Improving the Social Connectedness of Older Adults Through Digital Social Gaming - A Pilot Study

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Abstract

Background Digital social interventions for older adults have become increasingly important due to their flexibility and potential to reduce loneliness. Digital games provide easy and fun interaction possibilities but need more exploration.

Methods Using a mixed-methods design, we piloted a chat-based mobile application (*PhotoSnake*) designed to elicit social connectedness. Participants joined two in-person workshops two weeks apart and a focus group afterwards. They filled in a demographics and loneliness questionnaire pre- and post-intervention, and we collected anonymous in-app data.

Results At baseline, participants (N=15) were 74 years old, moderately lonely (Median=2.0), partnered (40%), retired (93%), and living independently alone (53%) or with others (47%). Loneliness did not change over time. They valued the in-person workshops to get to know each other. Participants enjoyed playing the game for a few days but felt it lacked sufficient variation to persist gameplay. Furthermore, the in-app interaction mainly focused on the game and was perceived as too superficial to be meaningful.

Conclusion This study helps design future digital interventions by showing the importance of in-person contact for engagement and meaningfulness. Players do not automatically label in-game interaction as valuable, and game design should focus on aiding players in creating personal interaction moments.

Keywords Loneliness · Serious Games · Implementation · Qualitative Research · Digital Technology

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Introduction

As people age, their social network changes. Age-related functional limitations result in smaller networks and fewer social activities (Bruine de Bruin et al., 2020; Huxhold et al., 2013; Litwin & Stoeckel, 2014; Shiovitz-Ezra, 2013; Wrzus et al., 2013). Maintaining a strong network throughout the lifespan is essential for our cognitive and physical health (Cornwell & Waite, 2009; Hawkley & Cacioppo, 2010; Kelly et al., 2017; Zunzunegui et al., 2003), and extra important for older adults (Suragarn et al., 2021), as it may play a protective role in cognitive decline (Bennett et al., 2006; Glei et al., 2005; Li & Dong, 2017).

This importance translates into the multitude of interventions designed to strengthen social interactions and decrease loneliness (Cohen-Mansfield & Perach, 2015; Dickens et al., 2011). However, despite the available literature, concluding evidence is still lacking. Authors of previous reviews attribute this to methodological shortcomings (Shah et al., 2021) and the difficulty of finding a uniform solution for a highly individualized experience such as loneliness (Fakoya et al.,

2020). Furthermore, they stress the importance of pilot and feasibility studies to provide indications of working elements of new interventions before using many valuable resources (Fakoya et al., 2020; Findlay, 2003; Gardiner et al., 2016).

One type of new and underexplored interventions is social games. Mobile games are promising facilitators of social interaction (Iplikci et al., 2022; Li & Counts, 2007; Sra & Schmandt, 2015; Wenxin, 2020)¸ and older adults are generally positive towards digital technology adaptation, given a perceived benefit and ease-of-use (Ma et al., 2021; Melenhorst et al., 2006). Furthermore, older adults believe that although technology may not substitute face-to-face contact, it can help support social interactions and stay in touch when face-to-face contact is impossible (Eggermont et al., 2006; Ijsselsteijn et al., 2007). This shows promising potential for playful and meaningful online games to increase social connectedness and decrease loneliness.

The use of gaming against loneliness is not new. However, previous games fostering social connectedness either used in-person exercise gaming sessions (Schell et al., 2015) or fixed online meetings (Seah et al., 2017). Mobile social gaming, on the other hand, has the added benefit of being playable at all times and places, thereby possibly being more suitable for older adults with less mobility capabilities. Therefore, in previous research, we explored the use of a social gaming app that included more than twenty different games to increase social connectedness (Châtel et al., 2023; Janssen et al., 2023). Process evaluation of this app indicated that a fully digitally conducted intervention did not lead to long-term engagement, and that having many different games available is considered distracting. Using these suggestions, we adapted the app to incororate only one game and a different app environment. This app, *PhotoSnake*, is the focus of this study.

