Challenges in using Virtual Reality in Aged Care Settings: Reflections on Research-in-Progress

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ABSTRACT

This position paper reflects on the challenges associated with using head-mounted displays (HMDs) for virtual reality in aged care settings. The reflections are drawn from insights gained to date from a program of research that is currently investigating the opportunities and challenges associated with using emerging technologies to provide social and emotional "enrichment" in later life. Virtual reality (VR) is gaining popularity in residential aged care where it is used to enable residents to experience activities and virtually travel to locations they can no longer visit in real life. Challenges in this semi-private setting include managing the user's physical safety and guiding the user through the VR experience when the HMD occludes their vision of the physical environment around them. Furthermore, in this setting the VR experience is not fully private and needs to be carefully managed so the user's response to VR does not become a "spectacle" for onlookers. These and other challenges mean that great care is required to ensure a positive experience when using VR to provide enrichment for older adults in residential aged care.

INTRODUCTION

This paper draws on insights from research that is investigating the use of new technologies, such as VR, for social and emotional enrichment in later life. In this context, enrichment refers to activities that enhance people's social worlds, either by providing opportunities for older people to build new social connections, or to participate in activities they find meaningful and enjoyable and that provide them with a sense of connection to society [10].

Special report: VR opens doors for residents

By Darragh O'Keeffe on July 13, 2016 in Technology

Mercy Health is rolling out its virtual reality lifestyle program across its 22 facilities

Figure 1: Screen shots of news stories about VR in aged care

Recent research in gerontology has found that VR experiences can be calming and meditative for people with dementia in residential aged care [4], while HCI researchers have investigated the design of immersive VR to enable people with dementia to virtually experience activities they used to enjoy [3]. Emerging research has begun exploring older adults' responses to the use of VR for more interactive experiences, such as game playing and social interactions [8]. Outside academic research, VR is growing in popularity in residential aged care as a way of enabling residents to virtually travel to places they can no longer visit in real life ([7]; see Figure 1). However, residential aged care is a complex environment in which to introduce new technologies. Care staff face numerous challenges, including constraints around their time and job roles [2]. Meanwhile, aged care residents are typically frail, with mobility constraints and cognitive impairments that may limit their ability to learn to use new technologies [5].

While care home environments are not fully public settings, nor are they fully private. Activity programs offered in aged care settings are usually group activities that take place in semi-public spaces and are facilitated by staff. The use of head-mounted displays for immersive VR may provide an individual experience, but the activity needs to be supported by staff or volunteers who may struggle to communicate with residents while they are immersed in the virtual environment. These and other challenges are discussed below, drawing on my experiences in a program of research in which I have: a) witnessed aged care residents being guided through an interactive game-based VR experience, b) supported older adults, who were not in aged care, to use a fully immersive social VR application to interact with peers in a virtual environment, and c) conducted interviews with aged care providers, volunteers, and technology vendors about their experiences of introducing VR, and other emerging technologies, for activity programs in aged care. This research is currently in progress; the challenges discussed below are reflections on my experiences to date, rather than research findings. Further details about some of this research can be found in Baker et al [1].

CHALLENGE 1: MANAGING THE PHYSICAL SPACE AND MOVEMENT

Residential aged care facilities serve a dual purpose as "home" to the residents and workplace for staff [6]. They include communal spaces (e.g., lounge and dining rooms) and individual semi-private spaces (e.g., residents' bedrooms). Each space within the facility is typically designed and furnished to support the facility's daily routines and activities. This means there may not be sufficient space to introduce a fully immersive and interactive VR experience. Simple mobile phone-based VR experiences do not require much space, but more interactive systems, such as the Oculus Rift, do require a large space that is clear of obstructions.

Figure 2: Physical movement in VR

Figure 3: The iPad screen is a shared reference point for the user and their guide

Interactive VR can be used to encourage physical movement or to provide playful game-like experiences. The physical movement necessary to interact in such environments can be beneficial, encouraging people who are otherwise sedentary to engage in a modest amount of activity. But this movement can also put older adults at risk of harm because their view of the physical space around them is completely obstructed by the HMD. Great care must be taken to ensure there is no danger of the older person falling. Even if the user is seated, interactive VR may require users to reach forward (see Figure 2), which can put the older person at risk of falling out of a chair. There is also the complication of using a tethered HMD (for example, the Oculus Rift has a cable linking the HMD with the system), which can create a tripping hazard. If users in wheelchairs are able to move their chairs, the cable can become entangled in the chair. Such risks mean that the staff or volunteers supporting the resident need to watch the VR interaction closely, taking care to remove obstacles and ensure the user's movement is not obstructed, nor likely to result in a fall. Given that aged care residents are often physically frail and can be at great risk of harm should they fall, this raises a significant ethical challenge for researchers trialing VR in this space [9].

