same challenges: "Because I think, in my mind, [my husband] is the one who's going to get sick…according to genetics….So, I see ourselves living like that, like he gets sick, and I take care of him" (AA, 30-year-old, after engaging with *Coping with Alzheimer's*).

Similarly, 23-year-old participant J, projected his grandparents in *Coping with Alzheimer's*: "My grandparents now are in assisted living and…they're having memory issues….It's like a, like a short documentary of like…my experience, I guess. But like, from the perspective of them."

The trend of projecting instead of perspective-taking could be due to understanding what it is like to be a caretaker or be a supportive figure in their lives because they are close to others who are living with Alzheimer's, blindness, or who have lived in a refugee camp. Correspondingly, *Coping with Alzheimer's* evoked perspective-taking for Aline's husband, Walt, instead of Aline, who was living with Alzheimer's. When imagining being in the experience, participants often imagined being in his shoes rather than hers: "More towards of the caretaker. I do feel like sympathy for [the] person with Alzheimer. But at the same time…her husband, like….It's like, it's a difficult job. I mean, it's a caring labor…so I feel more sympathized over the caretaker" (DD, 23-year-old).

Interestingly, when participants projected close others into the VR videos, it reminded and reinforced how they thought and felt toward close others but did not extend perspective-taking toward the subjects of the VR narratives. Instead, these narratives evoked considerations for matters of self-interest.

Repeatedly, participants admittedly felt for subjects in the situations depicted in the VR narratives but said little about the subjects depicted within the narratives themselves. Often, the conversations during interviews gravitated toward topics that related back to the individual's concerns for a close other or themselves: "I'm in my 30s, and I'm preparing myself to have, you know, the safety and security for my parents…because I've already seen my grandmother having Alzheimer's, I'm like, 'Oh ok, my mom' " (G, 35-year-old, explaining why *Coping with Alzheimer's* made her feel the most deeply).

4.1.3.2. Gaining Perspective and a Call to Action

Despite these variations, both groups of participants—those with and without prior experience—reported gaining valuable perspective from the VR experiences. For example, as 24-year-old participant HH noted how *Notes on Blindness*, "I got to learn about the perspective of a blind person, how he sees the world through his inner feelings."

Prosocial attitudes and behaviors were reported, with participants mentioning their intentions to be more considerate, understanding, and respectful to others. While discussing *Coping with Alzheimer's*, for example, 21-year-old participant Z noted, "It made me more aware of accessibility, which is something I'd like to be more

mindful of." During a discussion about empathy, 21-year-old participant Y similarly commented, "It makes me think, 'What can I do to make the situation better?' While I may not be able to relate directly, I can understand the daily challenges they must be facing." Similarly, participant B, 22-year-old, stated:

> If anything, you just made me think about others, and I think it reminded me to remember to think about others in my daily life. Like, not just myself. And to just be, I guess, more conscious of other people and what they might be going through.

4.2. Quantitative Findings

4.2.1. No Significant Link Between Experience and Cognitive Load

To explore the extent of the relationship between prior IDEA experiences and cognitive effort, several linear regression coefficient test analyses were conducted to test the relationship between prior IDEA experiences and cognitive effort score (RQ3). In each scenario, there was no significant relationship found between prior IDEA experiences (personal or close other) and cognitive effort (*Coping with Alzheimer's*, F (1,33) = 0.46, $R^2 = 0.01$, $p = 0.50$; *Notes on Blindness*, F (1,33) = 0.28, $R^2 = 0.01$, $p = 0.60$; *My Home, Shatila*, F (1,33) = 0.57, $R^2 = 0.02$, $p = 0.46$).

Therefore, IDEA 360° VR videos do not put individuals who have prior experience with living in a refugee camp, blindness, or Alzheimer's disease in an overwhelmed cognitive state. In other words, participants who reported having prior experience do not experience greater cognitive effort spikes than those who do not have previous experience with IDEA. Given that cognitive effort spikes represent increased cognitive exertion, significant findings would suggest that greater prior experience correlates with higher cognitive effort exertion. However, this outcome would not be ideal, as cognitive effort indicates mental exertion or inefficient allocation of cognitive resources, potentially leading to disengagement with the content. Findings also indicate other factors might play a more significant role in determining cognitive effort levels.

