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Understanding perspectives of older adults on the role of technology in the wider context of their social relationships

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Abstract

Technological interventions are increasingly popular methods of targeting and preventing loneliness in older adults. Research has identified various factors that influence the willingness and propensity of older adults to integrate technology into their social lives and the ways in which this may enhance their social connectedness. Given prevalence rates and negative outcomes associated with loneliness for this population, further research is warranted to clarify the mechanisms through which technological interventions may decrease loneliness. This study aimed to better understand the perspectives of older adults on the role of technology in their social relationships in later life. Four focus groups were conducted with 27 older adults, aged 65–80 years. Transcripts were analysed using thematic analysis, and results were validated via written participant feedback. Participants reported technology as one of many tools used to maintain their social relationships. Their choice to use technology for social interaction was influenced by their estimation of effort required, likely quality of the interaction, and the privacy and security provided. These factors were the same as those that influenced decisions to use other methods (e.g. face-to-face meetings). Based on the results, we recommend that loneliness interventions should be technology-agnostic and multifaceted, providing a wide range of tools that recognise the technological competencies of older adults and supporting different interaction types to meet the preferences of the individual.

Keywords: social relationships; loneliness; older adults; Australia; technology use; Technology Acceptance Model

Introduction and background

Loneliness is a serious and widespread health concern with significant physiological and mental health implications for individuals and the broader community (Cacioppo *et al.*, 2002; Heinrich and Gullone, 2006; Hawkey and Cacioppo, 2010; Lim *et al.*, 2020b). Loneliness is defined as the subjective experience of social isolation, and is more related to quality than quantity of relationships (Perlman and Peplau, 1982; Hawkey *et al.*, 2008). It has been associated with a 26 per cent increased likelihood of death, making it comparable to other risk factors for mortality such as obesity (Holt-Lunstad *et al.*, 2015). Social connection, an umbrella term encompassing the structure, functions and quality of social relationships (Holt-Lunstad, 2021), is a protective factor against cardiovascular disease, depression and cognitive decline (Lee and Robbins, 1995, 1998; Cacioppo *et al.*, 2002, 2006; James *et al.*, 2011; Holt-Lunstad, 2021). Research indicates that higher rates of loneliness are also associated with higher rates of depression, partly due to a lack of social support (Liu *et al.*, 2016). As proposed by House's well-established categorisation, social support can involve various forms (House, 1981). Emotional support refers to providing a sense of trust and love, while companionship support refers to a sense of social belonging created by shared activities. Informational support may involve providing advice or knowledge, whereas instrumental support involves the provision of resources, including time or materials (House, 1981).

Research regarding negative health outcomes associated with loneliness has resulted in it emerging as a public health priority in many countries. In the United Kingdom, a 'Minister for Loneliness' was appointed and a public health campaign, the Campaign to End Loneliness, was established to prevent and address loneliness in the community (Campaign to End Loneliness, 2018). Ending Loneliness Together in Australia, an Australian not-for-profit dedicated to addressing chronic loneliness, was established because loneliness is identified as an emerging issue for Australians (Lim *et al.*, 2020a). One in four Australian adults are reported to experience problematic levels of loneliness (Abbott *et al.*, 2018; Lim, 2018).

Loneliness in older adulthood

Loneliness prevalence rates are highest among those aged 65–75 years (Nicolaisen and Thorsen, 2016; World Health Organization, 2021). International rates of loneliness in older adults range from 5 per cent in Finland (Savikko *et al.*, 2005) to 9–10 per cent in Great Britain (Victor *et al.*, 2000). In Australia, one study reported a 7 per cent prevalence of severe loneliness in Perth adults aged 65–85 years, with a further 31.5 per cent reporting feeling lonely 'sometimes' (Steed *et al.*, 2007). The role of individual risk factors, social-cultural contexts (*e.g.* norms and values) and psychosocial resources (*e.g.* coping behaviours) in contributing to loneliness over time for older adults were highlighted within a recent conceptual model proposed by Burholt *et al.* (2020). However, this model does not explain the various links between these factors and loneliness specifically.

Reviews and meta-analyses have identified specific individual risk factors for late-life loneliness, including marital status (*i.e.* divorced, widowed or never married), gender (*i.e.* women are at a greater risk), living alone, limited mobility and

physical independence, ill-health, limited leisure activities, low socio-economic status, language and literacy barriers, loss of a sense of neighbourhood community, recent loss of family or friends, security issues and concerns for personal safety, personality factors (*i.e.* introversion, lack of social motivation), and earlier life trauma and experiences (Pinquart and Sorensen, 2001; Stanley *et al.*, 2010; Cohen-Mansfield *et al.*, 2016).

Loneliness interventions for older adults

A variety of technological and non-technological interventions have been designed to target loneliness for older adults, with varying efficacy and levels of accessibility reported (Masi *et al.*, 2010; Choi *et al.*, 2012; Stojanovic *et al.*, 2017; Gardiner *et al.*, 2018; Poscia *et al.*, 2018). Technological interventions have generally incorporated information and communication technologies (ICTs), including personal computers, the internet and mobile phones (Heeks, 1999), however, newer research has extended this scope to include immersive experiences (augmented or virtual reality) and robotics (Khosravi and Ghapanchi, 2016). Whilst various studies indicate that technological interventions increase social connectedness, it is unclear whether they effectively decrease loneliness by replicating high-quality interactions online (*e.g.* Tsai *et al.*, 2010). Furthermore, existing findings relating to the efficacy of technology on loneliness is mostly cross-sectional, and contradictory (Cotten *et al.*, 2013; Nowland *et al.*, 2017).

In an early review of health promotion intervention studies targeting loneliness among older people, only ten of the 30 reviewed interventions were effective (Cattan *et al.*, 2005). In a more recent review, 71 per cent of (N = 27) interventions were found to be effective in reducing loneliness, including nine technological interventions (Gardiner *et al.*, 2018).

