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Care Beyond Borders: Investigating Virtual Reality Deployment Opportunities & Challenges Through the Lens of Dementia Care

Hiba Jawharieh^a , Luma Tabbaa^a , Chee Siang Ang^b , Ethan Cheung^a , and Alexandra Covaci^a 

^aSchool of Engineering, University of Kent, Canterbury, United Kingdom; ^bSchool of Computing, University of Kent, Canterbury, United Kingdom

ABSTRACT

One factor leading to compromised Quality of Life (QoL) for people with dementia in long-term care settings is the significant barriers they face in accessing experiences beyond their physical premises. Although, in recent years, research within HCI has investigated the use of Virtual Reality (VR) in providing enriched experiences for people with dementia, few studies have looked into the practical issues relating to integrating and deploying VR into care settings and how in-depth understanding of such issues can inspire VR design for dementia care. Considering the perspective of key stakeholders, we demonstrate VR's potential to create a rich conversation space with family members, preserve the identity and personhood of people with dementia through VR, and consider organisational issues of VR deployment in care settings. As such, this paper contributes to the HCI research community with future design directions to enhance the deployment and adoption of VR in dementia care settings.

KEYWORDS

Dementia care; care setting; virtual reality; technology deployment; technology adoption

1. Introduction

As of 2021, it is estimated that 55 million people are living with dementia worldwide, and the numbers are expected to rise to 78 million in 2030 and 139 million in 2050 (World Health Organisation, 2022). Dementia is a term that describes a variety of disorders that are progressive in nature and -currently- cannot be cured. As the condition progresses, people with dementia become forgetful, disoriented, and unable to communicate or retain new information (Jones et al., 2015). As such, people with dementia progressively lose their sense of autonomy and become dependent on others for everyday activities of daily living (Chenoweth et al., 2009). This often means they require care in long-term care settings, especially at the later stages of the condition (Verbeek et al., 2010).

Promoting a good QoL is essential in dementia care (Kane, 2001). QoL for dementia care is multifaceted, including measures related to i. physical comfort, hygiene, and well-being, ii. safety, security, and order, iii. maintaining a sense of autonomy, dignity, and privacy, as well as iv. living a meaningful life, individuality, maintaining relationships, and enjoyment (Kane, 2001). Although long-term care settings provide much-needed everyday care (i.e., physical safety and assistance in eating and bathing), studies suggest that almost half of people with dementia in long-term settings are diagnosed with depression (Schreiner et al., 2010). Often, medications such as antipsychotics and antidepressants are overprescribed, ineffective and cause unwanted

side effects such as sedation and respiratory problems (Orgeta et al., 2017). One major factor leading to compromised QoL is the significant barriers people with dementia face in accessing stimulating, interesting and engaging experiences beyond their physical premises (Tabbaa et al., 2019) due to location, weather, safety concerns, or mobility constraints. Thus, there is a need to design and develop non-pharmacological interventions to promote, support, and enhance the QoL of people with dementia.

Virtual Reality (VR) has shown great promise in offering enriching and enjoyable experiences, irrespective of physical constraints (Zhao et al., 2020). Human-Computer Interaction (HCI) research in this area has suggested that VR holds benefits for older people in general and people with dementia, specifically in long-term care settings, in improving mental health and mood (Tabbaa et al., 2019), reducing apathy and recalling memories (Cavenett et al., 2018). VR also promotes social interactions by facilitating conversations (Hodge et al., 2018) through storytelling, sharing, or reminiscing with care staff, family, and friends (Appel et al., 2020). Finally, VR has shown its potential to reduce behavioural symptoms of the condition, which impacts people with moderate to severe dementia (Rose et al., 2021; Tabbaa et al., 2019). As such, studies have shown that people with dementia often respond positively and engage in various tailored VR experiences (Eisapour et al., 2018; Hodge et al., 2018; Martins Mol et al., 2019). In addition to measuring the outcomes and experience of

people with dementia using VR, some studies have also considered and engaged with other key stakeholders, such as care staff (Kruse et al., 2015; Tabbaa et al., 2019; Waycott et al., 2022) and family members (Hodge et al., 2018; Karaosmanoglu et al., 2021). The involvement of such stakeholders was mainly to advise on participant selection (of people with dementia) (Tabbaa et al., 2019), engage in the co-design of VR, and establish design requirements (Karaosmanoglu et al., 2021; Tabbaa et al., 2019), as well as investigate the perceptions on the perceived pros and cons of VR for people with dementia (Hung et al., 2023; Karaosmanoglu et al., 2021; Waycott et al., 2022).

Some studies have examined the role of care staff in technology acceptance and deployment with people with dementia (Hicks et al., 2022; Liu et al., 2018; Sas et al., 2020). However, few studies have looked at socio-technical issues around the deployment of VR in long-term care, considering the views, perspectives, and roles of key stakeholders. Furthermore, limited research has highlighted the significance of tailoring the VR application, drawing on the feedback from people with dementia regarding their experience with wearing the VR headset and engaging in the immersive world. Although care managers play a primary role in the decision-making process of deploying activities and interventions, and hence play a crucial role in the deployment and VR adoption, to our knowledge, no studies have investigated their perceptions of the adoption and deployment of VR. Moreover, almost all studies involving family members have focused on understanding the perceived benefits of VR to their loved ones, with little consideration of the potential benefits to the family members themselves when sharing face-to-face or remote VR experiences with their loved ones and how it might affect their relationships (Afifi et al., 2022; Kruse et al., 2015). As such, this study aims to investigate the following objectives:

- i. How should VR technology be used to deliver engaging VR experiences to people with dementia in dementia care settings?
- ii. How can VR support family members in remotely participating in experiences with their loved ones?
- iii. What are the main issues and concerns of care staff and managers within dementia care settings when considering adopting VR?
- iv. Considering the perspectives of all key stakeholders, how can VR be better designed, addressing challenges and opportunities for achieving effectiveness in its adoption in dementia care settings?

Through this study, we aimed to contribute to the research in the HCI community by exploring the multi-dimensional issues of VR technology design to facilitate its deployment in dementia care settings, considering the perspectives of people with dementia, family members, care staff and managers within long-term care whilst situating people with dementia at the heart and centre of this research work.

2. Related work

2.1. Digital technologies for dementia care

Over the past decades, there has been increasing research in HCI into designing digital technology to support people with dementia. Previous research has investigated various technologies to promote the independence of people with dementia, increase their autonomy, improve their self-confidence, support them in maintaining specific skills and abilities, and increase their general QoL (Alzheimer's Society, 2015; Nishiura et al., 2021). Furthermore, the body of research found that digital technologies can enhance their socialisation by building strong and socially meaningful connections, which leads to a reduction in cognitive decline (Kleinberger et al., 2019) and depressive symptoms in older adults (Fields et al., 2021; Kleinberger et al., 2019).

As digital technologies are becoming mature and pervasive in people's everyday lives, we are starting to see some of these technologies being adopted in a formal long-term care setting, with a focus on improving "care delivery, management, and support", "safety, security, monitoring and reassurance", "training" and "social interaction and networking" (Lorenz et al., 2019). For instance, location tracking (including indoor areas) (Sait et al., 2019) provides a solution to the wandering of people with dementia, getting lost, and not finding their way back. Such technology can enable some people with dementia to have greater freedom and independence and can ultimately reduce unpleasant solutions such as pharmacological interventions and physical restraint (Alzheimer's Society, 2015). Furthermore, reminiscence using digital media tools is also increasingly being adopted in care settings to support the well-being of people with dementia. Reminiscence therapy is one of the most popular psychosocial interventions in dementia care; it assumes that remote memory remains intact until the later stages of dementia and may be used to communicate with people with dementia (Cotelli et al., 2012). Finally, various technologies have been deployed to support the overall dementia care setting to provide reassurance and support to care staff and help care staff manage risks in and around the physical space of the residence of people with dementia (Alzheimer's Society, 2015; Nishiura et al., 2021).

