

Co-Designing Companions in Virtual Natural Environments for Enhanced Well-being: Insights from Dementia Informal Caregivers

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Abstract

Informal caregivers of family members with Alzheimer's Disease and Related Dementias (ADRD) perform an often difficult and emotionally demanding task. The combination of Virtual Natural Environments (VNEs) and some form of social interaction could help meet some caregiver needs but remains unexplored. In this study, we investigate how ADRD informal caregivers envision companionship in the context of VR nature. Through co-design sessions with 15 ADRD informal caregivers, the thematic analysis identified four main themes: companionship needs, physical presence, virtual presence, and characteristics and behaviors. Diverse types of companions were suggested, with a preference for empathetic, credible, and authentic companionship. Design opportunities include integrating physical and virtual companionship within VNEs. This research highlights the importance of designing companions that help caregivers feel understood. Considering informal caregivers' perspectives is integral to developing interventions that effectively address their emotional and social well-being.

CCS Concepts

• Human-centered computing → Participatory design.

Keywords

Co-design, Dementia informal caregivers, Well-being, Companionship

ACM Reference Format:

Beatriz Peres, Daniel S Lopes, Joaquim Jorge, and Pedro F. Campos. 2024. Co-Designing Companions in Virtual Natural Environments for Enhanced Well-being: Insights from Dementia Informal Caregivers. In *Adjunct Proceedings of the 2024 Nordic Conference on Human-Computer Interaction (NordiCHI Adjunct 2024)*, October 13–16, 2024, Uppsala, Sweden. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3677045.3685415>

1 Introduction

Taking care of a loved family member suffering from Alzheimer Disease and Related Dementias (ADRD) can be a very difficult and emotionally demanding task. In addition to the challenges of offering care, informal caregivers of family members suffering with ADRD also have their own psychological and emotional challenges because this task can be emotionally and physically taxing, leaving little time for personal needs [6, 10]. Watching Virtual Natural Environments (VNEs) can give informal caregivers a sense of escape and relaxation from delivering care [1]. A VNE is a digital or simulated representation of a natural setting, such as forests, mountains, beaches, or other outdoor landscapes, created using VR technology. These environments are designed to mimic real-world natural settings and provide users with immersive experiences that simulate the sights, sounds, and sometimes even the sensations of being in nature. Natural environment representations can help reduce loneliness and social isolation through the sense of purpose and meaning that it can provide [2]. As a result, virtual reality technology can deliver immersive experiences of nature settings, improving well-being by lowering symptoms of anxiety and stress

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NordiCHI Adjunct 2024, October 13–16, 2024, Uppsala, Sweden

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ACM ISBN 979-8-4007-0965-4/24/10

<https://doi.org/10.1145/3677045.3685415>

[3]. But amid the peaceful scenes and calming noises of VNE, a significant factor is sometimes missed: the need for company. Those who provide informal care for their loved ones over extended periods may experience social disconnection—including social isolation, lack of social support, and feelings of loneliness [8]. These are common experiences among ADRD caregivers, with estimates indicating that most caregivers will report feeling socially disconnected due to caregiving responsibilities [7]. Much like nature exposure, caregivers cannot always step away from their care recipient to maintain other relationships or participate in social interventions. However, it is possible to reach this demographic through a virtual platform to reduce loneliness [9].

According to Faw et al. [5], multi-component interventions may benefit caregivers and ADRD patients. This means combining several components such as social support, community involvement, artistic involvement, and enrolling in the intervention alongside the individual with ADRD. A meta-analysis by Brodaty et al. [4] found that informal caregiver interventions were most successful when social support was paired with other tasks.

Including caregivers in the planning and execution of interventions, among other factors, seems to increase the effectiveness of said interventions [9]. Existing research also supports involving informal caregivers in creating and assessing programs [7]. Additionally, it is critical to consider the perspectives of ADRD caregivers when designing, testing, and implementing interventions. Since programs can go unutilized, multi-component interventions tailored to each person's needs and preferences may help enhance use [7].