Technological interventions in particular represent a growing area of research, as they provide opportunities for interactions despite physical isolation caused by rurality, limited mobility or residence in an aged care facility.

The increasing focus on technological interventions is also unsurprising given the growth in internet use in older adults, with the rate of internet use in Australians aged over 65 years increasing over the last ten years from 31 per cent in 2008 to 55 per cent in 2018 (Australian Bureau of Statistics, 2018). Notably, the internet usage rates are even higher around pre-retirement age, at 82.8 per cent for those aged 55–64 (Australian Bureau of Statistics, 2018). However, nationally representative data from the United States of America indicate that older adults face digital inequalities in accessing reliable internet and adopting social networking sites, particularly for those experiencing economic, sociocultural or physical disadvantage (Ihm and Hsieh, 2015; Yu *et al.*, 2016).

Whilst technological interventions may have a vast array of functions, assistive technologies are innovatively designed to enhance or maintain the functional capacity of those living with cognitive, physical or communicative decline or disability (Marshall, 1997). A systematic review of assistive technologies for older adults found that 88 per cent (seven of the eight interventions) were effective in increasing social inclusion, reducing social isolation or loneliness (Khosravi and Ghapanchi, 2016). However, half of these studies utilised robotics technology, which are less

accessible and financially viable for distribution to the general community, when compared with ICTs. The methodologies of the remaining studies differed widely, incorporating different interventions ranging from computer training (Blažun *et al.*, 2012) to an online community forum (Bradley and Poppen, 2003). The extent to which findings from such disparate methods can be generalised is therefore somewhat limited. A small body of research has attempted to explore the perceptions older adults may hold in relation to social media, which highlighted privacy as their primary concern and a key barrier to adopting this technology (Xie *et al.*, 2012). However, this particular study was limited to exploring perceptions around existing social media platforms and recruited a small convenience sample of participants (N = 10) with a relatively high level of experience with technology.

While findings of reviews indicate that technology may have the potential to help manage or reduce loneliness among older adults, they also highlight the preliminary nature of the current evidence base and the need for more interventions to be designed *with* older adults, rather than based on assumptions *about* older adults (Lindley *et al.*, 2008; Choi *et al.*, 2012; Gardiner *et al.*, 2018). Recent evidence has also highlighted the dynamic and bidirectional relationship between loneliness and social internet use, in that those experiencing loneliness may be more likely to displace offline connections with online interactions (Nowland *et al.*, 2017). As proposed within the *displacement* and *stimulation hypotheses*, technological tools may reduce loneliness by enhancing existing and initiating new relationships, or they may increase loneliness by displacing offline interactions. Therefore, support is needed to encourage individuals to utilise technology in ways that enhances their existing connections and enables initiation of new relationships.

Role of technology in older adult social relationships

The development of technological loneliness interventions for older adults has primarily been informed by the Technology Acceptance Model (TAM; *e.g.* Sum *et al.*, 2008; Chung *et al.*, 2010; Braun, 2013). The TAM posits that external variables (*e.g.* demographic characteristics, perceived internet self-efficacy and technology features) influence perceived usefulness and ease of use, which then affect attitudes towards using technology (Davis *et al.*, 1989; Chung *et al.*, 2010). In turn, such attitudes affect one's behavioural intention to use and, ultimately, actual use or adoption of a specific technology (Davis *et al.*, 1989). Recent research has highlighted that providing a high-quality and credible user experience is a key influence on an individual's perceptions of ease of use and usefulness (Portz *et al.*, 2019). However, perceived enjoyment has been identified as a stronger predictor of attitudes than ease of use and usefulness (Hornbæk and Hertzum, 2017). Several revisions to the TAM have also been proposed, including the Senior Technology Acceptance Model (STAM), which includes factors specific to older adults, including social influence, facilitating conditions, experimentation and exploration. Notably, it also includes a rejection outcome rather than implying eventual technology acceptance by all users (Renaud and Van Biljon, 2008). The Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh *et al.*, 2003) has been proposed as an alternative model, which highlights social influence, effort and

performance expectancy in influencing behavioural intentions and use behaviour. These three models have been applied to explain users' engagement with various applications of technology, ranging from social media use to e-learning (Masrom, 2007; Rauniar *et al.*, 2014), with research suggesting that usefulness is a primary driver of behavioural intention, regardless of whether they perceive having difficulty executing such intentions (Chung *et al.*, 2010; Braun, 2013). Other research profiling how older adults use technology has found that older adults primarily use the internet for discrete tasks such as asynchronous communication (*e.g.* to send or read email, send instant messages or take part in online discussions), information-seeking (*e.g.* in relation to a hobby or interest) and financial transactions (*e.g.* online purchases or banking) (Sum *et al.*, 2008), rather than for new or ongoing social interactions.

An important limitation of using the TAM/STAM for researching and developing loneliness interventions is that these models fail to consider the fit of technology within the much wider non-technological social life of the individual, as the model only considers specific drivers of technology use (Figure 1). For example, Braun's (2013) study of social networking use among older adults considered the perceived usefulness, ease of use, trust in and social pressures to use social networking sites only. The study did not consider how other key factors in the social lives of older adults, such as their living arrangements, existing quality and quantity of face-to-face friendships and neighbourhood social contacts, mobility, physical independence and socio-economic status (Pinqart and Sorensen, 2001; Stanley *et al.*,