2.2. Virtual reality (VR) for dementia care

VR technology has developed considerably in the past decade and gained significant research interests in multiple domains, including healthcare and well-being. In the context of dementia care, several studies explored the use of VR to promote, enhance, train, or assess people with dementia's physical (Eisapour et al., 2018; Karaosmanoglu et al., 2021; L. Kruse et al., 2021), cognitive (Hodge et al., 2018; Li et al., 2023) and overall well-being (Hodge et al., 2018; Siriaraaya & Ang, 2014). VR may provide an innovative and effective means to assess specific cognitive skills as a tool for early detection of dementia (Mendez et al., 2015) and support training activities for daily living (i.e., spatial navigation (Ijaz et al., 2019; White & Moussavi, 2016) or cognitive skills

(i.e., mental stimulation (Andringa et al., 2019)). For instance, one study examined the use of VR as a training tool to tackle memory decline and found that the experimental group showed significant improvements in memory tests over six months (Optale et al., 2010). VR has also supported reminiscence therapy, proving its efficacy for people with dementia; VR can stimulate recollections of autobiographical memory and convey familiarity with a given scene, an essential requirement for reminiscence therapy (Benoit et al., 2015; Saredakis et al., 2021). One study found that it is easier to deliver reminiscence therapy using VR over traditional platforms due to the extensive access and range of content, which allows therapists to tailor the therapy better, and the immersion in VR, which allows people with dementia to become engaged in the therapy (Hayhurst, 2018). VR can also “serve as a point to talk about” (Hodge et al., 2018), enhancing the social interaction of people with dementia. A study indicated that the short, playful VR experiences could be shared on an ad-hoc basis with friends and family, and people can discuss what they are experiencing even while they are experiencing it (Hodge et al., 2018).

The benefits of VR were not only assessed from a clinical standpoint but were also articulated from the perspective of individuals with dementia. People with dementia have perceived VR as an enjoyable activity (Andringa et al., 2019; D’Cunha et al., 2021; Moyle et al., 2018). Enjoyment plays a vital role in improving the mental status of people with dementia, especially those who live in long-term facilities. They reported that they experienced presence (Matsangidou et al., 2022; Rose et al., 2021), which in turn granted them the feeling of “really being there” (Blackman et al., 2007). They also reported a willingness to use VR again (Afifi et al., 2021; Appel et al., 2020; Chaze et al., 2022), indicating their positive technology experiences.

While many interventions have been developed for assessment and training (Sokolov et al., 2020; Tarnanas et al., 2013; Xue et al., 2023) for people with dementia residing within the community (i.e., independently or with family), people with dementia residing in long-term care may require additional care in supporting their journey through dementia and promoting their QoL. In particular, 70% of people with dementia in long-term care have mental health needs due to the cognitive, psychological, and behavioural symptoms of dementia (Thraves, 2016). The restrictive institutionalised care environment compounds this problem, where simple activities such as “going out” are challenging due to mobility, health, or other extraneous conditions such as location and weather constraints. Research has shown that VR allows people with dementia to travel virtually to various places, leading to a sense of escapism associated with positive feelings, and provides a high level of visual realism and immersion, enhancing the experience and triggering autobiographical memories (Munoz et al., 2021; Niki et al., 2019). As such, VR can offer a virtual alternative to the “outside” world (Rose et al., 2021; Tabbaa et al., 2019) when such locations or experiences are not accessible in the real world.

2.3. Technology adoption in care settings

The success of new technology is not simply based on its measured outcomes but on how well it is implemented and integrated into dementia care settings (Shiells et al., 2020). There is a myriad of literature investigating the issues of Information & Communications Technology (ICT) adoption in various care settings. One study (Koru et al., 2016) outlined vital challenges faced by care settings that affect technology adoption in supported care (i.e., services delivered to homebound patients at their homes): i. the challenge of coordinating clinical and administrative workflows, ii. inadequate access to service users’ medical records and difficulties with medication reconciliation, iii. hiring, training, scheduling, and retaining qualified care staff, and iv. educating service users and family members (Koru et al., 2016). Another study indicated the importance of familiarising people with dementia and observing their interaction with the designed system (Karaosmanoglu et al., 2021). Other studies looking into the adoption of Electronic Health Record (EHR) systems in long-term care settings (Cherry et al., 2008; C. S. Kruse et al., 2015) highlighted that the main barriers to adoption include: i. cost-effectiveness (i.e., does the benefits outweigh the costs), ii. evidence that the technology will improve care outcomes, iii. user perceptions (i.e., acceptance and complete understanding of the new system by care staff, family members, and other key stakeholders), iv. fear of changing the facility culture and v. lack of external support from governmental agencies. Perhaps the most relevant literature to the current study is a paper on the adoption of gaming technology to support the well-being of people with dementia within care homes (Hicks et al., 2022). The study found that due to limited resources, care homes tend to focus on day-to-day physical care (i.e., feeding and bathing). Other environmental barriers can be as simple as not having internet connectivity or a big enough TV screen. Furthermore, the study found that care staff do not perceive gaming technologies to be dementia-friendly, given that most games are not built with people with dementia in mind. In addition, the study highlighted that care staff must be educated regarding potential physical hazards (i.e., tripping, falling) from trailing game console cables and people with dementia overexerting themselves while using motion-based games.

Despite VR’s potential benefits to people with dementia, deploying such technology in long-term care requires significant organisational resources at various levels. In addition to examining the benefits of VR for people with dementia and the positive outcomes of such interventions, some studies have engaged with other key stakeholders, such as family members and health experts who primarily contributed to the research through co-designing the VR intervention (Karaosmanoglu et al., 2021; Tabbaa et al., 2019) and sharing their perceptions on the potential benefits and pitfalls of VR for dementia care (Hodge et al., 2018; Karaosmanoglu et al., 2021; Kruse et al., 2021; Waycott et al., 2022). Only a few studies have focused on investigating the views of care staff over the deployment of VR. In particular, (Eisapour et al., 2018; Zhao et al., 2020) highlighted care staff’s views

on the opportunities and challenges of VR games, focusing on the physical skills of people with dementia (i.e., physical limitations when playing VR games) and cognitive abilities (i.e., using complex technology such as controllers) and its effects on the deployment of VR. Moreover, managers of dementia care settings (especially managers who are responsible for care planning, quality management, operations, scheduling, and budgeting) play a crucial role in adopting VR into their settings (Hicks et al., 2022), especially when considering the heavy workload, high staff turnover and other competing priorities (Oosterveld-Vlug et al., 2019). To our knowledge, no studies have examined their perceptions and views of VR deployment. Finally, almost all studies engaging with family members have focused on understanding the perspectives of family members over the perceived benefits of VR for their loved ones, with little consideration to the potential benefits for the family members themselves when sharing face-to-face or remote VR experience with their loved ones (Afifi et al., 2022; Kruse et al., 2015).

As such, there is a need to investigate the opportunities and challenges of integrating and deploying VR into dementia care settings to understand how an in-depth understanding of such issues can inspire better VR design for dementia care. Therefore, the paper aims to explore the multi-dimensional opportunities and challenges of VR technology design to facilitate the deployment of VR in dementia care settings, considering the perspectives of key stakeholders, including people with dementia, family members, care staff, and managers within dementia care while putting people with dementia at the forefront.

3. Methodology

We adopted a qualitative approach to the study, which consisted of three phases. First, a series of focus groups and discussion rounds (Phase One) with key stakeholders were conducted to evaluate, understand, and identify key challenges and opportunities to deploying and adopting VR in care settings. In Phase Two, researchers curated the VR experiences in consultation with people with dementia, family and care staff members through interviews to ascertain the interests and past history of the participating people with dementia. Finally, the system was developed, care staff members were trained, and people with dementia, family members, and care staff were engaged in VR sessions (Phase Three). These VR sessions were conducted in face-to-face

mode, where care staff co-located with people with dementia, and remote mode, where care staff co-located with people with dementia and joined with a family member virtually from a remote location. Figure 1 below summarizes the procedure of the study¹.

3.1. Ethics

Participants were recruited from an elderly care provider in the United Kingdom. The care provider is a not-for-profit organisation that cares for over one thousand older people through registered well-being support services, daycare centres, home care services, and nursing and dementia care homes. Ethical approval was obtained from the University of Kent (Ref: CREAG085-08-2021). Where concerns were expressed regarding the capacity of people with dementia to consent, capacity assessments were completed using the “Mental Capacity Act (MCA) 2005 Assessment Checklist” (Tabbaa et al., 2019). Only individuals with the capacity to consent were invited to participate.