In this mixed-methods pilot study, we explore the possibility of a purposefully designed mobile social game to facilitate and elicit social connectedness. The game, PhotoSnake, differs from our previous gaming app in that it only contains a single, photo- and text-based game, and that in-person practice sessions are incorporated (Châtel et al., 2023; Janssen et al., 2023). We aim to explore the possibility of this game to activate and engage older adults over time, increase social connection, and decrease their loneliness level. We furthermore explore the added value of in-person practice sessions.

Material and Methods

Design and Participants

We used a pre-post mixed-methods design in which we conducted focus groups and collected questionnaires and backend in-app game data. Participant recruitment occurred via *Sterker*, an organization concerned with the wellbeing of older adults in Nijmegen, The Netherlands. We used advertisements in local newspapers and community centers and invited volunteers and their coordinators to pass the information to interested older adults. The advertisement focused on learning how to use a tablet, play the game, and interact informally. Furthermore, part of the recruitment targeted people who did not have the financial means to purchase a tablet or smartphone. Those participants received a tablet from the researchers, which they could keep after the study ended. We created two groups, with participants either having their own tablet or receiving one. We aimed recruitment at Dutch-speaking older adults aged 65 years and over who could join the workshops and focus group.

The Gaming App: PhotoSnake

PhotoSnake is a chat-based gaming app purposefully designed and developed by Games for Health. It aims to elicit interpersonal, meaningful, and playful interaction. Meaningful interaction refers to a feeling of social connectedness, i.e., the subjective, short-term experience of belonging and relatedness (Barbosa Neves et al., 2019). Social connectedness thus moves beyond mere interaction and entails deeper, qualitatively important connections (Bel et al., 2009).

The app consists of group chats where participants can send text messages and photos using their camera or photo archive. People in the same study group were in a chat group together. In PhotoSnake, someone sends a photo of an object, and the next person then sends a photo of an object, starting with the last letter of the object on the previous photo. The game was designed based on the assumption that the photos would trigger questions and story-sharing, thereby starting a conversation. The functionalities and interface were deliberately kept straightforward and limited for this study.

Study Procedure

The study consisted of three sessions for each group: two 1.5-h workshops two weeks apart and one 1-h focus group two weeks after the second session. The first session started with an introduction round, explaining the study goals and signing informed consent, after which participants filled in the baseline questionnaire. After that, we installed the app on participants' tablets or smartphones and played the game to gain some experience. We then encouraged them to keep playing at home in-between sessions. The second session started with discussing any problems that arose with independent gameplay the previous two weeks, after which some suggestions for alternative gameplay were given (e.g., only

sending photos of a given color or from a particular part of the house).

The focus group, chaired by two researchers (JJ and VvE) and voice recorded, aimed to receive participants' experiences and improvement points. At the start of the focus group, participants filled in the same questionnaire as at baseline.

Data Collection

The questionnaire consisted of questions on demographics, loneliness, and social network. For quality of life and demographics (i.e., age, gender, and marital, living, working, and educational status), we used a selection of The Older Persons and Informal Caregiver Survey-Short Form (TOPICS-SF) (Santoso et al., 2018). We chose this standardized survey as it is a brief and convenient survey based on older adults' preferences. We selected those questions that measured demographic information. To measure loneliness, we used the six-item De Jong Gierveld Loneliness Scale. This is a validated shortened version of the eleven-item original scale (De Jong-Gierveld & Kamphuis, 1985), with comparable validity and reliability (De Jong Gierveld & Van Tilburg, 2006). It comprised six items (score range 1 to 6), where higher scores indicate higher loneliness. Lastly, social network size was measured by asking how many people the participants had regular and important contact with (response options: 2 to 5, 6 to 10, 11 to 15, 16 to 20, more than 20) (Kuiper et al., 2019). For every message sent in-game, we stored the sender, type of message (text/photo), timestamp, and, for text messages, the message length in words.

The focus group was voice recorded and structured around a predefined interview guide. It contained the following questions: "What did you think of the game PhotoSnake?", "What did you think of the application itself?", "What did you think of the group sessions?", "Do you feel that playing PhotoSnake meets your needs in terms of social contact?", "Do you think PhotoSnake might strengthen social contacts of older adults?" and "Concerning further development, which functionalities would you like to change or add to the game and the application?".