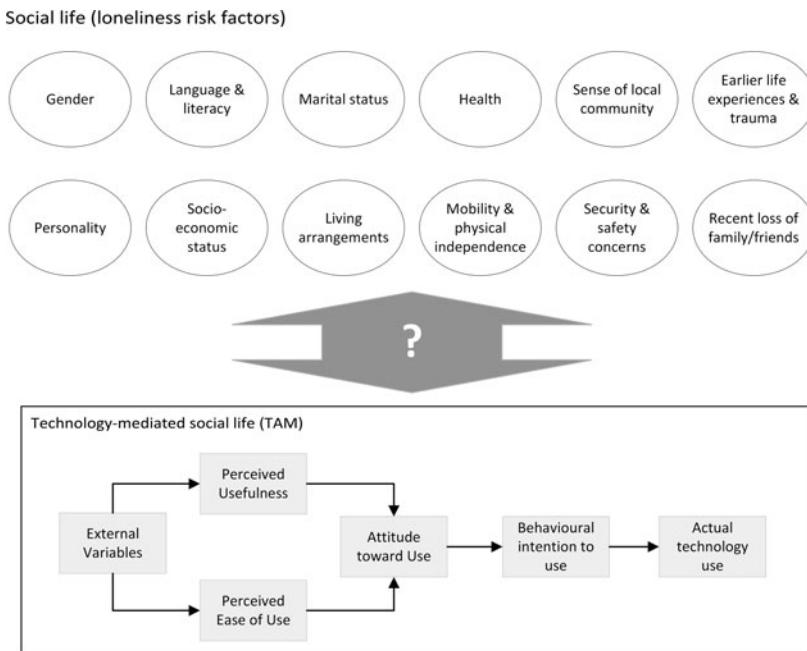


Figure 1. Alignment between the Technology Acceptance Model (TAM) and risk factors associated with loneliness.

2010; Cohen-Mansfield *et al.*, 2016) may have affected participants' perceived usefulness, ease of use, trust in and social pressures to use social networking sites. Existing research, therefore, has not considered whether the factors that drive individuals' face-to-face social interactions are the same as those that drive their technologically mediated social interactions.

Study aim

The aim of the study was to develop an understanding of the perspectives of older adults on the role of ICTs in social relationships in later life to better inform future interventions targeting loneliness in older adults. Specifically, we were interested in exploring whether: (a) the factors that drive individuals' face-to-face social interactions are the same as those that drive their technologically mediated social interactions; and (b) in what circumstances older adults would choose to use technology over face-to-face or more traditional (*e.g.* letter) social interactions.

Methods

Research approach and methodology

The study was conducted as part of a larger project, in partnership with Relationships Australia Victoria, which aimed to develop an intervention to prevent and reduce loneliness in older Australians (Al Mahmud *et al.*, 2022). The project adopted a flipped health-care model to allow consumers to direct the development of the intervention (Vallo Hult *et al.*, 2019). We conducted focus groups to explore the perspectives of older adults on several areas of interest, including the maintenance and initiation of older adults' relationships and use of technology in social relationships. The use of focus groups allowed participants to express and exchange their views on this topic, thus leading to an interactive and iterative exploration of the topic (Krueger and Casey, 2015).

Setting

Four focus groups were conducted, three in metropolitan Melbourne and one in regional Victoria, Australia. Focus groups lasted approximately two hours and were facilitated by MHL, SC, KH and AAM. Each group comprised between six and eight participants (mean = 7.33, standard deviation (SD) = 0.82).

Participants

Participants were recruited by Relationships Australia Victoria (2018) using letter-box drops, advertisements on the Relationships Australia Victoria website, social media posts, and flyers displayed by local councils, libraries, neighbourhood centres, support organisations and seniors' groups. Participants were reimbursed Aus \$50 for their time and travel expenses for each workshop. A participant information sheet was provided prior to the first focus group, and participants had the project verbally explained to them at the start of each focus group. All participants provided written informed consent at the beginning of the first workshop they

attended. The project was approved by the Swinburne University Human Research Ethics Committee.

To explore the characteristics and representativeness of the sample, participants completed the following self-report measures before focus group discussions: demographic questionnaire, UCLA Loneliness Scale – Version 3 (Russell, 1996), De Jong-Gierveld Loneliness Scale (De Jong Gierveld and Van Tilburg, 2006), Geriatric Depression Scale (Hoyl *et al.*, 1999), Geriatric Anxiety Inventory – Short Form (Byrne and Pachana, 2011) and Lubben Social Network Scale – 6 (Lubben and Girona, 2003). Participants were identified by a pre-filled participant code and demographic data were manually inputted into a password-protected Excel spreadsheet. A summary of participant characteristics is provided in Table 1.

Table 1. Participant characteristics compared with age-matched population norms or comparative samples from similar research

Variable	N	%	Population norm (%)
Gender			
Female	16	59.3	51.2 ¹
Male	11	40.7	48.7 ¹
Age			
65–69	9	33.3	32.3 ^{1,2}
70–74	15	55.6	24.1 ^{1,2}
75–79	2	7.4	17.8 ^{1,2}
80–84	1	3.7	12.5 ^{1,2}
Education			
Pre-year 12	1	3.7	17.8 ¹
Year 12	7	25.9	32.8 ¹
Post-secondary	19	70.4	36.5 ¹
Employed	3	11.1	21.0 ¹
Marital status			
Married/ <i>de facto</i>	17	63.0	65.1 ¹
Divorced/separated	8	29.6	18.7 ¹
Widowed	1	3.7	10.4 ¹
Single	1	3.7	5.7 ¹
Household size			
1 (lone household)	8	29.6	18.4 ¹
2	13	48.1	–
3+	5	18.5	–
Carer	1	3.7	20.0 ³

(Continued)

Table 1. (Continued.)