3.2. Phase one: Opportunities & challenges to the deployment of VR in dementia care setting

In the kick-off meeting with the participating care provider, attendees (directors (n=2), managers (n=5), practitioners (n=1), technicians (n=1), and a psychiatrist in old age (n=1)) were introduced to VR technology and the latest literature relating to the use of VR in dementia care (Appel et al., 2020). Attendees raised some questions about the health and safety measures of integrating the technology into the existing care infrastructure. They also inquired about learning time care staff would need to deliver VR experiences effectively, considering understaffing issues, a common challenge within elderly care and dementia care (Costello et al., 2019; Harrington et al., 2021; Hicks et al., 2022). Following this, we conducted a series of focus groups and discussion rounds (n=14, 1-2 hours each). All sessions were led by two HCI researchers who documented the minutes and collected any written materials (i.e., flipcharts, sticky notes, etc.), then corroborated the notes with attendees via email afterwards to ensure the fitness of notes. Discussions mainly revolved around four primary components:

- i. Care Settings Suitability to Adopt VR: among the 10+ day care centres, nursing, and dementia care homes

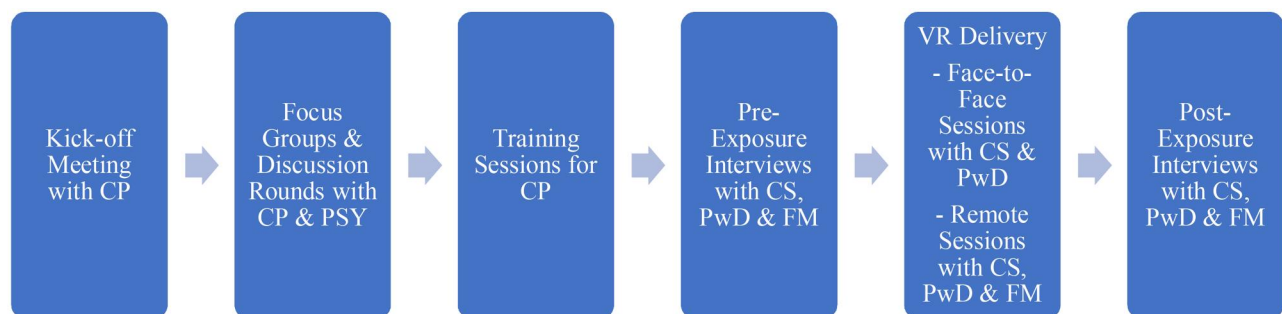


Figure 1. Summary of the procedure of the study.

under the administration of the participating provider, two dementia care homes and one day care centre were identified as suitable for inclusion in the study. This selection was influenced by COVID-19-related health restrictions (i.e., those who are hosting residents classified as “vulnerable” due to underlying medical conditions) and severe staff shortages (due to COVID-19).

- ii. Participants with Dementia Suitability for Participation: the exclusion criteria included participants’ stage of dementia and its effect on their capacity to consent. Additionally, it considered medical health issues (physical, mental, and psychological) that could be exacerbated when using VR and safety considerations provided by headset providers.
- iii. Care Staff Selection & Training: staff close to the participants with dementia were considered the most suitable staff to lead the VR sessions. However, attendees expressed the need for care staff technical training on how to set up and administer VR, how to prepare participants with dementia to “enter” and “exit” the VR experience and understand the potential side effects of VR and how to alleviate such adverse effects.
- iv. Health & Safety Technical Requirements: Wireless VR headsets were deemed suitable to reduce risk when discussing the hardware. Also, the headsets need to be flexible enough to be worn with glasses. As for interaction, considering the participant’s lack of familiarity with technology, simple exploration was deemed suitable. To further support this, an external application is required so that care staff can fully manage the VR experience from the “outside”. Finally, when exploring suitable content for people with dementia, it was important that the positive content should not cause participants with dementia to be startled or scared and should not cause motion sickness (i.e., moving camera) or dizziness (i.e., low-quality content).

3.3. Phase two: Curating personalized VR experiences

Based on our previous research findings (Tabbaa et al., 2019) involving people with dementia, we have established what kind of VR content people with dementia would find interesting and appealing. Furthermore, we conducted a workshop with fifteen specialists, such as clinical psychologists and nurses within dementia healthcare, to select suitable VR content for people with dementia. The workshop aimed to understand further the needs and requirements for appropriate and safe VR content. Finally, through discussions with HCI experts, we laid out the technical criteria for safe VR content. For instance, we excluded VR videos which contain sudden transitions between scenes to avoid people with dementia being startled or confused and animals or people that are close to the camera that may be perceived as startling or scary (Tabbaa et al., 2019). In consistent with previous literature, which recommends curating VR experiences that match people with dementia’s interests and hobbies, aiming to enhance engagement in the VR activity,

maintain attention for as long as possible, and motivate reminiscence (Baker et al., 2020; Hodge et al., 2018; Siriaraaya & Ang, 2014), we conducted interviews with participants with dementia (n=6), family (n=5) and care staff members (n=3). The interviews, lasting 20-30 minutes each (n=14), intended to explore the past and current interests and life stories of participants with dementia. The care staff members (caregivers specialising in dementia care (n=1) and activity coordinators (n=2)) were regular carers for the people with dementia participating in this study and, therefore, were able to provide insights into participants’ personal interests. An HCI researcher asked interviewees about places participants with dementia grew up in, places they travelled to in the past, and places they wanted to visit but never got the chance to. They also inquired about previous hobbies participants with dementia enjoyed but can no longer do for any reason and things and activities that interested them in the past and the present. Key findings were noted at the time of the interview.

When considering the type of VR content, previous research work highlighted the advantages of using 360° video-based experiences over computer-generated (i.e., 3D) experiences due to the time and cost to design, develop and personalise the content (Niki et al., 2019; Tabbaa et al., 2019). As such, we decided to deploy 360° video-based experiences, mainly because many studies have used this content modality with older populations, reporting little to no adverse effects (Moyle et al., 2017; Rose et al., 2021). Figure 2 illustrates examples of 360° VR experiences that were used in the study. Using royalty-free online platforms, 24 VR experiences were identified under the following themes: Religion (n=1), Tourism, History & Heritage (n=7), Films or Series (n=5), Bird Watching (n=2), Water Spaces (n=6), and Greenery (n=3). Throughout our VR deployment sessions, we continued to broaden the range of the VR experience in response to the preferences and specific requests people with dementia expressed a desire for. For example, during the first VR session, a person with dementia requested a Disneyland-related VR experience, while another reported a desire to visit Italy. In response to their desires, we have secured suitable VR content that corresponded to their requests.

3.4. Phase three: The VR sessions

3.4.1. The technology

The team of researchers developed a VR system consisting of the following components. The VR headset, Meta Quest 2² (571 gm and comes with an extra frame for users wearing glasses (glass spacer)), was selected based on the outcomes of the discussion rounds in Phase One addressing the “Technical Requirements for Health & Safety” (see Section 3.2). We chose a wireless headset to make sure not only that the person with dementia doesn’t feel constrained and restricted but also to reduce potential safety hazards. The headset is fitted using its 3-point head strap; this not only reduces the risk of it falling and startling participants with dementia but also reduces the risk of experiencing dizziness

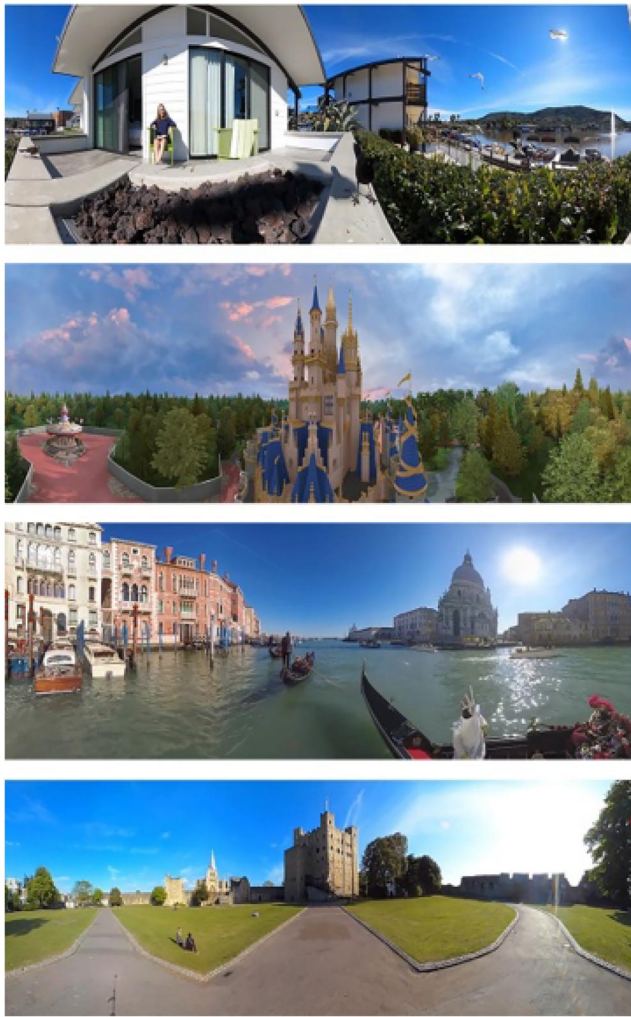


Figure 2. Examples of 360-VEs used in the study.

and disorientation. The VR app was created using Unity³ and Firebase⁴. To minimize the amount of learning required from the person with dementia using VR, the entire management of the experience (select, play, pause, change VR experiences) was done via a web app using any smart device (phone, tablet, PC, etc.). This also ensures that people with dementia can use VR without taking the headset on and off whenever they want to change an experience. The management web app (connected to the VR app via Wi-Fi) allows care staff to fully manage VR experiences and view the perspective of participants with dementia in real-time.