Data Analysis

We analyzed demographics, network size, and the pre-post difference in loneliness descriptively. To analyze gameplay and engagement, we restructured the data in oneday intervals containing the number of text messages and photos, the total number of messages, the average message length, and the text-to-photo ratio in that interval.

For descriptive analyses, we exclude messages sent after the focus group (5.0%). The focus groups were transcribed verbatim and coded independently by two researchers (JJ and VvE).

Data Integration

To measure app engagement and adaptation, we created graphs of the number of messages sent, the average message length, and the proportion of text messages compared to photos over time. We expected message length and proportion of text messages to increase when participants got to know each other and liked app usage. Using results from the focus groups, we assessed whether participants' gameplay reflected their opinions, thereby realizing a complete picture of gameplay experiences, personal contact, and future implementation.

Ethics

The study was reviewed by the local research ethics committee of the Radboud university medical center (file 2022–13690). The committee judged it did not fall within the remit of the Dutch Medical Research Involving Human Subjects Act (WMO), and no formal approval to perform the study was needed. All participants signed informed consent at the start of the first session, prior to data collection.

Results

Table 1 indicates that in the sample (N = 15), 60% is male, about half is partnered (47%) and living alone (53%), and most are retired (93%). At baseline, six participants were categorized as not lonely, three as moderately lonely, and six as severely lonely (Mdn = 2.0, IQR = 5.0). After the intervention (Mdn = 2.0, IQR = 4.0), compared with baseline, five people decreased, four increased, and five remained stable on the loneliness scale. One participant dropped out of the study after the first session.

Gameplay

Participants indicated they enjoyed the game for a while and that it is a fun activity that stimulates them to stay active. They used PhotoSnake for small interaction moments:

> "If I look at what I did on PhotoSnake these past weeks, I have been quite active. If I have nothing to do, I open it to see if someone posted something" (M, 68)

However, participants felt the game got monotonous after several days, for which they gave two reasons. First, the objects in the photos often ended in the same letters, causing players to look for the same objects repeatedly and, as a result, lose interest:

Table 1 Baseline characteristics of subjects participating in the PhotoSnake pilot (N = 15)

Age in years, Median (IQR)	74.0 (9.3)
Female sex, n (%)	6 (40)
Loneliness, Median (IQR)	2.0 (5.0)
Quality of life, Median (IQR)	8.0 (1.0)
Network size, n (%)	
2 – 5	6 (40)
6 – 10	2 (13)
11 – 15	3 (20)
16 – 20	3 (20)
> 20	1 (7)
Marital status, n (%)	
Married/partnered	7 (47)
Divorced	2 (13)
Widowhood	3 (20)
Unmarried, no partner	3 (20)
Living situation, n (%)	
Independently, alone	8 (53)
Independently, with others	7 (47)
Highest education, n (%)	
Primary school	2 (13)
(Pre-)vocational secondary education	3 (20)
Secondary vocational education	8 (53)
University entrance level	1 (7)
University or higher education	1 (7)
Working situation, n (%)	
Working < 20 h/week	1 (7)
Retired	14 (93)

IQR = interquartile range

"[...] the letter 'k' again. [...] Then you wait for another letter, resulting in the fact that you do not respond anymore" (M, 70)

Participants mentioned this in the second session, after which we proposed game variations (e.g., only using objects with a specific color or from a particular room). However, these variations did not last, as they "did that twice or so, after which it got quiet again." Furthermore, the same group of people was often online, and some participants had to make time for it and felt obliged to play. Second, players mentioned there was too much focus on the rules rather than the interaction:

"You have too many rules to take into account, whereas playing this game should stimulate interaction between people" (F, 65)

The quantitative data support these experiences. In total, participants sent 1,159 messages. The number of messages sent over time (Fig. 1) shows that gameplay varied over time

though it primarily occurred in the first few days after commencement and around the second session (14 days). In general, there were a small amount of continuing players (e.g., Player 1, 2, and 8), while others stopped after some time, usually after the second session (e.g., Player 3 and 7), or hardly sent messages at all (e.g., Player 11, 12, 13, and 14).