Variable	N	%	Population norm (%)
Religion			
Christian	8	29.6	67.7 ¹
Atheist/secular/agnostic	12	44.4	18.8 ¹
Buddhist	2	7.4	1.6 ¹
Hindu	5	18.5	0.51 ¹
Location			
Regional Victoria	8	29.6	
Melbourne	19	70.4	
Ethnicity			
Caucasian	19	70.4	
Asian	8	29.6	
		<i>Mean values (SD)</i>	<i>Comparative sample, mean values (SD)</i>
Geriatric Depression Scale		0.50 (0.91)	1.73 (2.19)6 to 2.2 (2.5)7
Geriatric Anxiety Inventory – Short Form		1.04 (1.60)	1.2 (1.3) to 1.2 (1.7)7
UCLA Loneliness Scale		37.19 (8.74)	35.61 (10.11) ⁴
De Jong-Gierveld Loneliness Scale			
Emotional loneliness		0.74 (0.90)	0.63–1.48 ⁵
Social loneliness		1.44 (1.25)	0.95–2.27 ⁵
Lubben Social Network Scale – 6			
Family social support		9.15 (3.52)	9.05 (3.24) ⁸
Friend social support		10.85 (3.30)	8.03 (3.74) ⁸

Notes: 1. Australian Bureau of Statistics (2017). 2. Calculated as percentage of total older people (65+ years). 3. Australian Bureau of Statistics (2016). 4. Steed *et al.* (2007). 5. De Jong Gierveld and Van Tilburg (2010). 6. Campbell *et al.* (2017). 7. Byrne and Pachana (2011). 8. Pilkington *et al.* (2012). SD: standard deviation.

The sample comprised 27 adults aged 65–80 years (mean = 70.6, SD = 3.7). Each participant attended at least one focus group, with two participants attending two focus groups (*i.e.* Group 1 or 2 and Group 4). Compared to all Australian adults aged 65–75 years (Australian Bureau of Statistics, 2016, 2017), the sample had an overrepresentation of participants who were female, had post-secondary education, were divorced/separated, lived alone, and had secular or Hindu religious beliefs. Participants also reported lower depression scores and greater friend social support than found in similar studies of older adults in Australia (Steed *et al.*, 2007; Byrne and Pachana, 2011; Pilkington *et al.*, 2012; Campbell *et al.*, 2017), and internationally in France, Germany, The Netherlands, Russia, Bulgaria, Georgia and Japan (De Jong Gierveld and Van Tilburg, 2010).

Data collection

The first three focus groups aimed to develop an understanding of how technology plays a role in initiating and maintaining relationships. Focus group questions (Table 2) were developed for the project by MHL and SC and were revised prior to each focus group as new concepts and issues emerged from the focus groups and stakeholder reflections. Participants in the fourth focus group were provided with a written summary and presentation of the findings from the first round of focus groups and were invited to provide feedback. The focus groups were audio-recorded and transcribed verbatim. Audio recordings, notes and documentation were de-identified using a participant code, prior to being imported into NVivo 11 (QSR International, Melbourne).

Data analysis

The qualitative data were analysed using inductive thematic analysis (Braun and Clarke, 2006). Analysis involved constant comparison and concurrent data collection and analysis. Transcripts of the first two focus groups were analysed by KC and KML using open coding to identify emergent concepts. These codes were then compared and discussed between KC and KML to identify higher-level themes. The coding framework was subsequently used by KC and KML to close code the transcript of the third focus group. This process allowed the researchers to test the adequacy of the themes against the new data. Relationships between concepts were identified through the use of coding matrices and by identifying the causal and temporal language in participants' statements (*e.g.* when, after, before, since, then) (Miles *et al.*, 2014). Specifically, matrices were used to compare the relevance

Table 2. Example focus group questions

<p>Establishing and maintaining relationships</p> <ul style="list-style-type: none"> • Where have you formed important or meaningful relationships in your life? • How do you maintain your existing relationships? • Do you have any concerns about being able to maintain relationships in the future? What do you feel might get in the way? • If you wanted to initiate or establish new relationships, how would you go about doing that? What might get in the way of that? • Have you made any new friends in the last decade? How? • How have your relationships changed over your life? Have they expanded or contracted since you retired? Why? • What is the role of family, neighbours, relationships with younger generations in your lives? • Do you have people in your lives who you feel comfortable sharing problems with and where do you find them?
<p>Digital platforms and relationships</p> <ul style="list-style-type: none"> • What role does technology play in your social relationships? • How important are digital technologies in making new friends in older age? • How important is face-to-face social interaction as opposed to maybe a phone, text messages? • Which digital platform do you use the most or are you the most comfortable with? • What are the key features of digital platforms that make it attractive or difficult for you? • What else would help with your social connections and sense of connection to the world?

of the generated themes for technology-mediated *versus* non-technology-mediated interactions and to explore the patterns of relationship types described by participants. Where necessary, the framework was adapted to incorporate new concepts identified at this stage. A literature review was conducted in parallel, to help situate the results in the wider body of research on older adults, social connections and technology.

Rigour was ensured by prolonged engagement with the participants (*i.e.* over repeated focus groups), triangulation of the data and interpretations across focus groups and between investigators, peer-debriefing and member checks (Lincoln and Guba, 1985). Member checks (Birt *et al.*, 2016) were conducted by mailing or emailing a preliminary report of the findings to all 18 previous focus group participants. Question prompts were embedded throughout the report prompting participants to reflect on the completeness and representativeness of the analyses, *e.g.* ‘Are there any functions of social relationships that we have missed?’ ‘Is there anything you would like to add or correct in these interpretations?’ Seventeen participants returned the report with comments, with their responses only identified by a pre-filled participant code. Data from member checks were coded against existing themes.

Results

Participants used a wide range of technologies to facilitate social interactions. They most frequently mentioned telephones and social media (predominantly Facebook with one participant using Instagram), but also discussed using emails, messaging apps (*i.e.* WhatsApp, Skype, Facebook Messenger), multiplayer games (*i.e.* Words with Friends, Scrabble) and shared drives (*i.e.* iCloud for photo sharing).

Four themes were generated to describe the social relationships of older adults and the factors affecting their choice of social contact method (*e.g.* face-to-face, telephone, emails, social media/messaging apps). The interrelationships between these themes are depicted in Figure 2. In summary, older adults’ social relationships were defined by both their *source* and *function*. Relationships required ongoing *maintenance* through meaningful contact. The type of contact and ease of maintenance was *affected by* a range of factors, including: individual traits; opportunity and access to connections; life transitions; a desire for independence, control and choice; effort and learning required to interact; and social and community norms.