3.4.2. Care staff training

A total of fifteen care staff (10 activity coordinators and 5 caregivers) undertook the training. The training was designed to address issues including the i. technicality of VR (i.e., how to set up and interact with the technology), ii. physical safety considerations (i.e., how to manage risk), iii. pre-post VR considerations (i.e., how to prepare participants with dementia to “enter” and “exit” VR experiences), and iv. VR-induced distress management; although care staff are well equipped to manage distress, stakeholders in Phase One (see Section 3.2) highlighted that care staff might not be

fully aware of the adverse effects of VR and how to manage distress caused by these effects, including the management of the equipment and ensuring the safety of the person of dementia. To ensure that all the training content delivered by the HCI researcher integrates seamlessly with dementia practices, the training was co-designed and approved by HCI researchers (n = 2), psychiatrists in old age (n = 1), care organisation directors (n = 2), managers (n = 5), practitioners (n = 1), and technicians (n = 1). The training content was based on the manufacturer’s VR health and safety guidelines, previously published best practices for VR in healthcare⁵, and the expertise and practical knowledge of those who participated in co-designing the training content. The face-to-face 2-hour training was delivered by a researcher in HCI, where at the end of the presentation, care staff delivered a mock session where they set up the VR system on their own.

3.4.3. VR delivery

First, participants with dementia and care staff engaged in a conversation about where they would like to “go” in VR. Then, the care staff assisted the participants in wearing and adjusting the headset and its straps until they felt comfortable. Participants were assured they could choose not to use VR at all or decide to quit at any point. Participants were offered to view one or multiple VR experiences depending on what they fancied at the time. As people with dementia may struggle to maintain attention (McWhirter et al., 2019), such design aided them to overcome the deficits of attention and provide care staff with a platform to engage PWD for more extended periods (Tabbaa et al., 2021). During exposure to VR, the care staff prompted a conversation with participants with verbal prompts and provided support and reassurance whenever needed. After the VR sessions, participants engaged in semi-structured interviews. Participants spent 9-17 minutes in VR, and the total session duration (including exposure to VR and interviews) varied from 15-70 minutes.

The VR sessions were carried out in two modalities: face-to-face and remote. Both session modalities followed the same procedure, except that the remote sessions involved a family member joining from a remote location via a video conferencing platform (i.e., Zoom⁶). The family member was given a web link that allowed them to see (on their smart device) the perspective the participant with dementia is viewing while using VR in real-time. The family member and the participant with dementia engaged in a video chat before and after exposure to VR. Family members engaged in a semi-structured interview after the session. Finally, semi-structured interviews with care staff were conducted after all participants with dementia received their first VR session.

3.4.4. Interview & observation data

Semi-structured interviews with participants with dementia aimed to reflect on their general thoughts over the audio-visual aspects of the VR experiences, emotional affect,

presence, and technology acceptance. Some questions were constructed based on the System Usability Scale (Brooke, 1996) and the Presence Questionnaire (Witmer & Singer, 1998). In the case where participants with dementia could express their answers elaborately, questions were asked in an open-ended nature to allow discussions. On the other hand, a simplified version of the questions was adopted for participants with dementia, who best respond to simple and close-ended questions. Finally, to ensure the reliability of the answers, the same questions were asked more than once and sometimes in a different format. Semi-structured interviews with family members aimed to reflect on their general thoughts over the remote VR experience, their experience regarding the technical aspects of joining and setting up the necessary links, and the perceived benefits/problems of the remote VR session. Semi-structured interviews with care staff aimed to evaluate their experience in delivering the VR intervention and sought their opinion on VR's usability and feasibility problems in their respective care settings. The usability questions were based on the System Usability Scale (Brooke, 1996). All interviews were transcribed verbatim by one researcher and then corroborated by another researcher to ensure the quality of transcripts.

All users' (participants with dementia, family members, and care staff) reactions, behavioural responses, and verbal expressions were audio-recorded to capture any unexpected issues or interesting remarks to understand further how the VR sessions were carried out. Qualitative observations were recorded by an HCI researcher who was dedicated to recording observations during the sessions. The observation notes were then verified and corroborated later using the audio recordings, then by two researchers independently to ensure the reliability of the observations.

3.4.5. Participants

The exclusion criteria for participant selection included the following: i. individuals with pacemakers and defibrillators (as per headset manufacturer safety guidelines), ii. individuals with substantial visual impairment, history of motion sickness, history of psychosis features of dementia, history or active experiences of hallucinations or delusions, and iii. individuals who were deemed unsuitable based on multi-disciplinary team clinical judgment. Furthermore, capacity assessments were carried out using the "Mental Capacity Act (MCA) 2005 Assessment Checklist" (Tabbaa et al., 2019). Only those who were found to have the capacity to consent were invited to participate in

the study. Table 1 below describes the key demographic information of the participants.

3.5. Data analysis

Altogether, our data consisted of i. meeting minutes and written material (i.e., sticky notes, flip charts, etc.) from focus groups and discussion rounds, ii. interview notes with care staff and family members to curate personalized content, iii. transcribed interviews with participants with dementia, family members, and care staff after engaging in VR sessions, and iv. qualitative observation notes of the VR sessions. The data was analysed using thematic analysis; a method for identifying, analysing, and reporting patterns (themes) within data (Braun & Clarke, 2006). We used an inductive approach to thematic analysis, where codes and themes were developed from the data content (Guest et al., 2012). Three HCI researchers coded the data. The coders reviewed and critically discussed the themes and the underlying codes together until an agreement was reached on the final themes, then refined the codes and themes.

4. Findings

Overall, from the perspective of the participants with dementia, they reported enjoying the experiences they chose together with care staff and family members (e.g., "PwD-4 stood up and hugged the HCI researcher saying with excitement: I forgot the words I needed to use, so I hugged you to show you how happy I am!" [Researcher's Note, F-2-F Session #1, Data Collection]⁷ In the first instance, all participants accepted trying on the headset as the care staff had no trouble fitting and adjusting the headset for the participants with dementia. Participants with dementia commented that the headset felt comfortable and that the exploration of VR experiences was similar to how one would explore real surroundings (e.g., "It was easy wearing the headset... When I had that thing on, the effect I got was that I was there" [PwD-3, F-2-F Session #2, Interview]. Participants with dementia spent 7-19 minutes in VR. During interviews, all participants with dementia showed an interest in and willingness to use VR again (e.g., "Thank you so much for coming in today. When are you (HCI researcher) coming back, and how many times I'll get to use the VR?" [PwD-5, F-2-F Session #1, Conversation at the end of the VR Session]. However, two participants reported feeling acrophobic due

Table 1. Demographics of participants with dementia (PwD).

Participants with Dementia	Care Setting	Age	Gender	Dementia Diagnosis	Other Considerations	VR Sessions
PwD-1	Care Home	94	Female	Signs of Early-Stage Dementia	Hearing Impairment, Wears glasses	F-2-F (x2) Remote (x1)
PwD-2	Care Home	85	Female	Vascular Dementia	–	F-2-F (x2) Remote (x1)
PwD-3	Care Home	83	Male	Vascular Dementia	–	F-2-F (x2) Remote (x1)
PwD-4	Day Care Centre	86	Male	Vascular Dementia	Aphasia	F-2-F (x2)
PwD-5	Day Care Centre	87	Male	Vascular Dementia	–	F-2-F (x2)
PwD-6	Day Care Centre	82	Female	Alzheimer's- Vascular Mixed Dementia		F-2-F (x2) Remote (x1)

*Note: It was not possible to conduct a third VR (remote) session with PwD-4 and PwD-5. Participant PwD-4's family member was elderly and did not have access to any internet-enabled devices. Participant PwD-5's family members were not responsive.

to one VR experience filmed from a considerable height (e.g., “*I don’t like being up here*”) [PwD-6, F-2-F Session #2, Conversation during VR Session] to which distress management protocol was followed by the care staff successfully (i.e., remove the headset, ensure the participant does not stand up or risk their physical well-being in any way and then comfort the participant) and the participants with dementia reported feeling well afterwards. They continued to use VR by choosing a different experience.

As for family members, it was not surprising that they found it an exciting opportunity to engage in an activity (albeit a virtual one) with their loved ones and share an experience together, especially with family members who lived far from the care setting. All family members who joined the VR sessions found the web-enabled application easy to access and manageable. They enjoyed the session with their loved ones and expressed their interest in engaging in more VR sessions in the future.

As for care staff, two (CS-1 and CS-2) were reasonably confident in administering VR right after receiving the training, commenting, “*It was easy being raised in the technology era; I’m used to using apps, controllers, connecting to the internet and so on*” [CS-1, F-2-F Session #1, Interview]. The third care staff (CS-3) was older and unfamiliar with technologies apart from day-to-day usage (i.e., using a smartphone, using basic PC skills, etc.). As such, CS-3 did not feel confident enough to lead the first VR session; however, as they carried more VR sessions (with the support of the researcher), they built up their confidence and ended up leading 4 out of the total 6 sessions they delivered.