However, the combination of VNEs and social support components created with the involvement of caregivers does not seem to have been studied. Considering the demand for relaxation in VNEs and the loneliness that informal caregivers feel, it is important to investigate how ADRD informal caregivers see companionship within VNEs. Understanding caregivers' preferences and needs for companionship when using VNEs can help create tailored interventions that promote companionship and offer comfort and relaxation.

Through co-design sessions, we aim to investigate the type of companionship expectations and requirements among ADRD informal caregivers when watching a VNE. We want to find design opportunities to provide specialized interventions that successfully meet caregivers' demands for companionship by getting to know informal caregivers' viewpoints.

2 Methods

We conducted five co-design sessions where participants were asked to brainstorm what type of companionship they would expect or prefer while watching a VNE. The main objective of these sessions was to generate ideas and solutions to conceptualize companionship effectively in a VNE context. A total of 15 informal caregivers participated in the study, with three in each session. The participants (two males and thirteen females, averaging 56 years old, $SD=11$) were recruited via snowball sampling, targeting informal caregivers of ADRD family members. Participants had been informal caregivers for an average of seven years, $SD=5$, and cared for family members, except one, who cared for a friend. As for the types of Dementia affecting their loved ones, two participants identified Vascular Dementia, two others Alzheimer and the remaining participants did not describe any specific type of Dementia. The sessions,

each lasting approximately one hour, started with introductions and filling out a consent form. Participants then completed a brief demographic questionnaire, followed by an ice-breaking activity. We then showed to the caregivers examples of VNE (Figure 1) and asked how they would envision having companionship while viewing a VNE. Three prompts facilitated the brainstorming process: visual, sound or voice, and what the companionship may do. If their conceptualization included a conversation with the companion, we asked participants to outline what this dialogue would be.

As part of our qualitative data analysis process, two researchers performed a thematic analysis to identify and categorize common themes in the data. We began with open coding to produce a preliminary list of codes that were subsequently filtered and categorized. Validity and consistency were verified through team-based assessments and discussions of the codes and categories. Several patterns and themes appeared throughout the analysis. Figure 1 exemplifies the virtual natural environments and the brainstorming activity.



Figure 1: The virtual natural environments and the brainstorming activity (left to right)

3 Results

From the thematic analysis, we identified four themes: (a) Companionship needs, (b) Physical presence, (c) Virtual presence, and (d) Characteristics and Behaviours.

3.1 Theme: Companionship needs

Most ADRD informal caregivers ($n=9$) explicitly stated the need for a companion. Participants reasoned that they need someone to talk to (e.g. "There are days when I also need to confide in someone; otherwise, one becomes depressed and sad, so I think it's important to have someone to talk to" (P10)), someone to listen to them (e.g. "I would talk, and she would listen, because it is necessary to vent..." (P2)), and a companion that understands them.

Participants mentioned that their need for companionship when watching VR nature may vary according to their own and other people's personal needs and preferences. Different contexts were presented: (i) they sometimes prefer to be alone (e.g. (...) "I prefer to view [VNE] by myself and to relax." (P5)), (ii) nature serves as companionship by itself (e.g. "...sounds of nature only to listen to and nothing to interact with, just for a company" (P7)) (iii) their preference depends on the circumstances (e.g. "Depends on the situation, on the context, sometimes a person could feel like being alone and listening to relaxing music, or sounds of nature, on the other hand, they could want company, to talk to (...) it will depend on the mental state, and the context (...)" (P8)).

We identified two themes in companionship: an actual physical presence while watching VNE or a virtual companion within the

VNE. Inside these two major categories, the results can be further organized into companionship types, as participants mentioned human and animal companions for both options.