We found that the same factors affected participants’ choice of ICT and face-to-face contact. Participants actively chose a method of social contact based on the effort required, the quality of the contact provided, and the privacy and security of the method, given any opportunity and access limitations.

Below we describe each of these themes in more detail. Representative quotes are provided with the data source, participant ID and associated demographics where possible. Audio-only recording meant that at times it was impossible to distinguish individual speakers.

Social relationships are defined by their source and function

Participants’ social relationships were defined by the interplay of the source of the relationship and its function. For example, while one old school friend (source) may only

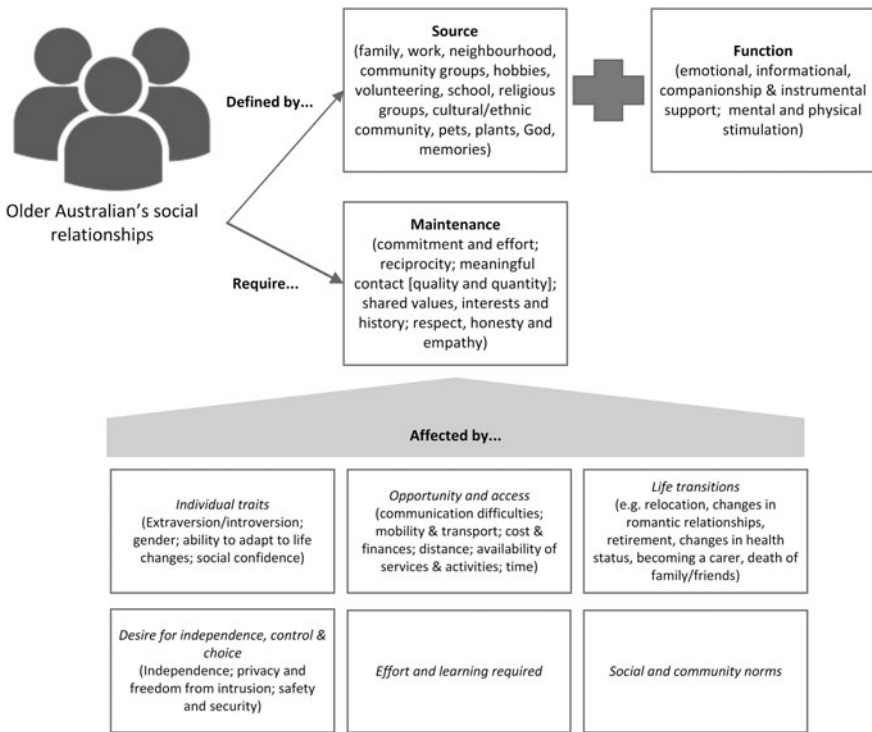


Figure 2. Thematic description of older adults' social relationships.

provide the function of companionship (e.g. doing activities together), another may also provide emotional support (e.g. sharing worries). Participants' sources of social connections came from a variety of contexts, social roles and non-human sources, such as: family (including spouses), neighbourhood (including direct physical neighbours and members of the local community), work, community and religious groups, hobbies, volunteering, schooling (both as students and as grandparents/parents of school-aged children), membership of a cultural or ethnic group, pets, plants, a personal relationship with God and past memories (for representative quotes, see Table 3).

The main functions of participants' relationships aligned with House's (1981) typology of supportive behaviours – emotional, companionship, informational and instrumental support. Social relationships also promoted a sense of physical and mental wellbeing, by providing stimulation and encouraging a sense of connectedness.

Emotional support, the offering of a sense of trust, empathy, concern, affection or love, was primarily provided by spouses or long-term friends from work or schooling in a reciprocal manner. For example, one participant highlights the reciprocity and unconditional emotional support she receives from five of her school friends:

We support each other with family issues, they're the people we go to, we're there to talk to each other and support each other no matter what. We've often said we're like sisters really. (Focus Group (FG) 1, Female (F))

Table 3. Relationship source with representative quotes

Source	Representative quotes
Community groups, hobbies and volunteering	I also work as a volunteer ... I don't think it provides friendships necessarily ... at one stage I did look at it as providing other avenues to create friendships, but I probably now that I've been doing it for three years, think slightly differently. But it's still a nice sharing of thoughts and ideas. (FG4, P8, F, 69 years)
Family	My best friend is my husband. (FG2, P12, F, 74 years)
Work	What I didn't realise is how, over working for 45 years ... How your network is centred around work. When you retire, one day, ... there's a few that I keep the odd contact with, but pretty much in one day that whole network's dropped off. (FG3, P18, M, 65 years)
Schooling	I have 61 years of friendship with five of my school friends and we still see each other. (FG1, F)
Neighbourhood	Neighbours, they are very important in my life. (FG1, F)
Cultural/ethnic community	Connecting with other eth[n]ic clubs!! I was invited to lunch by an Italian friend at her Italian Club and connected with a number of lovely Italian community leaders! (MC, P4, M, 73 years)
Pets	Just before Christmas I got a little rescue dog and he is wonderful for companionship. And you take your dog out and everybody talks to you. (FG4, P15, F, 75 years)
Garden	For me, the garden provides a source of relationship with nature. (MC, P9, M, 73 years)
Online	I'm building up some contacts that I can exchange stories with over the internet. And I'm wondering whether I build up a network that's not dependent on being able to be mobile that might survive. (FG1, M)
Through children	Our daughter and grandchildren's friends and families up over from our own [extended] family... (MC, P9, M, 73 years)
Religion	I have a friend who's very strongly Christian and I can't speak for her of course but I'm wondering if she would say that she has what she believes a real relationship with God. (FG4, P26, F, 71 years)
Memories	Memories (e.g. remembering what it is like to chat/do something with your deceased spouse, or a mentor, or a close friend). (MC, M)

Notes: FG: Focus Group. P: Participant. F: Female. M: Male. MC: Member Check.