In regard to the perspective of the care managers and administration team, although three care settings were identified as suitable to adopt VR during focus groups and discussion rounds (Phase One), one care setting manager decided to drop out due to the increased staff workload and burden caused by COVID-19-related demands. A manager at one of the care settings was quite sceptical about “why” they should consider VR, even though they had attended the kick-off meeting, focus groups, and discussion rounds (Phase One). However, the care manager became more interested and engaged after a chat with another care manager who had overseen VR sessions in their care setting and observed the positive outcomes. Overall, the care manager’s main struggles were scheduling staff who delivered the VR sessions and securing the logistics (i.e., private space).

From these four perspectives, we identified five themes through an inductive approach to data analysis: i) Enriching Conversations through Upgrading the Family’s “Phone Call”, ii) Family Members as Partners in Care, iii) Preserving the Individuality and personhood, iv) Emotional, Physical & Contextual Safeguarding and v) Technology Adoption & Integration.

4.1. Enriching conversations through upgrading family’s “phone calls”

In this theme, we explored the quality of conversation between people with dementia and family members through

the VR system. Not only did VR help shorten the geographical distance between people with dementia and their family members, but it also served as an upgrade from the conventional phone (or video) family calls in two unique ways. Firstly, we found that family members often struggle to find appropriate conversation topics when visiting or speaking to people with dementia. We observed how VR facilitated a new level of engagement for people with dementia and their loved ones, allowing them to explore a broader range of topics in an interactive manner without the limitations or restrictions of the physical environment. The VR content enabled people with dementia in the care home to experience locations outside their care home’s natural environment, thus providing them with additional stimulation to stimulate conversation and create new threads. The VR content served as communication support, offering a stimulus to elicit conversation. During the VR session, it was evident that VR could provide a new context for conversations through the VR experience as well as strengthen the relationship between both parties.

FM-4: What are you seeing now? PwD-1: I’m seeing a door, stairs, lights ... You’ve got all the lights, 1, 2, 3 ... 7, loads of that, FM-4: Do you know what cathedral it is? PwD-4: It’s what you said ... It’s ... It’s ..., FM-4: It’s in England somewhere ... PwD-4: I can see the writing on the floor, FM-4: I can’t read it. It’s Italian. [PwD-4 & FM-4, Remote Session, Conversation during VR Session]

Furthermore, VR experiences could provide a viable solution to family members who encounter challenges in identifying suitable conversation topics beyond mundane day-to-day updates when interacting with their loved ones. Through the use of VR, family members were presented with an engaging environment that provided them with opportunities to stimulate conversation topics. As such, FM-1 shared an experience about a personal event.

FM-1: Can you see lots of people walking around the Colosseum? PwD-1: Yeah, I can, and I see the Colosseum. FM-1: Yes, it is very impressive, isn’t it? PwD-1: Yes, it is! FM-1: I went there with [husband] and [daughter] and [son] for my 40th birthday. We went to Rome, but you must have been there before that, a long time ago, I expect. PwD-1: Are these old pictures or new? FM-1: It looks like people have got face masks on, so they must be quite new, I think. I think they’re quite recent, probably. PwD-1: Are they? Yeah, I do see that! [PwD-1 & FM-1, Remote Session, Conversation during VR Session]

Secondly, VR experiences provided a new opportunity to strengthen the bond between family members and people with dementia further. Interestingly, family members and participants with dementia viewed VR as an activity that they can “do together” rather than just a conversation:

FM-1: ... to do something with me ... yes, it’s beneficial ... it’s nice to find an activity that we can do together. [FM-1, Remote Session, Interview]

PwD-1: It was nice ... It was also nice to know that they could see the same thing ... thank you, thank you very much ... It was like we were travelling together. [PwD-1, Remote Session, Interview]

Previous research has indeed shown that the lack of conversation topics erodes the quality of conversation between

people with dementia and their family members and that providing conversation resources and activities can increase their connectedness and intimacy (M. Kang et al., 2015). However, barriers such as distance, commute cost, work, and life responsibilities or restrictions (i.e., COVID-19 lockdown) can restrict people with dementia from interacting and engaging with family members frequently (Miller, 2019; Verbeek et al., 2020). Research in the HCI community has previously focused on designing interventions to create “better visits” for family members visiting people with dementia in their care setting. These interventions aim to enrich visits by making them enjoyable and engaging. For instance, studies have explored the use of social media applications to collate content (i.e., pictures, videos, articles, etc.) and then use them during visits as discussion prompts (Welsh et al., 2018) and tablet-based games for people with dementia and family members to engage with during visitation (Munoz et al., 2021). Our study has supported findings from previous work reporting that people with dementia were more conversationally and behaviorally engaged with their family members when using VR compared to regular video conferencing calls (Afifi et al., 2021) as VR provided them with the opportunity to do an activity together while conversing.

4.2. Family members as partners in care

In this theme, we explored the potential benefits of VR extending to family members of people with dementia. We found two instances in which VR technology rendered support to the family members by taking the connection with their loved ones a step further. Specifically, we found that VR provided a virtual space where family members continued caring and giving emotional care to their loved ones. It helped them alleviate their guilt due to not contributing enough to care for their loved ones in care homes. By involving family members in what is perceived as a beneficial activity for people with dementia, family members may feel better about their involvement in the care process.

FM-2: I could see how much my mum enjoyed them (the VR sessions) and made her happy and content ... At the end of the day, I want her to have a positive and pleasant experience ... VR gave her a new experience, which I thought was really good ... The VR session was totally about her ... It generated more memories that we both had together ... I enjoyed the pleasure that they gave (PwD-2). [FM2, Remote Session, Interview]

Unexpectedly, we found that VR could help nurture family members’ trust in the care staff and, by extension, the care system overall. VR was seen as a tool to help build trust between family members and their care staff. Trust is “this safe feeling” (Waite et al., 2019), which is built through dialogue (Hung-Baesecke & Chen, 2020). Trust within the dementia healthcare setting is an indicator of best practice as well as adaptation to the needs of people with dementia (Karlsson et al., 2014). It is a caring partnership between the involved parties (Ter Meulen & Wright, 2012). The shared experience between family members, care staff, and people

with dementia allowed the family members to observe the care staff in action. It also allowed the family members to interact with care staff. During the VR sessions, family members observed how participants with dementia are being treated and cared for:

FM-1: During the remote VR session when we were on Zoom, I saw the activities coordinators were helping (PwD-1) and they were looking after them very well. It gave me a little insight into (PwD-1)’s life; it is difficult to know how they are getting on in the care home when I am so far away. [FM1, Remote Session, Interview]

Family members often feel guilty when they transfer their care responsibility to care professionals by placing their loved ones (persons with dementia) in a long-term care setting (Cottrell et al., 2018). Research suggests that increasing the contact between family members and care staff wherever possible is essential for building a trusting relationship (Sävenstedt et al., 2003). Not unsurprisingly, early research found that video conference calls not only helped family members feel more connected to people with dementia but also highlighted the idea that “to see makes me part of the caring”; the study reported that “seeing” people with dementia helps family members alleviate negative feelings of guilt (Sävenstedt et al., 2003). We argue that VR takes this idea further, enabling the feelings of “visiting together makes me part of the caring”. Our findings are consistent with previous research that has stated that VR potentially improves the QoL of family members and people with dementia and reduces the family members’ feelings of guilt and burden (Afifi et al., 2022).

4.3. Preserving the individuality & personhood of people with dementia

This theme highlights the potential of VR technology to enhance the QoL of people with dementia by facilitating all-encompassing person-centred care and catering to the preservation and continuation of their personhood. We found that VR can be used to explore the past and present of individuals living with dementia to help care staff gain greater insight into their unique personalities and interests. Consequently, VR can be leveraged to continue fostering the growth of these traits following a dementia diagnosis. It is important to note that person-centred care would mean care staff must learn about the history of the person with dementia, as well as their interests and hobbies (past and new). Our observations found many instances where VR experiences triggered old interests. For example, PwD-4 was part of a local church’s choir as a child. When choosing the VR experiences, they decided to “go” to the cathedral three times, saying it would make them “happy and calm and bring pleasant memories” [PwD-4, F-2-F Session #1, Observation Notes]. Such interaction enabled care staff to learn more about the past memories of the participants with dementia:

PwD-3: This is all very familiar, very familiar. CS-2: Yeah, what does it remind you of? PwD-3: Well, it reminds me of Disney in Florida and all the good times that [wife] and I had there. CS-2: Oh, bringing back good memories from when you went there.

