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Title Page

Title: Virtual Visits: Reminiscence in residential aged care with digital mapping technologies

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ABSTRACT

Objective

Digital technologies can support reminiscence and lifestyle enrichment in residential aged care. This study explores potential benefits and risks of virtual visits using digital maps, tablet computers and virtual reality technologies.

Methods

Reminiscence sessions were conducted with metropolitan aged care facility residents (n=7), using digital mapping applications to "visit" places of personal significance. Residents and family members (n=4) were interviewed.

Results

Some older adults found virtual visits valuable and all reminisced in various ways about personal, family and social experiences. Family members felt that virtual visits would be enriching for loved ones, and that they supported sharing of life stories. Our results also highlight that VR usability improvements are needed to better suit older people.

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Conclusion

Virtual visits could offer valuable opportunities for positive reminiscence for some older adults in residential aged care. Digital technologies need to provide better support for older users and people who assist them.

Keywords

Technology [J01.897]

Maps as Topic [J01.897.280.500.426];

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INTRODUCTION

Providers of residential aged care are investing in digital technologies such as tablet computers and virtual reality (VR) headsets to support lifestyle enrichment activities. There is interest in older adults' use of digital technologies to revisit the past,[1] and travel to locations they would otherwise be unable to visit.[2] In this study, we examine the role that such virtual visits might play in place-based reminiscence. We extend existing understandings of the value of reminiscence with older adults, and of digital technologies for residential aged care facilities (RACFs).

We worked with seven older adults living in a RACF. Their family members were also invited to participate in interviews exploring broader expectations about digital reminiscence. By conducting reminiscence sessions using tablet computer (iPad) and VR headset (Oculus Go), we examined how these two types of technology compare as tools for reminiscence. This work provides insights into the opportunities and challenges associated with using digital mapping technologies with older adults, as part of reminiscence activities.

Reminiscence and Digital Technologies

For older adults living in RACFs, reminiscence enables connections with the past and social interaction,[3] thereby influencing quality of life.[4] Reminiscence can include group activities for communication, and

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individual interventions targeting mood and cognition.[4] However, research indicates RACF residents may lack opportunities for reminiscence which is fulfilling and allows for social bonding.[3]

Photographs, music and physical objects have long been used to prompt reminiscence. Digital technologies extend the options for prompting reminiscence, allowing use of public and personal media tailored to individual interests and life history.[5] Researchers have explored reminiscence through mobile applications,[6] online media technologies,[7] and through a simulated 'virtual world'[8] containing old media such as photographs, posters and radio.

Digital mapping technologies, such as Google Maps Street View, Google Earth and Apple Maps Look Around feature, provide a new opportunity for place-based reminiscence. Virtual streetscapes created with stitched panoramic photographs are available for a large proportion of streets and landmarks in many countries. Users can "virtually visit" a street address using a computer web browser; using a smartphone or tablet computer app (e.g. Google Maps); or using a virtual reality (VR) headset app (e.g. Google Earth or Wander VR). In an evaluation of VR technology for older adults, Baker et al.[9] reported participants' enthusiastic response to viewing Google Earth through a VR headset, noting that one participant was pleased to see a former home, even though it prompted sadness. Virtual visits to places associated with an individual's history, then, might prompt personally meaningful reminiscence.

There is considerable interest amongst RACFs in VR headsets for lifestyle programs.[9,10] The sense of immersion offered by VR headsets[11] can allow older users to transcend the geographic limitations of the RACF and explore fully immersive virtual environments.[9] However, VR presents risks and usability issues, and might not meet the needs of older adults with mild cognitive impairment.[12] Current VR headsets are reportedly uncomfortable for some older users, and interacting in VR is challenging for people with mobility issues.[9] In contrast, tablet computers have been found to offer usability and satisfaction for older users,[13] including people with early-stage dementia.[14]

Yet there is a lack of knowledge about how virtual visits conducted via different technologies might mediate reminiscence activities. This study therefore investigated older adults' experience of reminiscence using digital mapping technologies, through VR or tablet computer, and potential benefits and challenges of deploying these technologies in RACFs.

METHODS

Digital Mapping Technologies

To study digital mapping technologies for reminiscence, we used Google Maps Street View, the maps platform with greatest coverage of Australian streets.[15] The Oculus Go VR system (www.oculus.com/go) was

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chosen as it offers a high level of immersion (through head-tracking and stereoscopic vision)[11] while being lighter and more portable than systems requiring tethering to a gaming computer. Wander VR, an Oculus Go application that uses Google Maps Street View images, was used with the VR headset. An Apple iPad was used with the Google Maps application to examine the experience of reminiscence using a tablet computer.