Instrumental support was most common in family and neighbourhood relationships. Older adults both provided and received this form of support, albeit in different relationships (e.g. giving support to grandchildren, receiving help from neighbours). This participant highlighted their reciprocal relationship with neighbours and described some of the instrumental tasks of looking after children and animals that had led to a friendship:

Neighbours, they are very important in my life. We look after each other's animals when either of us go away, the kids have always grown up as they'd be mine, I don't have children. There's a real looking out for each other and the friendship that's developed over the years. (FG1, F)

Companionship support, a sense of social belonging created by shared activities, generally occurred in neighbourhood interactions, community groups, hobbies and volunteering. These relationships tended to lack the depth of other relationships. As one participant described when asked about his new friendships:

A few new friends from my line dancing class at a community house, but I'm not as close with them as with a lot of my other friends. (Member Check (MC), Participant (P) 26, F, 71 years)

Informational support, the provision of advice or information, was most often provided by older adults to younger generations through family relationships or volunteering. This was a role that was very much valued by the participants, but sometimes seen as missing:

I think it's very important to communicate to the younger generations. I think that's what we're missing out on today ... once upon a time, the grandparents would teach the grandchildren a lot of things about the old days and their youth and that. But I don't think that's done quite so often in these days and I think it should be. (FG3, P19, F, 70 years)

Mental and physical stimulation was provided by intergenerational interactions and community group involvement. For example, one participant highlighted how much she valued having younger people in her life as they challenged her ideas and opinions on the world:

I like to contact younger people. I like to have them in my world. Last Saturday I had afternoon tea with former colleagues, and also people from other countries and that was really lovely. So I've got young mums, so my garden was full of young children running around. Which was a bit exhausting! (laughter) I really like to have young people as they challenge me; I get a bit set and opinionated about some things. We have nice discussions. (FG1, F)

This relationship between the source and function of relationships suggests that certain relationships are less 'replaceable' in later life. For example, long-term childhood or workplace friends who provide the most emotionally supportive relationships are likely harder to replace as older adults are no longer in these settings. They also lack decades over which to build and deepen these relationships through reciprocal maintenance.

Relationships require maintenance

Participants described their social connections as in a constant state of change, hence requiring ongoing maintenance. They identified several key maintenance factors.

Participants explained that personal commitment and effort were necessary to ongoing relationships, however, to sustain social connections over time, the commitment and effort needed to be reciprocal:

I think what ultimately matters is your own attitude and commitment to yourself and your people around you, and last but not least the trust in you and the trust in others too. To make sure that the relationship grows. (FG2, P10, Male (M), 76 years)

When reciprocity was not present, participants described it as leading to a sense of distance or a loss of friendship:

It's hard or not possible to be friends with someone to whom you give a lot of one-way support. (MC, P26, F, 71 years)
I feel like I make more effort towards my family members, making more time to go and see them or keeping in contact over the phone for instance. But family relationships are very much a moving feast and sometimes family members come closer and sometimes they, we have more distance. (FG1, M)

This commitment, effort and reciprocity created opportunities for meaningful interactions, which participants generally defined as regular face-to-face contact:

I think for my mental health, that's what I've come to see that I need to be in contact with people at least two or three times a week I would say. (FG3, P22, F, 65 years)
I'm more of a people person, I like to speak to people on the phone. But I would rather drop in and see someone. I'm not great on the computer. I've got one, but it's not my lifeline like some people. (FG2, P10, M, 76 years)

Many participants reported using messaging apps to share information and photos, and video-chat with existing contacts overseas and interstate, but 'still prefer using [a] landline for long, intimate phone conversations when [they] or a friend feel the need' (MC, P26, F, 71 years). This reflects participants' opinion that more recent technologies provide lower-quality social interactions than face-to-face or telephone contact, but also offer lower-effort solutions for group and long-distance communication. As one participant said:

To my mind, there are limited applications [of technology] to improving interpersonal relationships. It has got a purpose, it has a way of facilitating things, but nothing like person-to-person contact. Or seeing and meeting. It's a bit impersonal to me. (FG2, P14, F, 70 years)

Shared values and interests were important factors in friendship initiation, *e.g.* 'You make friends in your same interest group, or as you say, belief systems too' (FG3,

P19, F, 70 years), but less so in relationship maintenance. In relationships where participants had a long-term friendship with a shared history, similarities in values and interests were reported to be less important than mutual respect, honesty and empathy. As one participant shared:

Why would you have anybody in your life that isn't going to respect you, listen to you and whatever. And while I can have those people in my life, the people that I really want to spend time with are the people who are going to listen and hear what I have to say and be empathetic to where I'm at. (FG3, P22, F, 65 years)

This difference in the need for shared values and interests again highlights the subtle differences in the implicit rules that govern long-term relationships *versus* newer relationships.

This theme also begins to highlight the role of technology in the maintenance of older adults' social relationships and highlights two factors, quality and quantity of contact, that older adults consider when deciding whether to use technology-mediated contact. Further consideration of older adults when choosing to use technology-mediated contact are discussed in the next theme – factors affecting maintenance.

Factors affecting maintenance

Participants identified a range of factors affecting their capacity and desire to maintain relationships (see Figure 2).

Many participants attributed the social isolation of other older adults to a range of individual traits, such as extraversion/introversion, male gender, lack of social confidence, and an inability to plan for or adapt to changing personal circumstances, as represented in the following statements:

Some people are extroverts – they actually need the company of others to feel energised and happy. As they get older and their circle of friends starts to get smaller, they really feel the loss.

Interestingly, nearly all of the men in my retirement village keep to themselves – they are not interested in socialising with anyone else in the village. (MC, P26, F, 71 years)

There are a whole lot of people that can't push themselves to join or go out. That's just a personality thing I think or lack of confidence. (FG1, F)

They generally perceived social isolation as a choice and expressed concerns about interacting with lonely individuals due to a risk they might become 'too dependent', thus creating a non-reciprocal relationship that may 'limit [their] own choices' of social interactions. One participant shared their experience of working with older people where they 'found they become dependent and manipulative', creating 'a position that's hard to get out of' (MC, F).