3.2 Theme: Physical presence

3.2.1 Human physical presence. Most participants (n=11) considered that a physical companion would be ideal. They suggested that the companion be beside the informal caregiver while they watch the VR natural environment. There were mentions of human physical presence (n=11) and animal physical presence (n=2). Human physical presence was described because participants enjoy talking and sharing with others (e.g. "(.) when having someone there [physically] we can always chat" (P10), "(.) share what we are feeling and seeing" (P6)).

3.2.2 Animal presence. Some participants (n=2) mentioned they would like a physical animal with them as they watch VNE. These would be the animals that they have at home as "the dog provides company but does not speak (...) but we can talk to it" (P10).

3.2.3 Concerns with technology. Some participants (n=7) voiced concerns and reluctance in having virtual companionship without a physical presence: "I do not want to be alone in there with a virtual thing/person" (P4), "(.) we are always reluctant to talk to a robot" (P1, P2, P6).

3.3 Theme: Virtual presence

3.3.1 Animal virtual presence. Participants mentioned a variety of perspectives regarding interaction with a virtual animal companion. Some participants (n=8) expressed the idea that the companion should be a virtual animal that would appear in the VNE such as a dog, as (e.g. "(...) they provide company, although they don't speak" (P4, P10, P13)). Participants mention the audible component of the animal, even without its visual appearance, suggesting an immediate association with its presence (e.g. "if we hear the sound of a barking dog in the VR headset, for example, we already associate that to companionship, (...) if a dog is barking, there is someone there, a companion" (P4, P3)). While some participants would prefer to interact with virtual animals (n=5), others (n=2) emphasized that interaction was "not a necessity", and one participant mentioned that the animal could be a complement to the VNE, not an element for active interaction. However, some participants (n=5) mentioned that virtual animals should understand and respond to human interactions in a basic way. Overall, the number of mentions of virtual animals and humans is almost the same, with a slight preference for virtual animals. Participants highlighted that they would more easily accept the presence of a virtual animal in the VNE than a person, suggesting greater familiarity and comfort with this form of presence.

3.3.2 Human virtual presence. Participants (n=7) expressed a preference for a human virtual representation. Some participants (n=4) highlighted the need for a virtual presence that is a "good listener and provides positive and encouraging responses" (P2). Participants highlighted the importance of a virtual companion being a "positive guide, providing emotional support and being available to listen and respond to users' needs" (P1, P2). Participants (n=3) mentioned that the ability to interact is considered viable and desirable as long as the virtual company is "able to listen, understand and respond

appropriately to users' needs and emotions" (P3). Also, participants (n=2) indicate that they prefer a virtual companion that can "adapt to my individual preferences and provide a personalized interaction experience" (P2). While virtual interaction is considered a valid option, few participants (n=2) recognize technology's limitations in fully replicating human interaction experience, especially in terms of empathy and emotional understanding.

3.3.3 Importance of appearance. Participants mentioned the importance of the virtual companion's visual appearance. The seven participants who mentioned a virtual human companion expressed the desire for them to look pleasant and comforting, avoiding representations that could be considered (e.g., "frightening or aggressive" (P2)). One participant highlighted the idea of peace and tranquillity as important in the visual representation of the virtual companion. For some participants (n=9), the visual aspect of the virtual human companion would be enough to provide comfort without the need for verbal interaction or sound. They preferred a silent virtual companion without components that could interfere with the experience (e.g. "for me, just the presence is enough to feel someone is there" (P12)). Regarding the virtual animal companion, participants express a preference for animals that evoke feelings of affection and comfort (e.g. dog, cat), avoiding animals that may be perceived as threatening or repulsive (e.g. "The animal had to be a pleasant animal, not a bear or a snake" (P12)).

3.3.4 Voice characteristics. Participants highlight the importance of voice qualities when interacting with virtual companions. Those who mentioned virtual companionship (n=7) preferred authentic and natural human voices, avoiding robotic or artificial voices that would be less engaging for them or less authentic in the interaction. A few participants (n=2) also mentioned the possibility of animal companions in virtual contexts with human voices.