Interpersonal Contact

Participants highly valued the in-person workshops and the approachable atmosphere, both to get acquainted with each other and to ask questions, as described by a participant:

"You have seen and spoken to each other. I guess that makes it easier to play the game with each other" (M, 61)

Players did not regard the in-game interactions as valuable or meeting their social needs, nor did they label it as personal contact at all, as communication was merely about the game:

"Now you have no contact. The last letter is all that counts. Then a new photo is sent, but there is no conversation about that photo" (F, 74)

The contact was judged "too superficial" to be valuable, and interacting about the photos appeared to be difficult as players did not know each other. They emphasized the importance of asking specific questions initiated by other players or the game, which now did not happen:

"It is clear that we do not follow up on those things in this group. I do miss asking questions, for example, what the app is developed for. Like, when I sent a photo of an island, just ask, 'which island is that?' or something, you know?" (F, 74)

Presently, players judged PhotoSnake as a pleasant method to pass the time, yet insufficiently developed to elicit valuable contact. When comparing in-game contacts to in-person interactions, which participants use as a reference for "valuable contact," they were considered lower in value.

The quantitative data show that of the 1,159 messages sent during the study, 491 were photos, and 668 were text messages. In Fig. 2, we see the distribution of texts and photos over time, showing that the proportion of text messages does not increase. However, as the total number of messages decreases (shown at the top), the proportions become decreasingly reliable.