4.2.2. Cognitive Effort and Prosocial Behavior

To address whether there is a relationship between cognitive effort and prosocial attitudes and behaviors (RQ4), simple linear regression analyses were performed. In each scenario, there was no statistically significant relationship found between cognitive effort and prosocial attitudes and behaviors (*Coping with Alzheimer's*, F (1,33) = 0.37, $R^2 = 0.01$, $p = 0.55$; *Notes on Blindness*, F (1,33) = 0.00, $R^2 = 0.00$, $p = 0.97$; *My Home, Shatila*, F (1,33) = 0.41, $R^2 = 0.01$, $p = 0.53$). We used Cook's distance sensitivity analysis to investigate whether outliers affected our findings on the relationship between cognitive effort and prosocial attitudes. While we found no significant results for *Coping with Alzheimer's* and *Notes on Blindness*, excluding outliers, *My Home, Shatila* ($n = 27$) revealed a significant effect of cognitive effort on prosocial behaviors ($p < 0.01$). This suggests that outliers affected the initial results. This relationship may be significant in certain VR experiences.

5. Limitations and Future Directions

A small sample size constrained our study, and our findings may not be generalizable. Notably, the majority of our sample identified as Democrats (40%) compared to any other political party and could have different

ideologies on the IDEA topics, which could have impacted cognitive effort. Future studies should include a more representative sample for generalizability. Additionally, prosocial attitudes were assessed only once after VR engagement, making it challenging to determine their pre-existing levels.

Moreover, participants also mentioned the brevity and the lack of interactivity of VR experiences. Future studies could explore using longer stories that offer more background information, narrative depth, and interactive options. Additionally, this study did not assess the specific types of cognitive loads. Therefore, future research should categorize cognitive load (e.g., germane, intrinsic, and extraneous cognitive load; see Sweller, 2010) to better understand how each type of cognitive effort contributes to the development of cognitive empathy in immersive environments. Furthermore, future studies should investigate how perspective-taking mediates the impact of VR experiences on affective responses toward people who demographically differ from themselves.

As researchers continue to explore the importance of SDT and cognitive effort impacting one's ability to engage with perspective-taking in IDEA VR contexts, it is also essential to consider users' prior experience with such topics. Although our findings suggest prior experience does not correlate with nor have a statistically significant effect on cognitive effort, VR creators should still consider consumers' prior experience when designing IDEA-related VR content, especially if they want consumers to adopt prosocial attitudes and behaviors.

6. Conclusion

Our mixed-methods study revealed SDT (or the lack thereof) and perspective-taking emerge through discussions of prior experiences (close, other, and personal) after engaging with three 360° IDEA-centered VR videos. We find that of the three components of SDT, participants discussed autonomy as something that enhanced a participant's engagement with the 360° videos because they felt like they had a sense of agency over where they could look (RQ1). Contrastingly, they felt a lack of relatedness, describing feelings of being unwanted or needed. In addition, participants reported an absence of competence when the VR content lacked a detailed background story or when participants did not have prior knowledge of the VR subject's situation.

Moreover, our findings suggest that prior experience influences how people engage with perspective-taking (RQ2). Through interviews, we found that most participants themselves did not experience the observed IDEA topics, but a close other did. Further, findings indicate that close others' prior experience may lead to projecting or imagining a close other in the VR experience rather than themselves.

Additionally, we did not find a statistically significant relationship between prior experience and cognitive effort (RQ3). However, this is an encouraging finding in that those who have personal or close experience of struggles with Alzheimer's, blindness, or living in a refugee camp did not exert more cognitive effort than those with less or no previous experience with the observed IDEA topics.

Lastly, we did not find a statistically significant relationship between one's prior experience and prosocial attitudes and behaviors (RQ4). This is inconsistent with Depow et al. (2022) findings that show people are more likely to engage with prosocial attitudes and behaviors if the cause closely relates to them. This

inconsistency may be due to participants' introspection and appreciation of what they have rather than expressing a willingness to enact societal change. However, it is worth noting that some participants expressed that they would like to be more considerate of others.

Funding

This research was financially supported by Syracuse University's competitive award, the Collaboration for Unprecedented Success and Excellence (CUSE) Grant.

Conflict of Interests

The authors declare no conflicts of interests.

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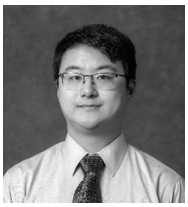

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