So, are you enjoying this then? PwD-3: Oh yeah, oh yeah. In my mind, [wife] is with me now. [PwD-3, F-2-F Session #2, Conversation during VR Session]

In addition to triggering old memories, we found that the VR content provided a space for more meaningful and personally relevant conversations between people with dementia and family members, ensuring a way to preserve and maintain personhood by re-living past experiences. For example, we observed that the participants with dementia and their family members co-created their experience in VR as they recalled memories and added verbal details to their experience, transforming a “generic” beach (the VR experience they were engaging in) into a past shared memory space (a holiday from the past) they were re-living together:

PwD-4: Oh, that’s a lovely one [referring to the VR experience], FM-4: We haven’t been to Tenerife in Spain! We’ve been to Florida. We’ve been to a lot of beaches like that, haven’t we? We’ve had a dip in the sea there. PwD-4: Yes, we did. FM-4: You used to dig a big sandcastle for the kids? You also used to make them a boat, didn’t you? PwD-4: I used to make a lot of things for them, actually. [the wife’s] birds used to come to me. FM-4: Remember the little Robin at the beach? You fed it out of your hands, didn’t you? PwD-4: Yeah... Different colours, remember? You got green! FM-4: We had a lovely tan. [PwD-4 & FM-4, Remote Session, Conversation during VR Session]

Reminiscence work has been seen to have a cognitive rationale. People with dementia often recall events from childhood, yet memories from the person’s earlier life will not all be sources of pleasure and happiness; indeed, some may be distressing or traumatic (Woods et al., 2018). For instance, PwD-4 experienced negative reminiscence due to “being” in a cathedral. As part of a church choir, the VR content reminded them of losing their mother in a tragic accident and how they had split apart as siblings. CS-3 was aware of this traumatic incident, so they managed the situation accordingly and redirected the attention of PwD-4 to a positive aspect of the experience. The selected VR content was a triggering stimulus in this case.

Equally and perhaps more importantly, the identity of people with dementia is not only defined by their past experiences; their identity transforms throughout the course of the condition (Beard, 2004). As such, our data showed that VR experiences helped people with dementia create positive narratives and outlooks that can enrich their lives post-diagnosis. Moreover, these experiences can assist in fostering their personalities and interests, allowing them to stay connected with the world around them. The importance of such a notion has been mentioned during interviews:

CS-1: I think people will enjoy it to make them feel like they’ve got more life. They can go places they can see things that they don’t always get to see. Say if they’re living in bed. And I think it would be a good thing to help them feel like life is still happening. [CS-1, F-2-F Session #1, Interview]

Through VR, people with dementia may be able to exercise (to some extent) their continued interests, which may not be feasible to achieve by means other than VR. One interview from Phase Two mentioned that PwD-5 used to have an aviary in their garden where they looked after many birds; however, such a hobby could not be maintained due

to old age and the lack of mobility required to care for birds. As such, we chose a VR experience that allowed them to “visit” a park full of flying seagulls and another one inside a resort with various birds. As a result, PwD-5 was ultimately (pleasantly) surprised to discover these experiences were curated specifically for them.

When the first PwD-5 experience started (Seagulls in the Park), a big smile appeared on their face. The more they watched, they started saying, “Dear our Lord, what have we got here!”. I asked them to move their head to see the surroundings. Every time they did, they laughed out loud. CS-3: Can you hear the birds? PwD-5: Oh, yeah... Lovely. [PwD-5, F-2-F Session #2, Observation Notes]

Our study found that through VR, people with dementia can also “go” somewhere new, try an exciting experience or fulfil an otherwise inaccessible experience. For instance, PwD-2 had some European cities on their “bucket list” but never got the chance to visit them. As such, PwD-2 chose two European city tours in VR, which they certainly enjoyed:

PwD-2: ... it’s really amazing what you see [in the headset]. That was exciting! It’s beautiful... It’s so nice to hear the talk [the tour’s voice-over]. I’d like to see more things. I’d like to see Switzerland ’cause I’ve always wanted to go to Switzerland. [PwD-2, Remote Session, Interview]

Digital Technologies, including VR, can be utilized to provide therapies to meet the social and emotional needs of people with dementia; one example is reminiscence therapy, which often involves using artefacts such as old photographs or music for therapeutic benefit (Lazar et al., 2014). A literature review found that VR is an effective and feasible technology for supporting reminiscence therapy (Tominari et al., 2021; Tsao et al., 2019). Reminiscence is a helpful communication approach in a care home setting (Redulla, 2019), where staff can learn more about the past of people with dementia. We speculate that if such information from VR sessions were systematically captured and extracted, it might be embedded into the care plan, thus improving QoL for people with dementia.

4.4. Emotional, physical & contextual safeguarding

Our study showed that the deployment of VR primarily relies on the care staff administering the equipment, delivering the session, and supporting the participants with dementia. Perhaps the first critical step in using VR with people with dementia is to help them understand the technology, what it does, and why the care staff want them to try it.

CS-1: It’s just explaining it to them; that’s the most difficult part. When you say VR or virtual reality, there’s no context that they can grasp. So, I Think... that’s the only thing is explaining before it happens, getting it through what’s going to happen. [CS-1, F-2-F Session #1, Interview]

Consistent with the recommendations focus group attendees made in Phase One, we found that the VR acceptability of participants with dementia is influenced by how familiar they were with the care staff delivering the VR session as they would trust them with trying something

completely new, such as VR. Such support provided to maximize the acceptability and meaningfulness of VR sessions does not stop at the beginning of the session (i.e., introduce VR at the beginning). Still, it also carries over throughout the session as care staff facilitate the interaction and directs the attention of the participants with dementia to the various elements of the VR experience (Siriaraya & Ang, 2014).

CS-1: What are you seeing now? PwD-4: I can see everything. I can see the stairs in the corner and the lights. CS-1: What about on the floor? PwD-4: I can see some writing. CS-1: Is there anything behind you? PwD-4: It's lovely, lovely! CS-1: What can you hear? PwD-4: I can hear music, yeah, I like everything! [PwD-4, Remote Session, Conversation during VR Session]

Moreover, we found that safeguarding the physical and emotional well-being of people with dementia is crucial. Consequently, we incorporated multiple measurements that care staff can implement to ensure the safety and well-being of participants. During the focus groups (in Phase One), we discussed the exclusion criteria for people with dementia who may experience adverse effects of VR due to their underlying health conditions. In Phase Two, while designing the VR experiences, we took into account technical considerations to the content (i.e., low resolution or shaking cameras), content type (i.e., pleasant experiences), and interaction style (i.e., simple navigation) to support the physical well-being of participants with dementia. Additionally, to assure the safety of participants with dementia, we noted that appropriate staffing, delivery modality, and training should be incorporated into the deployment plan. In our study, although participants with dementia did not encounter a risk of falling (as they were seated on a sturdy armchair and instructed not to stand up), two participants with dementia reported feeling acrophobic due to one VR experience filmed from a considerable height. As such, the headset was immediately removed, and the distress management protocol was followed by the care staff successfully (which was covered as part of the training) and gave them the appropriate time and support to recover fully:

PwD-3: I'm feeling a bit dizzy [CS-1 took off the VR HMD as soon as she heard them complain]. CS-1: A bit dizzy [while holding their hand]? PwD-3: Yeah, CS-1: Would you like me to get you a drink? PwD-3: Yes, please, a cold one. [CS-1 brought them their favourite juice and helped them drink it.] CS-1: You are safe, and you will feel better soon. [PwD-3, F-2-F Session #2, Conversation during VR Session]

Facilitating the transition between the physical and digital space was another substantial role of the care staff involved in deploying VR. For instance, care staff facilitated the transition from the real world to the VR experience using phrases such as "It will play now, and you're going to see the Opera House in Vienna" and the transition back to the real world by using phrases such as "There you go, hello again!". In our study, the gentle transition was sustained using verbal prompts to support the participants with dementia while they fell in and out of the two spaces.

It is paramount for the HCI research community to safeguard considerations of people with dementia, who are

particularly vulnerable due to their cognitive decline and memory impairments, as HCI studies become increasingly complex. Several studies have underscored the importance of considering the safety and security of individuals with dementia when utilising VR to ensure a positive and viable experience (Eisapour et al., 2018; Goodall et al., 2021; Jütten et al., 2017). To prevent spatial disorientation (Desai et al., 2020; Ijaz et al., 2022) suggested using engagement prompts to help participants with dementia become aware of the transition into another world smoothly and seamlessly. Moreover, several studies highlighted the importance of delivering VR sessions with care staff being present with people with dementia (Appel et al., 2020; Moyle et al., 2018) to ensure a secure environment for the latter.

