

VR-based Empathy experience for nonprofessional caregiver training

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Abstract. This paper presents the development of a virtual reality (VR) system designed to simulate various caregiver training scenarios, with the aim of fostering empathy by providing visual and emotional representations of the caregiver's experience. The COVID-19 pandemic has increased the need for family members to assume caregiving roles, particularly for older adults who are at high risk for severe complications and death. This has led to a significant reduction in the availability of qualified home health workers. More than six million people aged 65 and older require long-term care, and two-thirds of these individuals receive all their care exclusively from family caregivers. Many caregivers are unprepared for the physical and emotional demands of caregiving, often exhibiting clinical signs of depression and higher stress levels.

The VR system, EVRTalk, developed by a multi-institutional team, addresses this gap by providing immersive training experiences. It incorporates theories of empathy and enables caregivers to switch roles with care recipients, navigating common scenarios such as medication management, hallucinations, incontinence, end-of-life conversations, and caregiver burnout. Research demonstrates that VR can enhance empathy, understanding, and communication skills among caregivers. The development process included creating believable virtual characters and interactive scenarios to foster empathy and improve caregiving practices. Initial evaluations using surveys showed positive feedback, indicating that VR training can reduce stress and anxiety for caregivers and improve care quality.

Future steps involve using biofeedback to measure physiological responses and further investigating the ethical implications of VR in caregiving training. The ultimate goal is to deploy VR training in homes, providing family caregivers with the tools and knowledge to manage caregiving responsibilities more effectively, thereby enhancing the quality of life for both caregivers and care recipients.

Keywords: Virtual Reality, empathy, caregiver training

1 Introduction

This paper outlines the development of a virtual reality (VR) system designed to emulate various caregiver training scenarios, aiming to foster empathy by providing visual and emotional representations of the caregiver's experience. The COVID-19 pandemic has necessitated that more family members assume caregiving roles. Older adults, being at high risk for severe complications and death due to the coronavirus, have led many families to avoid outside help. Social distancing and quarantine restrictions have further depleted the pool of qualified home health workers. More than six million people aged 65 and older need long-term care, and two out of three of these individuals receive all their care exclusively from family caregivers[1].

Many caregivers are unprepared for the physical and emotional toll of caregiving. Between 40% and 70% of caregivers exhibit clinical signs of depression and higher stress levels compared to non-caregivers. They frequently feel frustrated, angry, drained, guilty, or helpless [2]. Existing training materials and resources rarely consider the care recipient's perspective, underscoring the urgent need for a more effective and efficient means of training family caregivers. Without sufficient support, caregivers can experience burnout, a leading cause of nursing home placement, and, in some cases, abuse.

According to a 2017 Merrill Lynch study, eight in ten Americans describe caregiving as their "new normal" [3]. An estimated 40 million US adults act as caregivers, providing over \$500 billion in unpaid care annually. While adults aged 45 to 64 are the most likely to be caregivers (23%), 17% of older adults over 65 also care for another aging adult. Many caregivers do not identify as such, viewing their roles as familial duties. However, recognizing themselves as caregivers can lead to seeking help and skill development. Nonprofessional caregivers, predominantly family members, need specific task training. Well-designed products and processes are crucial to improve caregiving practices and mitigate the physical and emotional toll on caregivers.

Family members and friends often find themselves unprepared for the new challenges and personal care tasks required in caregiving roles. Existing educational materials can be time-consuming and inefficient for caregivers already managing numerous additional responsibilities. Thus, a more effective and efficient means of training family caregivers is essential. Caregivers universally struggle to find time to research and access resources that could enhance their caregiving effectiveness. Research indicates that access to appropriate supportive services and resources significantly improves the quality of care provided by caregivers, thereby enhancing the quality of life for care recipients.

2 Research Framework: VR Empathy and Skill Acquisition

Cuff defines empathy as an "emotional response (affective) dependent upon the interaction between trait capacities and state influences"[4]. He describes that "empathic

processes are automatically elicited but are also shaped by top-down control processes. The resulting emotion is similar to one's perception (directly experienced or imagined) and understanding (cognitive empathy) of the stimulus emotion, with recognition that the source of the emotion is not one's own." Baron-Cohen elaborates that "empathy comprises two primary components: a cognitive part—how we understand other people, and an affective part—our emotional reactions to others" [5].