Furthermore, of the 491 text messages, the majority (61%) contained a single word, and only 18% contained more than five words. Participants usually described the object on their photo with a text message, which could explain the high percentage of one-word messages. The message length (Fig. 3) fluctuates over time, although there is no clear pattern.
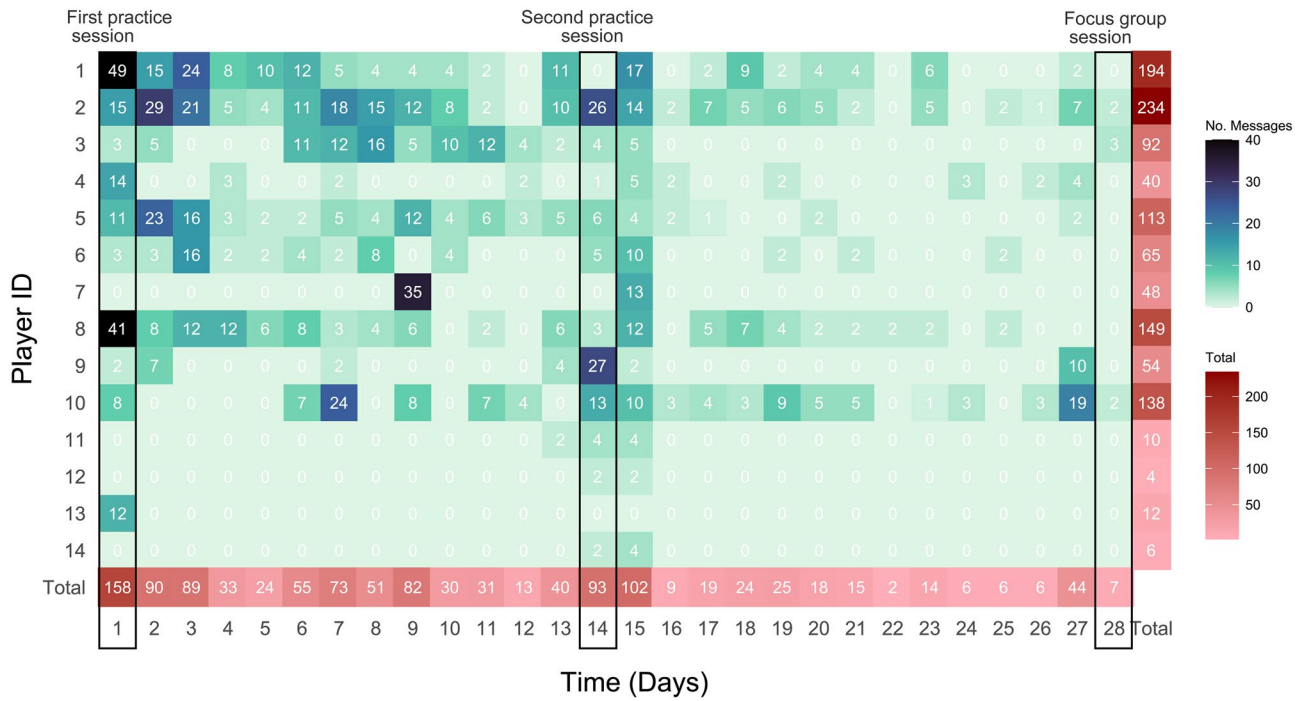
Fig. 1 The number of messages sent by every participant (Player ID) per day (Time). Every row indicates a participant; every column indicates a day. The number in the cells and the cells' shading