CHALLENGE 2: GUIDING USERS THROUGH THE VR EXPERIENCE

Using a head-mounted display fully obstructs the user's vision of the physical space around them. This occlusion creates social challenges that impede interaction between the user and others who are present in the physical environment. Interactions between VR users and non-users may be undesirable – they can interfere with the user's sense of being fully immersed in the virtual environment – but they can sometimes be necessary, especially when the user requires support to navigate their way through the VR experience.

In the trials my colleagues and I have conducted, we have found it can be quite difficult to show users where to point, where to look, or which buttons to press on the hand controller when they need help operating the VR system. Users cannot see any gestures that a support person might make when trying to explain what they should do. There is also no shared reference point. When helping an older adult to use an application on a touch-screen device (Figure 3), the user and helper can both see the screen, creating a shared reference point. In contrast, while the user's view of the virtual world might be replicated on a computer screen (Figure 4), and therefore visible to the support person, the user cannot see the screen from that person's point of view. They cannot see where on that screen the support person is pointing; nor can they see the hand controllers from the helper's vantage point. With visual instructions (e.g., point here) unavailable to users wearing a head-mounted display, helpers may need to resort to physically guiding the user by touching their hand or arm to help them, which can feel intrusive and interrupt the experience of immersion (Figure 5).

Figure 4: The VR experience replicated on a computer screen

Figure 5: Guiding a user in a VR experience

It can also be difficult to provide verbal instructions when users are wearing headphones attached to the HMD. Like physical touch, verbal instructions can detract from the user's immersive experience. If a user is suddenly alerted to the physical presence of a support person, they may experience confusion or distress. It is particularly important in aged care environments, where many residents will have dementia, to minimize the confusion users might experience when entering and exiting the virtual environment. Great care is required to ensure a gentle transition between the virtual and physical environments.

CHALLENGE 3: PROTECTING USERS' PRIVACY

Invasion of privacy is a common concern in residential aged care. Residents' activities may be monitored for health and safety reasons and staff may have unrestricted access to resident's rooms. Virtual reality creates additional privacy concerns because it is an individual experience that gives the sensation of cutting people off from their physical surroundings, yet they can still be *viewed by others* in that environment. Although aged care facilities are not fully public spaces, they are also not fully private. Using VR in aged care requires the active support of care staff or volunteers and may attract various onlookers (e.g., other staff, family members, other residents). If not carefully managed, the individual experience of being fully immersed in a virtual environment can become something of a "freak show": the person using the VR is on display, their responses closely observed by the audience.

This can be particularly problematic when people have strong emotional responses to a VR experience. In aged care, people might use VR to virtually travel to the city, country, or even house, where they grew up or raised their families. For residents in aged care who are facing the end of life, such virtual travel can elicit strong emotional reactions, including both joy and sadness. Users may not be fully aware that their reactions to the experience are being closely observed by others.

CHALLENGE 4: SHARING THE HEAD-MOUNTED DISPLAY

Using virtual reality in residential aged care involves introducing a piece of apparatus that is worn on the face, handled by multiple people, and shared among residents. This inevitably creates infection control risks. In residential aged care facilities, infectious diseases can have a significant impact on the health of residents, potentially causing multiple fatalities. In previous VR trials my colleagues and I have conducted, we took care to wipe down the HMD with anti-bacterial wipes after each use and before placing it on a resident. The research team and aged care staff involved in the trials were vigilant about this. Of course, aged care staff and volunteers are trained to be vigilant about infection control, but there are still inherent risks involved in sharing HMDs in such a sensitive environment, with vulnerable users. Practical measures – using anti-bacterial wipes – can be taken to *reduce* the risks, but such measures may not completely ameliorate the risks.