Participants

We recruited older adults living in RACFs to participate in two reminiscence sessions. Participants needed to be capable of giving written consent, with no physical or cognitive impairments which could cause difficulty or distress in using the digital devices. Staff at a 170-bed metropolitan RACF conducted purposive sampling, selecting residents who met the inclusion criteria on behalf of the research team (who lacked relevant clinical knowledge). This approach has been successful in previous technology-related research with similar cohorts.[16] Staff asked selected residents whether they would like to participate and a process of ongoing consent[17] was adopted throughout the study (see Data Collection and Analysis). One participant (Keith) withdrew from the study before the second session based on this ongoing consent process.

Six residents of the RACF participated in the study, along with a seventh residing at another facility, who took part in a study pilot. Table 1 provides an overview of participants (referred to by pseudonyms). Four participants (Graham, Keith, Olivia and Viola) exhibited some signs that the researchers believed were consistent with cognitive impairment (see Table 1). However, this did not appear to impact their ability to give consent and converse meaningfully about their memories.

Participants' family members were invited, through the RACF, to take part in interviews about their motivations and expectations about using these technologies for reminiscence. Family members of three residents responded to this invitation and four family interviewees took part in the study (see Table 1).

Data Collection and Analysis

Three forms of qualitative data (observations, interviews and questionnaires) were collected by the first and second authors. Both are post-doctoral research fellows (one male, one female) in Human-Computer Interaction, who aim through qualitative research and field trials of prototype systems[18] to critically examine the proposed benefits of emerging technologies, identify challenges and risks, and inform good design practice. Both have completed research ethics training and have experience with the methods utilised in this study.

Researchers met with potential participants individually, to explain study aims, provide participant information statement, gain written consent to participate, and demonstrate the technologies. Participants were

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asked to nominate up to three places of personal significance they might like to 'visit' using the technologies demonstrated. Over the following weeks, two reminiscence sessions were conducted with each participant.

Sessions began with a reminder of the research purpose and that participants could terminate the session at any time. Verbal consent was obtained. Researchers captured participants' demographic information, and prior experience and attitudes regarding digital technologies (see questions at Appendix I). Half the participants used the VR headset in the first session and tablet computer in the second; for the others, the order was reversed. Researchers were sensitive to the possibility that reminiscence could prompt negative emotions and designed sessions to minimise associated risks, through strategies such as enabling participants to guide conversation, allowing time to process and articulate memories, and giving opportunities to pause or reschedule the session. Sessions lasted approximately 45 minutes (including fitting the VR headset) and were video-recorded. During each session, one researcher acted as a facilitator. They opened the application; navigated to the nominated locations; provided devices to the participant, showing them how to navigate; and offered to help wheelchair users wearing the VR headset by turning the wheelchair on their behalf. The Oculus Go streaming capability was used through a smartphone, enabling researchers to see what the participant saw in the headset display.

Researchers collected observational memos, prompted participants to talk about their experience of the virtual visit, and conducted a semi-structured interview afterwards (see Appendix II). In the interview, participants were asked four rating (Likert style) questions, offering an alternative means to express overall perceptions of the virtual visit (see Appendix III).

Family members were provided with an overview of how reminiscence sessions were conducted and invited to participate in the study. Four respondents, family members of three participants, took part in a semi-structured interview (audio-recorded), at the RACF or via Skype, that investigated their expectations and motivations regarding the virtual visits (see Appendix IV) (see Table 1).

Recordings of interviews and reminiscence sessions, and observational memos, were transcribed and thematic analysis was conducted.[19] Interviews were segmented, and key ideas (codes) present in each segment were described. The second author conducted a coding consistency check on these codes.[20] These codes were then grouped into twelve categories, and from these code categories we identified three main themes, presented below, corresponding to: 1) the perceived value of virtual visits; 2) the varied forms of reminiscence prompted by virtual visits; and 3) the challenges of using VR and tablet digital mapping technologies with older adults. Participants' responses to the initial questions on digital technology attitudes were taken into account in the data analysis. Participants gave extended narrative responses to the experience rating questions (most had difficulty responding using a numerical score); these responses were included in the interview analysis. This research was approved by the [Anon University's] Ethics Committee (Ref #1954424).