Several research papers have investigated VR as a tool for providing empathy experiences. For instance, Trevena conducted a systematic and comprehensive scoping review that included 44 papers on the use of VR technology as an empathy enhancement tool. The author provides preliminary evidence for the technology's efficacy in inducing empathy[6]. BeAnotherLab, a collection of empathy VR projects, demonstrated that a better understanding of embodied cognition can enable a greater experience of empathy and engagement with empathy-driven experiences in VR[7]. Gillespie highlights the power of VR to influence people, particularly 360-degree video VR filmmaking, noting that "VR's novel vantage point is not merely visual or audio but relies heavily on its capacity to shift the audience affectively in a unique way" [8].

Beyond empathy experiences, immersive VR has been applied in education, professional training, and healthcare for skill and knowledge acquisition. Using VR, participants can have immersive experiences in simulated environments, closely mirroring real-world behaviors. Some VR training focuses on knowledge acquisition through actions. For instance, Falcone evaluated the effectiveness of VR-based simulation training in a shoulder dystocia scenario for healthcare providers, demonstrating the positive impact of digital learning methods[9]. Carcia-Behances researched current VR-based technologies for Alzheimer's disease, focusing on intended purposes, features, methodologies, immersion levels, and interaction types[10]. Some VR-based caregiver training aims to enable skill acquisition, such as effective oral care[11]. McEwen investigated the feasibility, safety, and effectiveness of an intensive VR intervention program for individuals with dementia[12].

In the healthcare platform, commercial VR products such as Mynd VR, Rendeever, VR Genie, and Viarama aim to improve seniors' lives. Research from the Massachusetts Institute of Technology Age Lab found that older adults using VR systems were more likely to feel optimistic about their health and emotions, less likely to experience depression, and less likely to feel socially isolated compared to those viewing similar TV content[13]. Psychologists developed VR platforms such as Psious for mental health professionals, achieving higher acceptance rates than non-VR therapies. Psious reported that "27% of patients suffering from specific phobias and anxiety issues reject using in vivo exposure therapy as they consider it overly intense, while only 3% refused VR exposure" [14].

With the growing interest in empathy VR, our multi-institutional team at Live Well Collaboratives, the Council on Aging (COA), and the University of Cincinnati developed a VR app called EVRTalk to address nonprofessional caregiver training. This simulated dialogue aims to reduce caregiver stress, burden, and injuries, increase caregiver confidence and communication skills, and improve care quality. The team identified physical scenarios for simulation, created a decision tree from the trainee's perspective, and mapped this decision tree into scripts and a non-linear storyline. The goal

is to use VR-simulated training to enhance COA's ability to help caregivers balance their lives and caregiving responsibilities.

In exploring the VR training concept, we employed the empathy theories mentioned earlier to translate both patient and caregiver experiences into several VR scenarios. By allowing caregivers to switch roles with their care recipients, we hope embodied cognition can help caregivers navigate common scenarios while offering a window into their care recipient's life. In EVRTalk, caregivers learn to manage events such as medication management, hallucinations, incontinence, end-of-life conversations, and caregiver burnout. Through EVRTalk, caregivers, as players, experience confusion, dementia, vision or hearing loss, instability, and hallucinations. We hope this experience can reduce stress and promote empathy among family caregivers, enabling them to provide better care for their loved ones.

3 VR Development: Role Playing

Role playing in VR is a crucial component for fostering empathy. For example, Wang explored the impact of a virtual reality (VR) public service announcement (PSA) presented in a first-person perspective on attitudes towards the PSA and individuals experiencing homelessness. The author claimed that "the VR PSA was the most effective format for inducing telepresence and empathy while minimizing reactance" [15]. Similarly, Russell assessed whether a VR simulation could enhance users' understanding of panic attack symptoms, leading to greater empathy[16].

In the early design stage, we identified common caregiver issues to create several characters, including patients, caregivers, and a doctor who acts as a coach. Players can assume the role of either a patient or a caregiver. These characters provide family caregivers with a VR training experience to help them navigate common scenarios and better understand the care recipient's perspective. Users engage in scenarios that aging individuals may face, with lessons and coaching on optimal solutions. Each lesson is paired with an empathy experience to better understand why their patients may react in unexpected ways. This role reversal is uniquely facilitated by VR technology, allowing users to see the situation from another perspective.

The VR scenarios immerse caregivers in an empathetic environment, educating them on five topics: medication management, conversations around incontinence, talking down a hallucination, end-of-life conversations, and caregiver burnout. For instance, in the Medication Management scenario, players gain empathy through two characters. First, the player is tasked with talking to a senior, Betty, who is hesitant about taking her medications. Upon completing the dialogue portion, players are transported to another level where they experience what it is like for Betty to have a vision impairment worsened by her medications. This scenario places players in the care recipient's shoes, allowing them to empathize with someone hesitant or resistant to adhering to their medications. Players experience the frustration of completing a task with a visual impairment during the role play (Figure 1).