Voice qualities are considered important by all the participants, who would prefer pleasant, calm and relaxing voices, avoiding very loud or shrill voices (e.g. "About the voice, a relaxing human voice that is not yelling..." (P5)). The ideal voice is described as "soft", "human" and "relaxing", with some participants mentioning specifically the voice of a yoga teacher. Some participants (n=4) mentioned the idea of voice as a means of one-way communication (e.g. "a relaxing virtual voice, just to hear what the voice says, not to interact with" (P8)), while other participants (n=9) saw voice interaction as a way to exchange ideas and information.

3.4 Theme: Characteristics and behaviors

Participants had various preferences regarding the type and behaviour of their companions. Most participants (n=11) would prefer the companion to be another informal caregiver, as they "understand their experience and challenges" (P2) and offer more effective support. Some participants (n=9) believed that the caregiver's shared experience could create a stronger bond and a sense of comfort during the VNE observation and recognized the value of exchanging experiences, especially with those who can offer insights and tips based on that experience. Some participants (n=4) would prefer a companion that they have a close relationship with (e.g. "as a family member or friend" (P5)). However, participants highlight that even if there is no prior relationship, closeness and mutual understanding can be developed throughout the interaction.

Using distinct communication modes, participants ascribe different behaviors to the human physical and virtual companions. Interaction with a physical human involves touch (e.g. "giving a hand" (P3)) and the "ability to share their sensory experiences while watching the VR nature" (P8). Verbal communication is essential to establishing a meaningful connection when interacting with a virtual human.

In this case, some dialogue scenarios were proposed by participants. The proposed dialogue includes various topics, from descriptions of the environment to discussions of personal feelings and experiences. It highlights the need for participants to feel understood by the virtual companion and have a supportive conversation. Overall, the dialogue should be positive and hopeful, encouraging.

4 Design opportunities

4.1 Bringing Together VNE and Physical Human Companionship

Participants have a preference for a human physical presence while viewing VNE. Based on our findings, a seamless connection between virtual nature and physical interactions, enhancing the sense of connection and presence, should be considered, exploring ways to integrate physical human companionship with conversation and physical presence cues, such as tactile feedback, into companionship experiences.

4.2 Integration of Animal Companions

Our research suggests that offering caregivers the option to interact with virtual animals within VNE and providing companionship and comfort are good approaches. However, it is important to consider and ensure that the virtual animal should evoke feelings of affection and familiarity, enhancing their therapeutic value. Auditory cues can help seamlessly integrate the virtual animals into the VNE experience. Alternatively, having different types of virtual animals for the caregiver to choose which one they prefer may be helpful.

4.3 Human Virtual Companions

Our findings indicate that, for participants, a human virtual companion could probably provide companionship as an alternative to a physical companion. With this, having a virtual companion with human-like attributes, including authentic voices, empathetic behaviours, and relatable dialogue, may be important and helpful for caregivers. Our data suggests that voice characteristics can significantly impact the user experience. It could be helpful to incorporate real-life caregiver testimonials and experiences into virtual companion narratives to enhance authenticity and credibility. This would also allow the virtual companions to adapt their behaviour and dialogue based on caregivers' emotional cues and preferences, as the dialogue must meet the emotional needs of informal caregivers. As with other recommendations, allowing caregivers to customize the virtual companion's characteristics can also aid the process.

5 Conclusion

In conclusion, informal caregivers of people with ADRD express the need for companionship during VNEs. They value having someone to talk to, whether physically present or virtually, to provide

emotional support, comfort, and understanding. Caregivers prefer positive companions and good listeners who provide personalized interactions to improve their well-being and reduce feelings of loneliness. Our findings from five sessions focused on investigating how informal caregivers imagined this companionship while viewing a VNE. To correctly understand how and what this companionship should entail, it is necessary to gather more data. This study offers potential considerations for developing companionship for informal caregivers. Our future studies involve replicating this study with a larger sample to yield more robust and reliable results. We will also develop VNE prototypes to assess the effectiveness of the design implications.