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RESULTS

Perceived Value of Virtual Visits

The reminiscence sessions elicited varied memories of the past for all participants. Most said that they enjoyed the opportunity to "revisit" or "take a trip down memory lane". For some, the experience of virtually 'seeing' a familiar place triggered strong, emotive memories. Viola had a powerful nostalgic response to seeing places in Italy where she grew up, saying that the experience was "something big" for her and left her "trembling". For Carol, the virtual visit provided an affirmation of her past travels, saying "it becomes more *indelible when you see it, you think, 'Yes, of course! I was there.' Sometimes you think you've dreamt it all*."

However, two participants seemed to derive little personal value from the experience. Larry stated that the virtual visits were "useful" but he would be unlikely to want to repeat them, and would prefer to visit the places in person. Olivia, who had had a scientific career, wanted to participate in the research project but was unsure why her place-based memories would be interesting.

Several participants expressed mixed feelings about the value of reminiscing. Carol, who had experienced the death of close family members, said "*I don't love to go back […] I'd rather listen to an audiob*ook or fill in *the present rather than hike back too far…*". During the reminiscence session, she chose to avoid seeing the street where she had lived with her late husband. Viola was excited to see the towns where she had grown up but expressed conflicted emotions, saying "I *don't want to remember […] I want to remember, but it's* something there in my heart" and, when talking about family who had passed away, said that it was "no good to remember".

Interviews with family members revealed diverse expectations about the potential value of virtual visits. All hoped that the virtual visits would be enriching for loved ones. Viola's daughter mentioned her mother's intermittent negative moods, and anticipated that reconnecting with her Italian heritage would elicit positive emotions. Olivia's son compared the experience to "a journey" which his mother might enjoy in the moment, regardless of whether she remembered it later. On the other hand, Graham's daughters hoped that the experience would prompt increased social interaction with his peers and other residents.

A secondary theme in family interviews related to capturing and sharing the life story. Olivia's son thought his mother's reminiscence would be interesting for the family, but noted that any capture would need to reflect the unreliability of his mother's memory. He suggested integrating family photographs with place-based reminiscence could be valuable, but would require considerable effort. Viola's daughter commented that seeing places as they are presently allowed for talking about memories in new ways, but hoped primarily the visit might allow expression of repressed, painful memories. By contrast, Graham's daughters were pleased that friends of their father's had reported that his repertoire of discussion topics had expanded; he was now

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sharing information about life events that extended his habitual "loop" of memory replays, something that they attributed to the virtual visits.

Varied Forms of Reminiscence Prompted by Virtual Visits

Our observations and analysis of session transcripts suggested that virtual visits prompted varied forms of reminiscence. Encountering familiar landmarks triggered recollections of the past, and the people who lived there. Viola was deeply affected by seeing the Italian towns of her youth, using both device types. Several participants were interested to see houses where they had previously lived. However, participants engaged most enthusiastically in reminiscence when visiting sites of community activity. For Carol and Olivia, town centres elicited warm memories of town social life, and for Cleo, village streets evoked the welcome she received from residents there. Virtual visits also prompted recollection of street names and how to navigate from one place to another. For example, Graham explained carefully the locations of key landmarks, and where main thoroughfares led.

Participants' reminiscence extended beyond place to social, interpersonal and cultural experiences. While place-based reminiscence was thought by Olivia's son to perhaps be a "safe" topic, unlikely to elicit negative emotions, we identified deeply personal recollections. Most participants recounted anecdotes involving close family, including recollections of hardship, tensions and loss. For example, Cleo lovingly recalled her husband's relatives that she had met overseas, recollecting "They just embraced me, the family. Whereas my father wouldn't even come to the wedding." Some memories reflected deep-seated world views, including values they aimed to pass on to their children. Reminiscence encompassed those aspects of community life which were important to the individual, including town social life, street parties, and religious festivals. Olivia and Graham, who chose to visit places of study and work, respectively, recounted anecdotes related to their professional lives with some pride in past achievements.

Using Digital Mapping Technologies with Older Adults

Comparing Device Types for Digital Reminiscence

The two forms of technology used in this study, tablet computer and VR headset, did not have noticeably different outcomes for participants' experience of place-based reminiscence. There was no clear overall preference for the immersive, VR head-mounted experience. For example, Larry was no more enthusiastic about the possibility of repeating the experience with a VR headset than with a tablet computer. Similarly, for Viola, seeing Italy was highly moving with both device types. For family members, the use of the VR headset was intriguing. However, Olivia's son felt that a VR-type experience would be unnecessary, saying "the 3D resolution of virtual reality is probably an overkill to be honest".