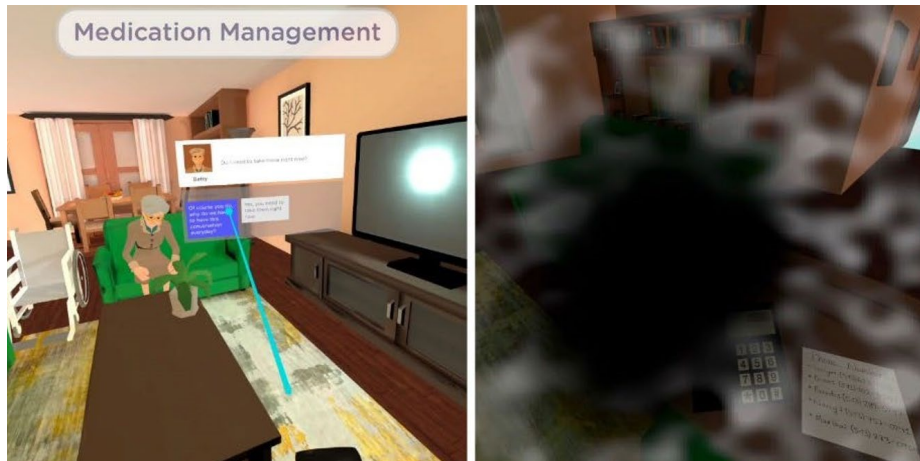


Fig. 1. simulated visual impairment in VR.

4 VR Development: Simulated Talk

The development team has investigated how VR can be used to enhance communication between patients and healthcare providers. For instance, Real discussed the efficacy of using VR for communication training, such as providing physicians with the opportunity to deliberately practice recommendation behaviors towards Human Papillomavirus (HPV) vaccination. Real proposed potential training strategies to increase HPV vaccination rates through VR interventions[17].

Our team has created talking scenarios centered on the topic of incontinence, a sensitive and sometimes embarrassing issue for care recipients. In this scenario, the player is immersed in the shoes of Betty, a senior experiencing incontinence, who overhears her caregiver, Kaitlyn, discussing her condition with a doctor without realizing that Betty can hear her. The player then assumes the role of the caregiver and is tasked with discussing incontinence with Betty, encouraging her to open up about her issues, and convincing her to seek help from a specialist. This simulated conversation demonstrates how to include the care recipient in discussions, rather than talking "around" them, to prevent embarrassment and maintain their dignity. The empathy experience promotes open discussion of the issue without accusatory or negative tones and reminds players of the importance of consulting a specialist for managing incontinence through medication (Figure 2).

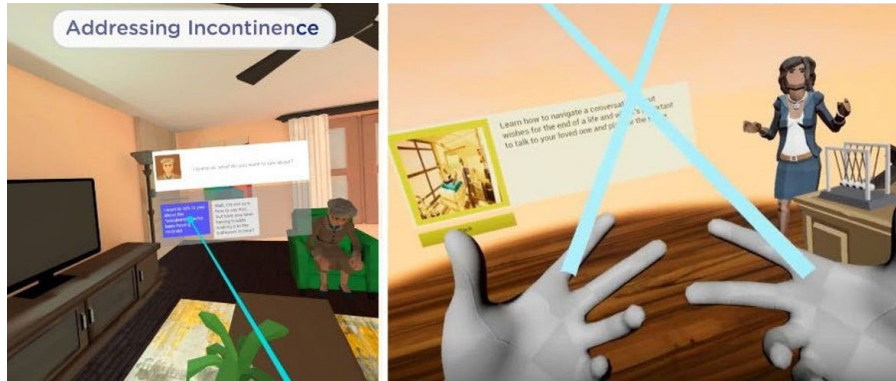


Fig. 2. Simulated conversation about incontinence.

The team also explored conflict through simulated dialogue, which can effectively foster empathy related to biases. As a precedence, Yildirim investigated the nuances of embodied communication and challenged ingroup and outgroup biases within the context of xenophobia through a VR simulation of air travel experiences, from airport security screening to in-flight events[18]. Similarly, García focused on cognitive rehabilitation training aimed at assisting medical personnel, healthcare workers, and other caregivers in improving the quality of daily life activities for people with mild cognitive impairment and Alzheimer's disease[19]. In our VR scene, "Talking Down a Hallucination," the player is immersed in the shoes of Don, a senior with dementia experiencing a hallucination, and then assumes the perspective of Kaitlyn, the caregiver, tasked with calming Don. This scenario helps users lean into the hallucination by agreeing with the senior rather than denying their experience. It shifts ownership of the hallucination away from the senior and attempts to resolve the issue, prompting players to consider what it must be like for the care recipient to experience something completely real yet not be believed (Figure 3).