Participant's desire for independence, choice and control in their social interactions was also reflected in participant concerns regarding their privacy, safety and security in technology-mediated social interactions. As represented by the quotes below, they generally described a lack of trust with newer technologies and found

them intrusive, which led to a conscious choice to limit their sharing of private information on these platforms:

This day and age Google knows where you live anyway and how many times you go to the bathroom. (FG4, P25, F, 65 years)

Our generation are thinking like you that we don't trust the system. The young ones I think are far more comfortable with it. (FG3, P18, M, 65 years)

Facebook, I believe, I call it a 'Gossip Book'. I don't really do too much with private information. But general information. (FG2, P13, M, 65 years)

Life transitions were one of the key drivers of significant change in participants' social networks throughout their lives (Table 4).

There was often a reciprocal relationship between these life transitions and the individual's opportunity and access to social interaction (Table 5).

In fact, physical distance caused by life transitions seemed to be one of the primary factors driving older Australians to use technology for social interactions. Participants reported using a range of different social media to stay connected with both friends and family overseas and interstate:

I love Facebook simply because we have friends all over the world, you see. (FG1, M)
Instagram, I joined because a friend was going away ... so I had to learn how to ... and it's been great for that purpose. I love Facebook, I can't say that I post very many things up. But the connectedness because of the next generation and the one after that is terrific. Because the important parts of my family live in Western Australia, and so you know I can be daily connected with them without too much effort. (FG1, F)

I have four lovely daughters who work overseas and are travelling ... and each morning we communicate with each other through the digital media, WhatsApp. I have a daughter who attended an international women's conference in Florida and she's now working in Dallas then she'll fly back to London. Each morning we apped each other, so we are in connection constantly because it's so important. I mean I don't know what we would do if we didn't have a digital technology. (FG1, M)

Other key drivers of relationship maintenance included social and community norms and the effort required for social interaction. One participant highlighted the difference between regional and urban community norms of social interaction:

I just think there's almost like a different culture that's in, what I call regional areas. And people are really happy to stop and talk to you in the street. I mean there's a whole range of things. That's the difference that I really noticed from living in like semi-suburbia to moving to regional Victoria anyway. (FG3, P22, F, 65 years)

While another highlighted how easy social media makes sharing family updates and limiting the time and depth of interactions to suit them:

And also you can send photos. And that's a lovely quick way of communicating something about what's going on in your family's life. And the other one, a big

Table 4. Key life changes with representative quotes

Life changes	Representative quotes
Changes in romantic relationships	They might get married or you might get married, and things change. (FG3, P20, F, 67 years) I think quality with family, in my case, has been weakened by the number of people who joined the family later on. Girlfriends have remained really firm because their partners aren't really included in what we do. (FG1, F)
Relocation	I often look back and think I was disadvantaged by moving interstate as a teenager with my family so I lost all those connections before they had grown enough to become lifelong. And then moved again, after that away from my family to Melbourne and I felt I was – only with the benefit of hindsight – disadvantaged by that. (FG1, F)
Retirement	Worked in a big organisation with lots of colleagues and developed one or two friendships there. But nothing lasted after I left work. (FG1, M)
Changes in health status	I went through two cancers and each time I had to retreat in order to save myself, and to rejuvenate. (FG2, P14, F, 70 years) We've got a perfect example of someone who lives around here who is very technically proficient. But because he's not well he's now isolating himself from society. (FG3, P16, M, 74 years)
Becoming a carer	At the moment I've got neighbours. She's in her middle eighties, I would say, and she's got an intellectually disabled daughter. Now she used to be very involved in a lot of community things and well-known in the town. But now her and the daughter have become totally isolated in the house. (FG3, P23, F, 68 years)
Death of family/friends	One bloke came along, his wife has died, he used to belong to a group of couples that used to go and do things together and so on. When the wife died he just didn't feel right, you know? Little things like that can change. (FG1, M) And then when my mum died all the family broke away. We've been through up and down. But I've struggled through. And I have two sisters, they've parted from our family through when my mum died. (FG3, P17, F, 69 years)

Notes: FG: Focus Group. P: Participant. F: Female. M: Male. MC: mMember Check.

addition is messaging. Because it now means we can have a quick conversation with someone without having a conversation, without having to fully engage with them. You can just pass on a little bit of information. (FG1, M)

Some participants also perceived or had experienced a steep learning curve in adopting social technologies, which some participants found especially frustrating as they have found it harder to adapt to new situations as they age:

That's what I've noticed as I've aged that it is harder to learn to adapt from what you already know. You seem to have all your wiring in place in your brain. What I've found is there are three stages, you've really got to get the basics understood first, then develop your skills of using the basics and then thirdly, once you've

Table 5. Opportunity and access to social interaction concepts with representative quotes

Opportunity and access	Representative quotes
Communication difficulties	We hadn't communicated with them, the families for three years because they're finding it difficult to communicate in English. (FG1, M) You can't read emotions over text. (FG3, P18, M, 65 years)
Cost and finances	I'm noticing that since I've gone on pension only I'm already feeling that my social connections and community activities might have to be restricted especially if I have to get rid of the car ... Because it's looking like I can't afford to just to keep it on the road so... (FG4, P26, F, 71 years) Technology for me play a big role especially as ... there is no cost involved. (MC, P27, F, 68 years)
Mobility and transport	I do have a minor mobility problem as I am on a walking stick and some public transport poses problems. (MC, M)
Distance	My close family is in New Zealand, and they don't connect that often. But I mean you know, we're not fallen out or anything. But I've got distant relatives in Australia, that I can contact with if I want to. (FG3, P19, F, 70 years)
Availability of services and activities	I just think we're absolutely spoilt with things to do. There's no reason for anyone to be bored really I mean there's just so much, it's overwhelming sometimes, what there is to choose from. (FG1, F) The local nursing home is redoing the whole complex because the original rooms ... didn't have all the Wi-Fi so obviously a lot of older people who are going there as residents, want all this modern technology. (FG3, P20, F, 67 years)
Time	When you're so involved with your work and then you've got your family and that, you don't know what's going on sort of in Melbourne with all groups and that because you've got your own stuff to do at home. (FG3, P17, F, 69 years) As I've gotten older I've felt my family relationships have got stronger. Perhaps because I've had more time for them... (FG1, F)