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Limitations of Digital Mapping Technologies for Reminiscence

The suitability of Google Maps Street View for older adults' reminiscence was limited by two characteristics. Firstly, participants said it was frustrating that they were restricted to views from the street; they wanted to navigate into parks or footpaths, for example. When using the tablet, researchers attempted to overcome this by using publicly submitted panoramic photographs of the locations (also available through Google Maps) but found it was not easy to switch between the street view and photographs. This was not attempted using the VR headset, due to the challenges of supporting VR technology use (described below), although panoramic photos were also available through VR applications. Secondly, participants were in some cases keen to know in which year images were taken. Although this information is available within the digital mapping platform, it is not immediately visible in street view imagery.

Limitations of Device Usability for Older Adults and Facilitators

Several usability challenges were encountered relating to older adults' use of VR headsets. Some participants mentioned they found the VR display blurry, even after adjusting the headset and trying alternative glasses. Poor visibility was frustrating for Carol who was living with vision loss. Fitting and adjusting the headset was difficult for all, most notably for Larry who was unable to lift an arm to head height. In contrast, only one usability issue was identified with the Google Maps tablet computer application: Larry said he could not navigate because the app's buttons were too small.

Most participants needed some ongoing support from the facilitator to use digital mapping technologies effectively. Overall, supported use was straightforward with the tablet computer but challenging with the VR headset. The tablet computer could be viewed and used concurrently by facilitator and participant sitting side-by-side, and readily passed back and forth between the two while both kept eyes on the display. However, using the VR headset, the facilitator often needed to manage the handheld controller on the participant's behalf, while viewing the low-resolution livestream of the participant's VR headset display on a smartphone. This was problematic and required careful communication while the participant was wearing the headset. At other times, the facilitator would temporarily remove the headset from the participant to navigate as needed, which interrupted the flow and immersion of the reminiscence session.

DISCUSSION

This study suggests that digital mapping technologies provide a promising approach to reminiscence for some older adults. It also sheds light on how such activities might be best designed, and how limitations of current technologies might be addressed. Our findings indicate that the value of virtual visits depends on the individual's life history and personal preferences. It seems this form of reminiscence is of particular interest to

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people who have strong, identity-based memories associated with locations that they have not been able to visit for some time.

Digitally-Mediated Personal Reminiscence of Place

Study findings provide new insights into the opportunities of digital mapping-based reminiscence for older adults. Chaudhury[21] proposes that place-oriented reminiscence entails conjuring memories which are "not photographic images […], but are personal reconstructions of the place". Most participants engaged in such reconstructions by recollecting personal, family and social life when viewing images of familiar places. Interestingly, community places, such as town centres, seemed to elicit richer reminiscence than private addresses, such as former family homes. This might be because Google Maps images are available for streets only; images of homes and gardens might have elicited more reminiscence about family life.

In structuring reminiscence for older adults, family members might play a significant role, by suggesting meaningful locations and events, or providing family artefacts to be incorporated. It is likely that future personal digital artefacts will be automatically geotagged, facilitating inclusion of photographs and other media into place-based repositories for reminiscence. Such an approach might approximate the "place-biosketch", proposed by Chaudhury[21] as a tool to help older adults to capture and retain a sense of identity. Creating such a repository with family might entail "putting past to work":[22] creating new experiences and reconstructing the past by recalling and sharing memories.

Technologies for Place-Based Reminiscence

Findings from this study provide insights into challenges that older adults and RACF practitioners could face in using novel digital technologies for reminiscence. In this study, participants did not seem to have richer reminiscence experiences using VR for virtual visits, compared with the iPad. Furthermore, current VR technologies present challenges for older users, relating to sensory limitations, mobility impairments, physical frailty, and cognitive decline. Researchers' experience of acting as facilitators in this study, for example, indicates that immersive VR presents challenges for collaborative navigation and shared experiences.

Limitations and Future Work

It should be noted that recruitment by the RACF might entail sampling bias towards participants thought likely to enjoy reminiscence and technology use. This research entailed just two reminiscence sessions, conducted by researchers, and therefore cannot allow for definitive claims about benefits or issues that might be encountered by RACF staff. It would be valuable to work with RACF lifestyle staff to further develop best practice strategies for an ongoing program of place-based reminiscence. Future research might investigate reminiscence which combines digital mapping technologies with media from public sources or family

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archives. In line with prior work[9], our findings suggest there is a need for further research and design to improve usability of VR technologies for older users, including mechanisms for supported use.