Fig. 3. Hallucination scenario.

Creating believable virtual characters in VR to interact with the player is essential. These virtual avatars can represent specific personas and act as agents to deliver empathy experiences. Muravevskaia described how children with low empathy levels can benefit from playing the VR Empathy Game. By studying how children interacted with VR characters and real people, Muravevskaia identified patterns of "Cognitive Empathy and Emotional Contagion" [20] and promoted "additional reflective questions and

reminders to interact with the characters” [21]. Muravevskaia emphasized engaging children in empathetic interactions with VR characters based on “constructive social principles and practicing empathy actions” [22].

Following this theoretical framework of allowing players to reflect on negative experiences and subsequently make the right decisions to gain positive experiences, we created characters representing a son and father in the "End-of-Life Conversations" VR scenario. The player is immersed in a hospital room, witnessing a stressful end-of-life scenario where the son, Manuel, cannot answer questions about his father's end-of-life wishes. The player is then transported to a moment where Manuel and his father, Luis, have a chance to discuss end-of-life wishes. The player guides the conversation and, upon completion, witnesses the positive impact of the conversation on the end-of-life scenario. This scenario emphasizes the importance of planning for the future, covering topics such as the power of attorney, living wills, the location of important documents, and medical wishes (Figure 4).

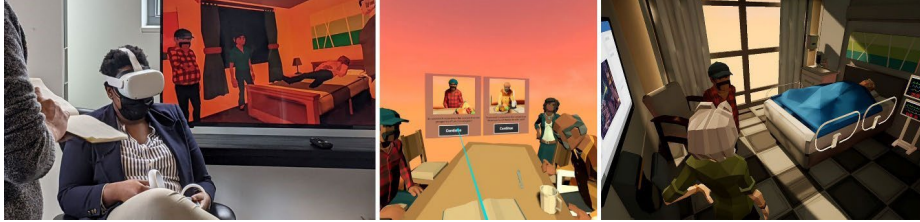


Fig. 4. End-of-life conversation.

Similarly, the development team created multiple characters in the "Caregiver Burnout" scene. The player is immersed in a living space where they can choose to hear stories from three different caregivers. Each caregiver shares their experience with burnout and their coping strategies. After each story, the player interacts with a virtual doctor, Dianna, to answer questions and reflect on what they heard. This scenario highlights the commonality of caregiver burnout, helps identify the type of burnout they might be experiencing, and provides strategies for managing it. It emphasizes the importance of daily self-care and reaching out for help when needed (Figure 5).

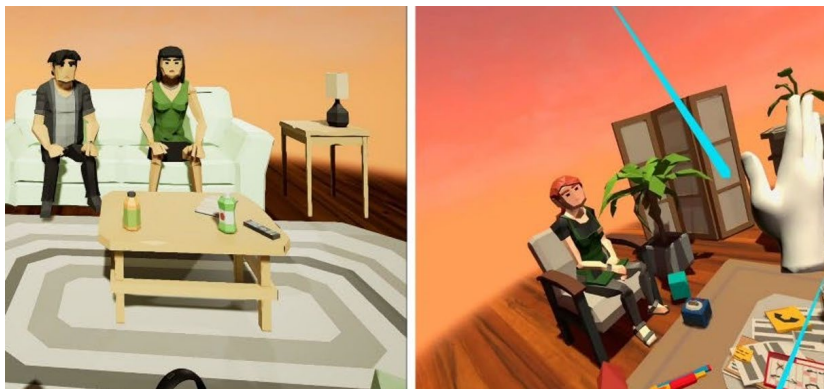


Fig. 5. Siblings discussing caregiver burnout.

5 Discussion

Vignemont identifies two major roles of empathy: epistemological and social. “Empathy may enable faster and more accurate predictions of others’ needs and actions, uncovering salient aspects of our environment. Furthermore, empathy can serve as a motivation for altruistic behavior and cooperation” [23]. To evaluate the effectiveness of these empathy experiences for players, the Council on Aging (COA) provided an ideal environment for assessing EVRTalk. COA programs engage family caregivers at critical points in their caregiving journey when additional support becomes necessary as family members can no longer care for themselves at home. COA staff equipped family caregivers with VR headsets and the EVRTalk app to reduce the stress associated with becoming a caregiver. EVRTalk was deployed through the organization’s network, lessening stress and anxiety for both caregivers and care recipients.