Notes: FG: Focus Group. P: Participant. F: Female. M: Male. MC: Member Check.

developed those skills to use the basics you can develop strategies to make best use of whatever it is you've learned ... I want to get to knowing what to do, I can't be bothered going back to learning the basics. (FG1, M)

What these themes highlight is that an older adult's decision about whether to use technology in their social relationships is not a simple or a global one. Instead, it is shaped by multiple conflicting factors that influence an individual's capacity and desire to *maintain each individual relationship* and their choice to use the many different types of social technologies available to them for that specific relationship.

Discussion

Addressing loneliness through enhancing meaningful social relationships in older adults is a significant public health concern. Unfortunately, the effectiveness of

interventions to prevent or reduce loneliness for older adults has been equivocal (Cattan *et al.*, 2005; Khosravi and Ghapanchi, 2016; Gardiner *et al.*, 2018). Therefore, we aimed to explore the perception of older adults on the role of ICTs in their social lives to identify key considerations for the development of future loneliness interventions.

A key finding of this study was the perception that technology was just one of many tools available for the initiation and maintenance of their social connections. Given the relatively low rates of loneliness within the sample, it is likely that most participants use social technologies to enhance existing relationships through facilitating high-quality interactions, as hypothesised within the stimulation hypothesis (Nowland *et al.*, 2017; Wilson *et al.*, 2021). Further research is warranted to explore how lonely older adults can engage with technology in ways that enhance, rather than displace, their social engagement with others (Nowland *et al.*, 2017).

Participants' choice to use technology was influenced by the same factors that they reported shaped their face-to-face social interactions – effort, quality of interaction, and privacy and security. This is consistent with previous findings reported by Xie *et al.* (2012), who found that older adults' perceptions around the privacy of social media was a key concern and barrier to adoption. Whilst the present study extends upon these findings with the use of a larger sample, participants who had post-secondary education and lived alone were overrepresented. Further research may be warranted with groups of lower socio-economic status or education levels, to explore whether privacy and security are universal concerns within this population.

When messenger apps, social media or the internet provided low-effort (*e.g.* free long-distance communication; group messaging) and good-quality (*e.g.* video or photo-sharing, or regular chat) contact in a controllable and more private setting (*e.g.* chat apps *versus* Facebook posts), older adults reported no reluctance in using these tools. These findings are consistent with previous research regarding user experience design which highlighted the importance of providing a high-quality user experience, to thereby improve older adults' perceptions of ease of use and usefulness (Portz *et al.*, 2019). Similarly, the findings from the present study that technological tools should be low effort are consistent with the UTAUT, which highlighted perceived effort in influencing behavioural intentions and use behaviour (Venkatesh *et al.*, 2003).

Taken together, these factors reported within the current findings provide a coherent framework for understanding how older adults choose between types of social interactions, whether they be technologically mediated or not. This is an improvement on previous research that relied solely on the TAM factors (*i.e.* ease of use, usefulness) as predictors of older adult use of technology for social interaction (Davis *et al.*, 1989; Sum *et al.*, 2008; Chung *et al.*, 2010).

Limitations

Participants in this study were less likely to live alone, less lonely and more socially engaged, both offline and online, when compared with similar-aged peers in the community. Because of this sampling bias, the perspectives of isolated and lonely older adults were underrepresented in this study. Socially isolated and lonely

individuals may have distinctly different experiences using technology for social interactions, for example, due to limited physical access to social contacts, they may rely more heavily on technology-mediated communication (Amichai-Hamburger and Ben-Artzi, 2003). Our sample also included individuals who were highly educated and younger (*i.e.* <74 years) older Australians (Ellis and Allaire, 1999; Xie, 2003); these factors may indicate that they are more likely to be technologically proficient. Hence, the barriers to technology adoption in the lives of the wider older Australian population may not have been completely canvassed in this study.

Another limitation is the use of a focus group methodology, with repeated group members. By recruiting participants for focus groups, the study limits the sample to those who are comfortable in a group setting and are able to access the community. Further, while focus groups are helpful in identifying normative beliefs and stimulating ideas, they are not well suited for encouraging the sharing of dissenting or highly personal views and experiences (Kidd and Parshall, 2000) and are at risk of being dominated by specific individuals. The effects of this bias were mitigated by the member checking. We also did not notice any impact of the repeated participants on the dynamics of Focus Group 4, with both contributing three to four times fewer comments than the top two contributing participants.

Implications

These findings have important implications for how loneliness interventions are designed for older adults. The results regarding the role of technology in the social lives of older Australians suggest that loneliness interventions should be technologically agnostic and multifaceted, implementing a wide range of tools to support a range of different types of social contact. The development of single-modality technological interventions (*e.g.* Wada and Shibata, 2009; Waycott *et al.*, 2013) risks providing low-quality social contact as perceived by older adults, while interventions that exclude technology not only underestimate the technological competence of older adults but may also constrain the ability of older adults to maintain existing connections especially as they lose mobility or move into residential facilities away from existing contacts (Banks *et al.*, 2008). Indeed, a holistic approach using technology as a key gateway service to facilitate access to targeted loneliness interventions for older adults was recommended in a 2015 report by Age UK and the Campaign to End Loneliness (Jopling and Vasileiou, 2015).

Conclusion

Our findings offer a coherent framework for understanding how older adults choose between types of social interactions, whether they be technologically mediated or not. By designing loneliness interventions with these factors in mind – *i.e.* effort required, likely quality of the interaction, and the privacy and security of the interaction – complex interventions can be developed that recognise the technological competencies of older adults and provide a range of interaction types to meet the preferences of the individual.

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