4.5. Technology adoption & integration

Here, in this theme, we illustrate the findings of the adoption and integration of VR at a managerial level. We found that although care managers and the administration team of the care providers showed great interest in utilising VR in their care settings during Phase One, integrating and adopting VR into the day-to-day practices of the care settings was a different matter. Unsurprisingly, the first challenge found in the deployment of VR was related to securing the logistics around it. Initially, it was agreed that a private room was required within the care setting premises to conduct the VR session. However, in such a busy and highly demanding environment, the care manager struggled to (and sometimes could not) secure a private room for the VR session.

When I arrived at the care setting, I was surprised that the room was reserved and the VR session had to be relocated. However, the other location was not tested before and lacked a good internet connection. [Researcher's Notes, Data Collection]

We believe that the acceptance and adoption of technology by the care manager of one care setting were severely affected because they felt burdened by all the logistics (i.e., location, staffing, etc.) required to arrange VR sessions. As such, we found that the success of VR in being realistically deployed in dementia care settings relies on how well VR becomes embedded as part of the existing care plan for people with dementia, aiming to minimize the amount of preparation and logistics planning required to deploy VR. In an interview with CS-1, they proposed an idea of how VR could be harmonized within a fixed activity in their care setting:

CS-1: You can do sort of an activity based on one scenario, so for example, if we're having a theme about Mexico, we can have scenarios [referring to VR experiences]. I suppose it would become an activity that we are able to implement onto our planners, and all [dementia care organisations] have [this kind of] activities, so I think it would be just another thing that we're able to add to our repertoire rather than the same things over and over again. This is what we need. [CS-1, F-2-F Session #1, Interview]

Furthermore, in Phase Three of our study, we anticipated that the care staff training would be challenging due to time constraints; hence, we aimed for it to be concise, to which

care staff commented that they were happy about it and did not feel like it took them away from their jobs for too long. Nonetheless, only three out of the fifteen trained care staff members were able to conduct VR sessions due to work overload and staff shortage.

CS-2: There should be a person responsible for the VR deployment other than caregivers... It's sad to say, but they don't have the time to sit down with them (people with dementia) for a long time... I don't think it's in their kind of day-to-day routine to kind of have time for activities as much as that. [CS-2, F-2-F Session #1, Interview]

However, we found that all care staff's attitudes towards VR changed when participants with dementia showed signs of appreciation for engaging with them using VR. In dementia care settings where appreciation is severely lacking and affecting staff retention, we speculate that through VR experiences, care managers could view VR as a tool to promote a positive atmosphere among their staff members. From our observations, we noted varied expressions of appreciation, satisfaction, and enjoyment participants with dementia expressed towards care staff during or after exposure to VR, such as "Oh, that's lovely!" and "It's really amazing what you see!". Other participants with dementia were more direct in showing their appreciation and gratitude to the care staff:

Researcher: Did you like (CS-1) being here with you? PwD-1: Oh yes, CS-1: That's good (laughing), PwD-1: I wouldn't do it without you, CS-1: Thank you, Researcher: How did [CS-1] help you? PwD-1: Just being with me, held my hand, I think (laughing), thank you, and thank you very much for doing it. [PwD-1, F-2-F Session #1, Conversation during VR Session]

Despite the many potential benefits VR can offer people with dementia in long-term care, deploying such technology in care homes requires significant organisational resources at various levels. The degree to which an intervention program or technology is accepted and maintained refers to whether it becomes part of routine practice or institutional culture (Glasgow et al., 1999). Given the limited resources most care homes have, they are primarily preoccupied with delivering care and running a business on a day-to-day basis. Research has recommended that introducing technology into care settings requires careful consideration of staff time and availability (Waycott et al., 2022), mainly when care staff in dementia care are subject to substantial workload pressure and burden (Y. Kang et al., 2021). Conversely, the lack of appreciation is one of the leading reasons the dementia care sector suffers from a low staff retention rate (Gilster et al., 2018). Studies show that when care staff feel appreciated, they feel empowered, highlighting that their job is worth doing, making up for any difficulties and stressors encountered on the job (Foà et al., 2020; Moyle et al., 2003; Zimmerman et al., 2005). We believe that our study demonstrated the potential of VR to boost satisfaction among care staff.

5. Discussion

In this study, we investigated the opportunities and challenges of deploying VR for dementia care, placing people

with dementia as active agents within the study to allow a deeper understanding of their perspectives. Simultaneously, we lined up this approach within a broader context based on the perspectives of other stakeholders, including family members, care staff, and managers. Examining the deployment of VR from multiple perspectives, we found out that VR can be used as a tool for communication (i.e., between people with dementia, family members and care staff), knowledge discovery (i.e., learning more about the being, personhood and cognitive ability of people with dementia) and shared travel experiences (i.e. reminiscence via lived memories and continued personhood). Herein, we now present a discussion highlighting some challenges we encountered and suggesting how VR design can be improved to facilitate better deployment and integration in dementia care settings.

5.1. Challenges encountered

We encountered a few challenges when deploying VR technology in this setting. The most common challenge was logistical issues, i.e., difficulty scheduling staff to deliver the VR experience, finding suitable and available locations, and IT infrastructure (lack of strong Wi-Fi connections). Due to staff shortages and busy schedules, we expanded the pool of VR facilitators by training and recruiting activities coordinators in addition to caregivers. Overbooking the meeting room in the care setting was also a challenge; as such, we delivered some of the sessions in common areas (i.e. cafeteria and living room).

Furthermore, we encountered challenges related to the institutional culture of the settings, i.e., staff and managers' perception of the suitability and benefits of VR for people with dementia. We thought it would be best to organise training sessions for care staff and managers to acquaint them with the impact of the technology on people with dementia and make them familiar with using the system on their own. To provide a positive VR experience, we investigated prior HCI studies for guidance and insights such as training the facilitators (Zhao et al., 2020), providing personalised VR content (Waycott et al., 2022), mirroring VR content on a screen (Kruse et al., 2015), sitting down on a swirl chair (Karaosmanoglu et al., 2021) and preserving personhood in dementia care (Heersmink, 2022). We believe this approach to conducting our study helped us avoid anticipated further challenges. Future research could consider including positive examples of how VR could uplift care staff through sharing the experience together, observing the change in mood and well-being of people with dementia (and the notes of appreciation that might come with it), and eventually, building rapport.

5.2. Design recommendations

5.2.1. Designing conversationally rich virtual spaces

Our findings indicate that remote VR experiences can not only connect people with dementia with their family members but also create a rich conversation space between their

family members, care staff, and themselves. We believe providing a virtual alternative may be beneficial, especially when considering the importance and value of maintaining these connections for people with dementia and the challenges and barriers family members may face physically visiting the care setting. VR technology is being increasingly adopted to meet the social needs of older people (Kim et al., 2021; Matsangidou et al., 2022). Research found that VR can enhance social interaction and has the ability to transport a person with dementia into socially engaging settings (Appel et al., 2021; Lee et al., 2019). This opportunity of remote conferencing through VR with people with dementia can take spatial design to a new level. Here the sense of “traveling together” is being offered, in addition to chatting over a video conference platform. This spatial element of VR can be integrated as a feature in the design of current video conference platforms. As such, we can investigate design directions where immersive content and conversational topics can be provided seamlessly for the users, generating rich conversations and deepening their connection. As such, we can envisage a VR system that allows the family members to stream an activity or event they would like to share with people with dementia using a 360° camera, whether done synchronously (i.e., live streaming) or asynchronously. Such flexibility could overcome issues such as time-zone differences, work schedules, and life responsibilities come into place. Hence, VR-dementia-care integration goes beyond integrating technology within the physical boundaries of the care setting and considers family members’ lives.

5.2.2. Empathetic design-centre understanding to preserve personhood

It has been well-documented in the body of literature that reminiscence with people with dementia can positively impact their QoL (Graf et al., 2020; Shin et al., 2023) and may contribute to preserving and continuing their personhood. Consistent with previous research (Baker et al., 2019; Sas et al., 2020), we found that the personalisation of VR experiences is an important design consideration to increase the benefits of VR. Similar to the efforts done in real-world care settings, where family members take an active role in personalising the room of a person with dementia with pictures, photographs, and other personal items, we believe family members could also be involved in the personalisation of VR experiences. Therefore, we think that the personalisation of VR could include family members participating more actively in the creation process by providing biographical stories of people with dementia and relevant media content. Another approach could involve larger-scale efforts in producing a 360-video-based archive. While earlier research has made immense efforts to streamline photographs tailored for reminiscence (Blythe et al., 2010), we believe future research could take similar steps to provide a 360-video-based library in VR. Such a solution could be combined with a recommendation system that captures the likes and dislikes of people with dementia to recommend appropriate VR content. Such a recommendation system also needs to

help expand the horizon of people with dementia by continuing to develop their identity and personhood. Finally, since the VR content serves as a structured means to enrich the dialogue through the co-exploring between the care staff and people with dementia, an intelligent recommendation system could facilitate meaningful conversations with intelligent prompts based on the recorded likes, dislikes, and interests of people with dementia.