CONCLUSION

In this study, we investigated how digital mapping technologies might support reminiscence for older adults in RACFs through virtual visits to familiar places. We found that for some older adults, virtual visits can be very moving experiences which engage important aspects of personal identity, while some perceive little value in them, and others prefer to avoid reminiscing. However, all participants engaged in varied forms of reminiscence relating to personal identity, social roles they had occupied, and relationships with others. Virtual visits can elicit mixed emotions, including feelings of sadness which lead some to avoid reminiscing about particular places or events. For family members, digitally-mediated reminiscence is of interest as a means to improve older adults' emotional and social wellbeing.

Several limitations of current VR technologies were found to hamper effective use for digital mapping-based reminiscence, indicating improvements are needed to address the needs of older users and those who support them in using digital technologies. Screen-based technologies, however, might allow for collaborative forms of reminiscence, combining digital mapping technologies with family photographs and other artefacts.

This research contributes new understandings of the role that digital mapping technologies might play in reminiscence activities in RACFs, and highlights considerations for deploying such technologies as part of enrichment programs in the future.

POLICY IMPACT STATEMENT

This study responds to interest in digital technologies as a means of promoting wellbeing for residents of aged care facilities. Findings point to opportunities, limitations and challenges for using tablets and virtual-reality headsets in place-based reminiscence with older adults. Study findings will be of interest to decision-makers seeking to promote the use of digital technologies in residential aged care.

PRACTICE IMPACT STATEMENT

Novel digital technologies allow for new forms of reminiscence activities which are of interest to some residents of aged care facilities. This study provides insights into the opportunities and challenges of using tablets and virtual-reality headsets for place-based reminiscence with older adults. Study findings will benefit facility providers and practitioners seeking to deploy digital technologies as part of enrichment programs.

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TABLES

Pseudonym	**Participation**	**Family Members Interviewed**	**Signs of cognitive impairment***
Carol	Tablet | VR (2 days apart)	-	None
Cleo	Pilot participant Tablet | VR (same day)	-	None
Graham	VR | Tablet (2 days apart)	Two daughters (interviewed together)	Repeated the same stories several times
Keith	Tablet only Declined second session	-	Could not remember details of past
Larry	VR; Tablet (1 week apart)	-	None
Olivia	VR; Tablet (1 week apart)	Son	Spoke about her experience of memory loss
Viola	Tablet; VR (1 week apart)	Daughter	Daughter spoke at length about her mother's dementia

Table 1: List of research participants, showing technology used in their reminiscence sessions, and family members interviewed (if applicable).

*Based on researchers' observations during the sessions, not a formal diagnosis

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APPENDICES

Appendix I: Initial questions

1. What is your age?
2. What is your gender?
3. How long have you been living at BASSCare?

Thinking about digital technologies such as computers, iPads and smartphones, to what extent do you agree or disagree with the following statements (where 5 is strongly agree and 1 is strongly disagree)

4. I sometimes enjoy using digital technologies
5. I think digital technologies can be beneficial for society
6. I can generally use digital technologies effectively

Appendix II: Semi-structured interview questions for older adults

1. Can you describe what you liked about this sort activity?
2. Can you describe what you didn't like?
3. Would you have any concerns about other residents doing this type of experience? If so, what?
4. How easy or difficult did you find it to explore and look around?
5. To what extent did you feel you absorbed in the experience?
6. What did it feel like to talk to us [the researchers] while you were using [the iPad / the VR headset]?
7. Did you feel confused or disoriented at any stage during the experience?
8. Do you have any other comments about that experience?

Appendix III: Experience rating questions

Thinking about today's reminiscence activity, to what extent would you agree or disagree with the following statements (where 5 is strongly agree and 1 is strongly disagree):

1. The experience felt like visiting and exploring a significant place
2. It prompted some interesting personal memories
3. It was a good way to discuss meaningful memories with other people
4. It was an emotional experience

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Appendix IV: Semi-structured interview questions for family members

1. When you heard about the study, what were your motivations for recommending your loved one be involved in the project?
2. When reading the recruitment poster, what were your expectations about the role this technology could play in your loved one's life
    - What benefits were you anticipating?
3. Do you think that digital technology has a particular role to play in older adults' recollection of the past?
4. If it were possible to capture digital reminiscence sessions with your loved one, would the results of that be of value to you and your family?
    - How do you think you would make use of that?
5. Is there anything else that you think you and the rest of your family might get out of this?
6. Have you spoken with your [family member] about the digital mapping session?
7. If so, what were his / her thoughts?
8. What are your thoughts based on what you've learned about that session?
9. Did that change your opinion about the potential for digital technology to be used as a reminiscence tool?

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