show the number of messages sent by a given player on a given day, with darker shades indicating more messages being sent. The red cells indicate the total messages sent per ID (rows) and per day (columns). The boxed columns indicate the dates of the two sessions (Time = 1 and Time = 14) and the focus group session (Time = 28)
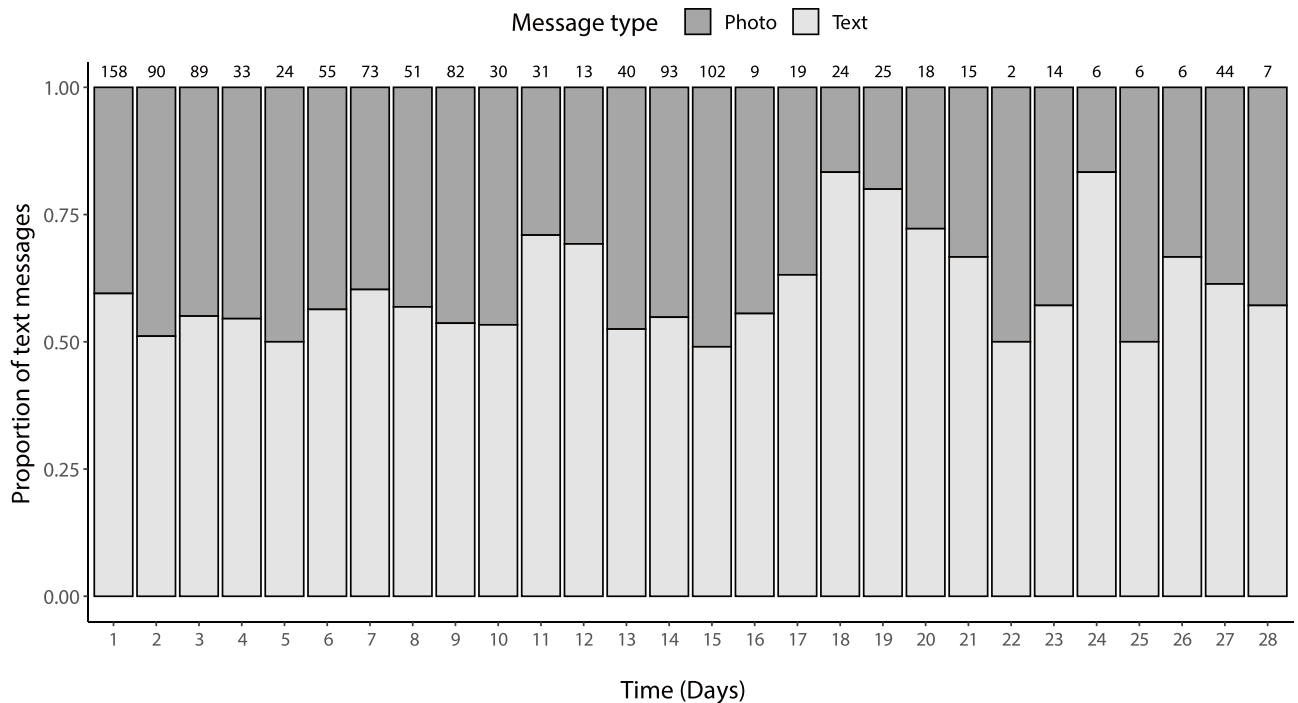
Fig. 2 Distribution of photos and text messages per day, with the total number of messages per day on top
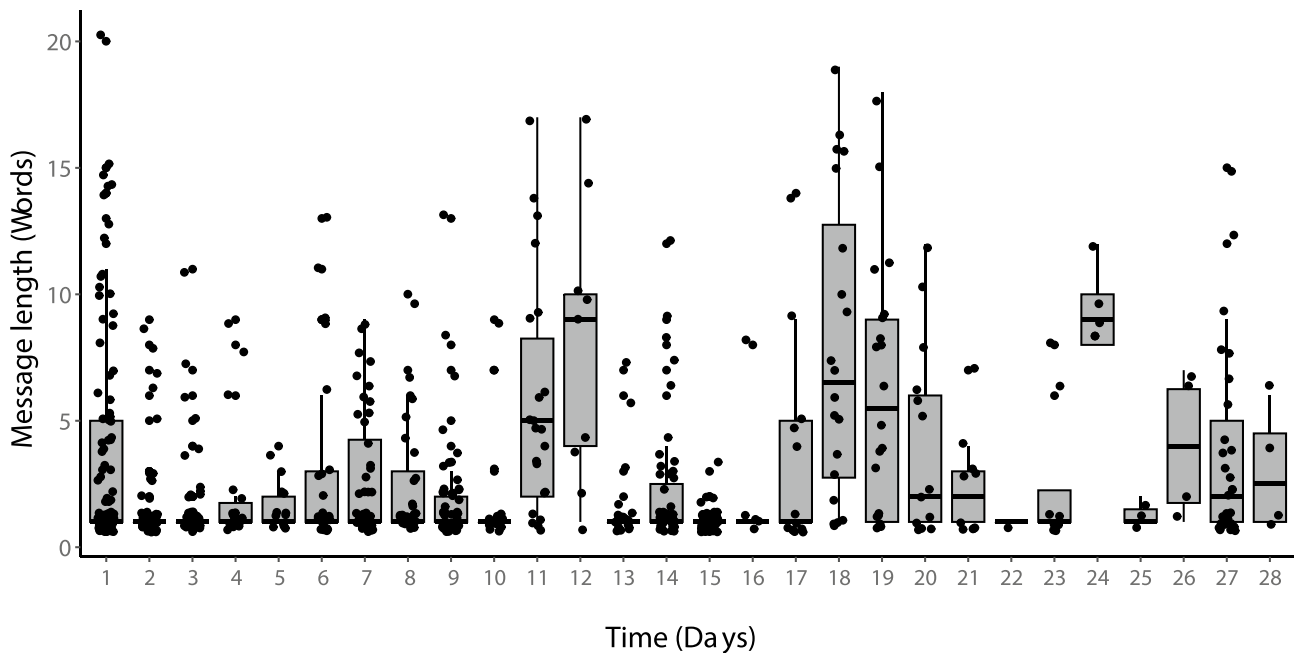
Fig. 3 Boxplots of message length (Words) distribution over days (Time)