Another future direction that could be considered in relation to the preservation and continuation of the personhood of people with dementia is through building an understanding of who that person is early on before even being admitted to the care setting. According to the managers in our study, people with early or moderate-stage dementia are choosing to stay at home for as long as possible to preserve their autonomy, identity, and personhood. This means that when people do need long-term care in an institutionalised care setting, care staff face significant challenges caring for them. Specifically, care staff caring for a new person with moderate or severe dementia do not have the opportunity to build rapport with them and develop an understanding of their socio-cultural background and life history. For instance, it could be more challenging to understand why people with dementia are agitated without this in-depth understanding. Perhaps Artificial Intelligence (AI) within VR can help address this issue through human-AI collaboration. AI (supported with smart sensors) can be deployed when older people are living with early-stage dementia or even before that to collect data about their lives to form an in-depth understanding of their socio-cultural background, preferences, hobbies, social roles, etc. Therefore, when they do require institutionalised care, such AI systems can collaborate with human care staff to provide much-needed contexts and high-quality care effectively. In this scenario, the AI can rapidly process the wealth of personal data of the people with dementia to allow human care staff to understand better why the person with dementia is behaving in a certain way, and the human care staff can help by providing sensory feedback (i.e., holding their hand, reassuring them).

5.2.3. A lens for family members to learn about their loved one’s dailies

Due to the significant involvement of many family members in caring for people with dementia in long-term care settings, it is crucial to consider how VR design can incorporate the needs and opportunities to enable family members to continue to be involved in the caring process. Our data shows that a shared VR experience could facilitate more positive interactions to help nurture more trusting relationships between family members and care staff. Previous research has shown that the involvement of family members in an activity in a care home would be beneficial since it enhances the interactions between family members and residents and increases trust towards this setting (Ibarra et al., 2017). When staff and family caregivers had trusting relationships and strong interpersonal communication, they better met the resident’s individualised care needs (Adra et al., 2015). As such, meeting the needs of people with dementia

can improve their QoL (Cho, 2018). Another challenge is the lack of continuous updates and communications about people with dementia and how it affects family members negatively (i.e., feeling anxious, untrusting, and impacted) (Lopez et al., 2013; Zmora et al., 2019). As such, future research could investigate deploying a simple mechanism to report on the VR experiences of people with dementia. For example, the VR system can send a notification to family members when a person with dementia is visiting a virtual place (i.e., “Your mum is virtually visiting Stonehenge today”). Such notification can even be in the form of social media engagement, where the VR system posts messages and screenshots of the virtual places visited by the person with dementia. The design of this type of interaction could take inspiration from virtual photography or in-game photography, which is a new form of media art where users take screenshots of video game worlds and share them on social media (Gerling, 2018). Such notifications could also be enhanced by drawing on the wealth of literature in affective computing, where emotion detection systems can automatically detect the happy moments experienced by them.

5.2.4. Design beyond usability

Consistent with the literature, our study highlights organisational issues relating to care staff workload, lack of technological knowledge and training, perceived high cost, etc. Therefore, we not only aimed to design a simple-to-use VR user interface, but we also strove to design a simple-to-follow deployment protocol, including risk management protocol, which can be easily taught in a short training session to the care staff who will administer VR to people with dementia. Care staff need to learn to effectively deliver virtual experiences, which involves using appropriate verbal prompts, observing the emotional and behavioural responses of people with dementia and reacting appropriately, and managing potential distress and physical risk. Indeed, introducing VR in care settings requires not only staff learning how to use the system but also understanding how the technology is embedded in the culture and infrastructure of the institution.

6. Limitations

The study is constrained by several limitations. First, the study explored the use of VR by a relatively small number of participants. As such, a more extensive study is required to examine the generalizability of our findings. Furthermore, the study investigated the use of VR in two care settings. As such, there is a need to expand and explore the use of VR in more diverse settings, such as people with dementia who reside in the community, social housing, or hospitals. Furthermore, our study was limited by the short deployment period; hence, a longitudinal study is required to assess the impact of VR on all key stakeholders in the longer term. Finally, the study was carried out by two HCI researchers. To obtain an independent intervention, it would be

necessary for the HCI researchers to provide less assistance in conducting the intervention.

7. Conclusion

This paper presents a multi-phase study investigating the opportunities and challenges of deploying VR in dementia care settings regarding the perspectives of key stakeholders, including participants with dementia, family members, care staff, and care managers. The study deployed a VR system that is a 360-degree video-based experience that has been meticulously chosen based on technical and non-technical criteria to ensure suitability and safety and align with the preferences and interests of people with dementia. To make the 360-degree videos accessible, a facilitator’s application was used, enabling care staff to oversee VR experiences while also viewing the perspectives of people with dementia in real-time. Our results revealed that VR could benefit not only people with dementia but also family members and care staff. Shared experiences in VR can help augment the conversation between parties involved and allow them to explore an exciting experience that may be otherwise inaccessible, expand on their existing interests, or share cherished memories. Our study demonstrated how VR can help mitigate family members’ guilt by enabling them to extend their care for their loved ones through spending time together, mainly when face-to-face time is limited due to distance, commute time and cost, or work commitments. VR can also foster family members’ trust in care staff as they gain a critical lens through which they can watch their loved one being cared for in real-time during the VR session. It underscored the potential of VR to improve the QoL for people with dementia by delivering comprehensive person-centred care, thereby preserving and maintaining their sense of personhood. We also highlighted the importance of safeguarding the physical and emotional well-being of people with dementia. In addition, we reported how VR can provide a satisfying environment for care staff through first-hand appreciation feedback they received from people with dementia. Furthermore, our discussions emphasised how VR could surpass the physical boundaries of a care facility, highlighting the crucial element of personalising VR content and addressing organisational issues to maximise the experience’s benefits. While our study provided a multitude of factors contributing to the successful deployment and adoption of VR in real-world dementia care settings, the study is limited by the small number of participants and the lack of diversity in care settings. This was due to several factors, including COVID-19 restrictions and inaccessibility to some family members. As such, a large-scale, multi-site study is needed to explore how VR can support the preservation and continuation of the personhood of people with dementia and the impact of VR on care staff. Furthermore, considering that the current study only examined the effects of VR in the short term, future research could explore whether the positive effects of VR are maximised and maintained, as well as the potential adverse effects and how to mitigate them. Nonetheless, this study contributes to the HCI

community with design and deployment considerations and future directions over the deployment and adoption of VR in dementia care settings, stemming from the perspective of key stakeholders.

Notes

- [Care Providers (CP), Psychiatrist (PSY), Care Staff (CS), People with Dementia (PwD), Family Members (FM)].
- <https://store.facebook.com/gb/quest/products/quest-2/>.
- <https://unity.com>.
- <https://firebase.google.com>.
- <https://painstudieslab.com/vr-guidelines/>.
- <https://zoom.us/>.
- [Participants with Dementia (PwD), Family Members (FM), CS (Care Staff), Session Mode & Number, Quote Resource].

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ORCID

Hiba Jawharieh  <http://orcid.org/0000-0001-8415-9294>
 Luma Tabbaa  <http://orcid.org/0000-0002-0947-4988>
 Chee Siang Ang  <http://orcid.org/0000-0002-1109-9689>
 Ethan Cheung  <http://orcid.org/0000-0002-2089-2144>
 Alexandra Covaci  <http://orcid.org/0000-0002-3205-2273>

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About the authors

Hiba Jawharieh is a PhD candidate at the University of Kent's School of Engineering. She holds a BA in Sociology and an MSc in Mental Health and Wellness. With eighteen years of experience in education and counselling, her research centres on immersive technologies, particularly virtual reality, for dementia care.

Luma Tabbaa is a lecturer in Digital Media at the University of Kent. Her research work focuses on Human-Computer Interaction (HCI) design for healthcare and well-being, with an emphasis on the use of

immersive technologies such as virtual reality, mixed reality, and the metaverse.

Chee Siang Ang is a Computer Science specialist in Human-Centred Computing, passionate about digital health research. His work combines quantitative and qualitative research methods to design effective technology for real-world deployment. His research interests include using Virtual Reality in dementia care, mobile health, and next-generation wearable technology.

Ethan Cheung is a PhD researcher in human-computer interaction at the University of Kent. His research interests include the impact of VR and Artificial Intelligence in Dementia care. He holds a bachelor's degree in biomedical engineering from his current University and is interested in game design, gamification, and playful research.

Alexandra Covaci is a virtual reality researcher and Lecturer in the Digital Design course at the University of Kent. She specialises in the confluence of VR, multisensory media, human-computer interaction, and psychology. Her work focuses on understanding multisensory experiences in interactive technologies through human factor studies and creativity.