COA, Live Well Collaborative, and University of Cincinnati teams integrated EVRTalk into existing programs, evaluating caregivers' willingness to embrace technology to better understand sensitive scenarios. To assess VR training's effectiveness, we developed surveys focusing on three key aspects: (1) whether VR can provide a safer virtual training environment during the COVID-19 pandemic, (2) whether VR can offer faster experiential training for family caregivers compared to typical programs, and (3) whether VR can serve as an effective platform for fostering empathy. The team defined metrics to evaluate the VR training experience and developed survey tools accordingly. These metrics included: (a) ease of use and understanding, (b) effectiveness of VR as a learning tool, and (c) satisfaction with the caregiver training experience.

We conducted over 40 user tests and provided educational guides to help participants navigate the technology and app. Additionally, we tested EVRTalk with local caregiver support groups, such as Catholic Charities and Expo for seniors, collecting user comments and feedback. This feedback was synthesized to refine the content and make the empathy experience more accessible and comprehensible. The team also explored the business model for the organization and product licensing. Survey feedback from user participants included:

- "It reinforced the idea that you should play along with the hallucinations rather than denying them. It reminded me to take ownership of the situation and to stop doubting myself. To stay calm, take control, and try my best to stay positive."
- "The importance of identifying what is going on and agreeing with them rather than trying to argue with them."
- "Learning to live in their reality. I also learned the correct way to handle that type of situation."
- "Knowing that this is available was nice, and also realizing there are a whole lot more people studying this and helping caregivers. It feels like we're all going to be taken care of, and that's reassuring."
- "It was validating, seeing both the responses next to each other. And also confirming that when I join their reality, things go so much better."

The EVRTalk project leverages VR to significantly enhance empathy among non-professional caregivers. By immersing caregivers in realistic, simulated environments where they can experience the challenges and emotions faced by care recipients,

EVRTalk fosters a deeper understanding and appreciation of the caregiving role. This immersive experience allows caregivers to walk in the shoes of their patients, encountering scenarios such as medication management, hallucinations, and end-of-life conversations from a first-person perspective. The empathy generated through these VR simulations helps caregivers develop more compassionate and effective communication strategies, ultimately leading to improved care quality and reduced stress. VR technology not only educates but also transforms the caregiving approach by making empathy a central component of training, thus enhancing the overall caregiving experience for both the caregiver and the recipient.

6 Next Steps

EVRTalk has explored using VR as a platform to provide empathy experiences and putting oneself in another person's shoes and experiencing their emotions, thoughts, and perspectives. Surveys have been the primary evaluation method. In the next phase, we aim to use biofeedback to measure users' physiological activity, which has been recognized as a powerful tool for gauging perceived empathy during compassion meditation exercises[24]. Additionally, we plan to further investigate the ethical implementation of VR. Cotton argues that “stimulation of empathic engagement is a necessary precondition, though insufficient to ensure good moral conduct. Empathy connects us with the thoughts and feelings of others, but without guidance, it can lead to moral mistakes—such as biases of similarity through proximity and identity.” Cotton also emphasizes the necessity of "dramatic rehearsal," demonstrating how VR can stimulate imaginative and empathic ethical engagement with various social problems[25].

Thaler's concept of "choice architecture" highlights that our decisions are influenced by how choices are presented[26]. Ramirez warns of potential ethical issues in VR empathy experiences, suggesting a shift in focus from “empathy” to “sympathy.” He notes that “VR-based empathy enhancement not only faces traditional ethical concerns about nudges (autonomy, welfare, transparency) but also a variant of the semantic variance problem arising from intersectional perspective-taking. VR empathy simulations deceive and manipulate users about their experiences.” Ramirez proposes that VR designers should “shift from creating simulations aimed at producing empathic perspective-taking to those aimed at generating sympathy for their targets. Such simulations could avoid serious ethical issues associated with VR nudges, semantic variance, and intersectionality” [27]. These arguments necessitate reflecting on the dialogue tree developed by our team and assessing each ethical choice presented to the player in various scenarios. Our goal is to deploy the VR experience in homes to reduce stress and anxiety for both caregivers and care recipients.

Overall, we believe EVRTalk has provided family caregivers with practical knowledge to address common caregiving scenarios. In addressing the current healthcare education gap, VR builds empathy for care recipients by allowing caregivers to respond appropriately to client's emotional needs and promotes compassionate behavior. It represents a new medium for empathy experience that is interactive and

immersive, offering a more hands-on approach, especially relevant in the socially distanced era.

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