Future Development

Participants gave several recommendations for future design and implementation. Most importantly, the app needs more challenge and variation to stay interesting in the long term. Game design should implement this variation:

> "You should work with more letters, not just the first and the last. Or with topics or themes, like this or that color, downstairs, upstairs, or the store. Game designers should introduce these themes, so it becomes easier for users" (F, 65)

Regarding fellow players, participants stressed that everybody could join, and the app could aid in gaining new and maintaining existing relationships. However, participants do not consider the app suitable for children, as they would lose interest quickly. Due to the game being approachable, participants think it is beneficial for maintaining contact, e.g., for people who find it difficult to make contact. Participants note the desire to create in-app groups, for example, with family or during a holiday for people interested in receiving updates. However, deepening connections is difficult in a group:

> "For example, if I use WhatsApp with someone, you can make personal contact, as others cannot see that. If you interact with me in PhotoSnake, that can never be personal because everyone can see it" (M, 68)

In terms of functionality, players requested to be able to delete a sent message or photo, to see who is online, so more direct interaction is possible, and prevent that multiple photos can be sent simultaneously, as this can be confusing.

Lastly, the digital skill level of the participants varied, partly due to recruitment strategies emphasizing learning about tablet use. Some participants signed up because they wanted to learn how to work with a tablet and felt it did not sufficiently come back in the sessions:

> "The announcement clearly indicated the workshops were intended for beginners with a tablet or smartphone. I even thought that it was too difficult for me, as I have no experience at all [...]. You all talk about these things very easily, but [being for beginners] was not the case in the workshop. [...] In other words, this workshop was not meant for people who have never held this [tablet]" (M, 82)

Discussion

We piloted the chat-based mobile gaming app PhotoSnake to explore the potential to engage older adults in personal and meaningful interaction, strengthen their social connectedness, and decrease their perceived loneliness. Although older adults perceived the game as an enjoyable leisure activity, they did not automatically experienced the in-game interaction elicited by PhotoSnake as valuable. The game should offer more variations and challenge to engage older adults in long-term playing. This study follows studies with previous app versions (Châtel et al., 2023; Janssen et al., 2023),

primarily showing the added benefit of in-person sessions for instruction and a sense of community, proving essential for engagement.

Social Connections in PhotoSnake

Regarding social connectedness, we found that participants did not perceive the in-app interaction as meaningful, for which several explanations are possible. First, older adults are generally skeptical about the quality of online connections (Hope et al., 2014; Lehtinen et al., 2009). Online communities and social interactions are discommended for the necessity to engage in weak-tie interactions and the lack of deeper one-on-one communication (Hope et al., 2014). Older adults desire a certain level of reciprocity and personal intimacy in their contact (Janssen et al., 2022; Lindley et al., 2009). Furthermore, to elicit meaningful contact in game design, Waycott et al. (2019) propose to provide a sense of connection with significant others, facilitate reciprocal communication, and value older adults' contributions. The interaction in PhotoSnake was mainly with unknown others. It comprised mostly sending pictures without response, which might have not been qualitative enough to increase older adults' connectedness, even though they did have social interaction (Barbosa Neves et al., 2018).

Second, with increasing age, people tend to focus their time on emotionally deep connections, resulting in a limited inclination towards meeting new people (Lansford et al., 1998). This process, called socioemotional selectivity (Carstensen, 1992), might have caused a mismatch between PhotoSnake's goal and the older adults' needs, as participants felt they did not know each other enough to have reciprocal interaction. However, this creation of weak-tie interactions are important against loneliness (Lam et al., 2023). An extensive weak-tie network, in addition to strong ties, relates positively to well-being (Sandstrom & Dunn, 2014), as weak ties provide support, access to new networks, and reciprocity (Huxhold et al., 2020; Lam et al., 2023; Liu & Yeo, 2021; Rademacher & Wang, 2014). Therefore, weak tie formation through social gaming can be socially beneficial (Osmanovic & Pecchioni, 2015; Wohn et al., 2011), provided that older adults perceive the added benefit. A previous study suggests that most older adults do not think social games are suitable for building lasting connections. Yet, people with little in-person day-to-day interaction saw the added value (De Schutter, 2011).

Lastly, the game's design choices caused a large proportion of players to be lurkers, i.e., people with medium usage and low variety in performed in-game actions, who use the game for entertainment consumption and to kill time (Loria et al., 2021). Lurkers, though inactive in-app, are an essential part of online communities (Crawford, 2009; Yang et al., 2017). It is a well-recognized social behavior (Nonnecke & Preece, 2000), providing lurkers with a sense of community and social benefits (Metzger et al., 2011; Nonnecke et al., 2004; Rau et al., 2008). These benefits, however, are provided the players actively chose to be lurkers, and it is not a result of lacking community trust (Yang et al., 2017), which is unknown in the current research. It could be that lurkers have a different view on the social effects of the PhotoSnake interaction than active players, thereby undervaluing their increase in social effectiveness.