CONCLUSION

Drawing on insights from research in progress, this paper has identified challenges associated with using head-mounted displays and immersive virtual reality in residential aged care. While there is growing enthusiasm for the use of VR in aged care as an enrichment experience for residents, the challenges outlined here suggest caution is required when introducing such innovative technology in such a complex setting. Some of these challenges are *social*: difficulties of communicating with users, and protecting users' privacy, when users are shut off from the physical environment and immersed in a virtual world via a HMD. But there are also practical challenges that need to be addressed to ensure the physical safety of aged care residents using VR. Residential aged care is a sensitive setting. Researchers, caregivers, and volunteers using VR in this setting have an ethical obligation to be aware of, and able to address, the challenges that this technology might present. Such challenges therefore need to be part of the growing conversation around ethical issues associated with novel uses of VR [11].

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REFERENCES

[1] Steven Baker, Jenny Waycott, Frank Vetere, and Thuong Hoang. 2019. The Technology Explorers: Partnering with Older Adults to Engage with Virtual Reality and Virtual Avatars. In *Ageing and Digital Technology: Designing and Evaluating Emerging Technologies for Older Adults*, B.B. NEVES AND F. VETERE Eds. Springer Singapore, Singapore, 231-246.

[2] Wendy Cavenett, Steven Baker, Jenny Waycott, Romina Carrasco, Elena Robertson, Frank Vetere, and Ralph Hampson. 2018. Deploying new technology in residential aged care: staff members' perspectives. In *Proceedings of the 30th Australian Conference on Computer-Human Interaction*, Melbourne, Australia 2018 ACM, 200-204.

[3] James Hodge, Madeline Balaam, Sandra Hastings, and Kellie Morrissey. 2018. Exploring the Design of Tailored Virtual Reality Experiences for People with Dementia. In *Proceedings of the Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, Montreal QC, Canada2018 ACM, 3174088, 1-13.

[4] Wendy Moyle, Cindy Jones, Toni Dwan, and Tanya Petrovich, 2017. Effectiveness of a Virtual Reality Forest on People With Dementia: A Mixed Methods Pilot Study. *The Gerontologist*, gnw270-gnw270.

[5] Barbara Barbosa Neves, Rachel L. Franz, Cosmin Munteanu, Ron Baecker, and M. Ngo. 2015. "My hand doesn't listen to me!": Adoption and evaluation of a communication technology for the 'oldest old'. In *Proceedings of the SIGCHI Conference on Human Factors in Computing* ACM Press, 1593-1602.

[6] Lucio Naccarella, Clare Newton, Alan Pert, Kurt Seemann, Ruth Williams, Kate Sellick, and Briony Dow. 2018. Workplace design for the Australian residential aged care workforce. *Australasian Journal on Ageing 37*, 194-201.

[7] Darragh O'Keeffe. 2016. Special report: VR opens doors for residents. *Australian Ageing Agenda*. https://www.australianageingagenda.com.au/2016/07/13/special-report-vr-opens-doors-for-resident/

[8] Amy Restorick Roberts, Bob de Schutter, K. Franks, and M.E. Radina. 2019. Older Adults' Experiences with Audiovisual Virtual Reality: Perceived Usefulness and Other Factors Influencing Technology Acceptance *Clinical Gerontologist 42*, 27-33.

[9] Jenny Waycott, Cosmin Munteanu, Hilary Davis, Anja Thieme, Stacy Branham, Wendy Moncur, Roisin McNaney, and John Vines. 2017. Ethical Encounters in HCI: Implications for Research in Sensitive Settings.

[10] Jenny Waycott, Frank Vetere and Elizabeth Ozanne. 2019. Building Social Connections: A Framework for Enriching Older Adults' Social Connectedness Through Information and Communication Technologies. In *Ageing and Digital Technology: Designing and Evaluating Emerging Technologies for Older Adults*, B.B. NEVES AND F. VETERE Eds. Springer, 65-82.

[11] Jenny Waycott, Greg Wadley, Steven Baker, Hasan S. Ferdous, Thuong Hoang, Kathrin Gerling, et al. 2018. Manipulating Reality? Designing and deploying virtual reality in sensitive settings. In *Proceedings of the 2018 ACM Companion Publication on Designing Interactive Systems,* ACM, 411-414.