Acknowledgments

We are grateful to all the participants who were generous with their time for this study. We are also very grateful to Hildegardo Noronha who provided the screenshots of the virtual natural environments used in this study and also to Catarina Correia who helped analyze the qualitative data. This research was funded by the Portuguese Recovery and Resilience Program (PRR), IAPMEI/ANI/FCT under Agenda C645022399-00000057 (eGamesLab) and supported by FCT - Fundação para a Ciência e Tecnologia, I.P. by project reference 2020.08848.BD and DOI identifier 10.54499/2020.08848.BD.

References

- [1] Mohammed Owayrif Alanazi, Arianne Patano, Gary Bente, Andrew Mason, Dawn Goldstein, Sina Parsnejad, Gwen Wyatt, and Rebecca Lehto. 2023. Nature-Based Virtual Reality Feasibility and Acceptability Pilot for Caregiver Respite. *Current Oncology* 30, 7 (2023), 5995–6005. <https://doi.org/10.3390/curroncol30070448>
- [2] Thomas Astell-Burt, Terry Hartig, I Gusti Ngurah Edi Putra, Ramya Walsan, Tashi Dendup, and Xiaoqi Feng. 2022. Green space and loneliness: A systematic review with theoretical and methodological guidance for future research. *Science of The Total Environment* 847 (07 2022), 157521. <https://doi.org/10.1016/j.scitotenv.2022.157521>
- [3] Laetitia Bodet-Contentin, Mélanie Letourneur, and Stephan Ehrmann. 2022. Virtual reality during work breaks to reduce fatigue of intensive unit caregivers: A crossover, pilot, randomised trial. *Australian Critical Care* (March 2022). <https://doi.org/10.1016/j.aucc.2022.01.009>
- [4] Henry Brodaty, Alisa Green, and Annette Koschera. 2003. Meta-Analysis of Psychosocial Interventions for Caregivers of People with Dementia. *The American Geriatrics Society* 51 (06 2003), 657–64. <https://doi.org/10.1034/j.1600-0579.2003.00210.x>
- [5] Meara Faw, India Luxton, Jennifer Cross, and Deana Davalos. 2021. Surviving and Thriving: Qualitative Results from a Multi-Year, Multidimensional Intervention to Promote Well-Being among Caregivers of Adults with Dementia. *International Journal of Environmental Research and Public Health* 18 (04 2021), 4755. <https://doi.org/10.3390/ijerph18094755>
- [6] Emily Hellis and Elizabeta B. Mukaetova-Ladinska. 2022. Informal Caregiving and Alzheimer's Disease: The Psychological Effect. *Medicina (Kaunas)* 59, 1 (Dec. 2022), 48. <https://doi.org/10.3390/medicina5910048>
- [7] Kimberly Orden and Kathi Heffner. 2022. Promoting Social Connection in Dementia Caregivers: A Call for Empirical Development of Targeted Interventions. *The Gerontologist* 62 (03 2022). <https://doi.org/10.1093/geront/gnac032>
- [8] Snorri Rafnsson. 2023. Loneliness and social isolation among older informal caregivers. 63–75. <https://doi.org/10.4324/9781003289012-10>
- [9] Isabelle Velloze, Dylan Jester, Dilip Jeste, and Brent Mausbach. 2022. Interventions to Reduce Loneliness in Caregivers: An Integrative Review of the Literature. *Psychiatry Research* 311 (03 2022), 114508. <https://doi.org/10.1016/j.psychres.2022.114508>
- [10] Ying Yu, Lily Xiao, Shahid Ullah, Claudia Meyer, Jing Wang, Anne Margriet Pot, and Fathimath Shifaza. 2023. The Experiences of Informal Caregivers of People With Dementia in Web-Based Psychoeducation Programs: Systematic Review and Metasynthesis. *JMIR Aging* 6 (29 May 2023), e47152. <https://doi.org/10.2196/47152>