The participants' digital skills varied greatly; some mentioned improving their skills as the main reason to sign up. During the workshops, people learned how to operate a tablet and send pictures and messages, essential skills for online interaction. Digital skill is a salient moderator for the psychological benefits of digital interaction (Nguyen et al., 2020; Yang & Jang, 2022). This is an example of what is called the 'digital divide,' i.e., older adults being less likely to benefit from the possibilities of online technology (Niehaves & Plattfaut, 2017), due to generally having a lower digital literacy (Broady et al., 2010). The consequence of this is that older adults not only have more difficulties with, for example, increasingly digitalizing governmental systems, they can also experience exclusion of online social networks (Mubarak & Suomi, 2022). Therefore, improving older adults' digital skills and digital literacy is both important and feasible, as most older adults are eager to learn digital technology skills (Ma et al., 2021; Melenhorst et al., 2006). This can be done explicitly through digital courses or implicitly through using social gaming apps.

Game and App Design

Regarding game design, PhotoSnake was purposefully kept simple in design and rules to minimize distraction from interaction possibilities. This aligns with research showing older adults prefer familiar games with uncomplicated, modifiable rulesets, preferably played in diverse teams (Mubin et al., 2008). Games' social aspects motivate persistent gameplay (De Schutter, 2011; Gajadhar et al., 2010; Marston, 2013). Furthermore, Lee et al. (2021) recommends providing difficulty selection, challenge, and guidance, which were currently not sufficiently available in PhotoSnake. The lack of challenge and variation was regarded as an important predictor for discontinued play, providing an important implication for future social game design.

Participants highly valued the in-person workshops to build a relationship and ask questions. Previous recruitment studies in older adults also showed the importance of in-person relationship cultivation for activation and retention in digital interventions (Auster & Janda, 2009; Dibartolo & McCrone, 2003; McHenry et al., 2012). These sessions provide an accessible source of instrumental support from other players and instructors in case of technological problems, so

older adults feel seen and part of a group. Furthermore, participants had opportunities to socialize with each other. As older adults mainly see the potential for in-game interaction with familiar ties, getting to know each other in person might be essential for effective future social gaming interventions.

Strengths and Limitations

Using a mixed-methods design, analyzing game data alongside questionnaire and focus group data, we could triangulate users' experiences with their actual gameplay, yielding a complete picture of the app's potential. Furthermore, this small-scale pilot study allowed to assess PhotoSnake's preliminary effectiveness and adoption, thereby not potentially overusing valuable resources and overburdening participants. Furthermore, in the game and study design, we build upon lessons learned in previous research, i.e., incorporating active engagement, online play, and qualitative evaluation (Fakoya et al., 2020; Findlay, 2003; Gardiner et al., 2016).

However, we should consider a few limitations when interpreting these results. First, as part of the project, we purchased several tablets for participants lacking the financial means to buy one themselves. They could keep the tablet after participation in all three sessions. Although we did not actively mention this in recruitment material, they received this information when contacted before participating. Therefore, we cannot rule out the possibility that participants felt extrinsically motivated or obliged to participate, thereby overestimating actual gameplay, although no clear differences are present between the two groups' gameplay.

Furthermore, in one of the groups, most participants came from the voluntary work network of one of the participants, resulting in a group where most people already had daily in-person contact, which may have influenced the results. It could be that the daily contact removed the need to interact in PhotoSnake, or being acquainted could have augmented the the possible topics to discuss and the desire to interact. Future research could compare groups knowing and not knowing each other to see whether a previous social connection truly matters.

Lastly, inherent to a pilot study, we cannot conclude whether PhotoSnake improves social interactions. We did not have a control group or randomized conditions, so we cannot firmly conclude on the effectiveness on loneliness or social interaction. We adhere to literature underlining the need for costefficient pilots and feasibility studies to develop and evaluate digital interventions (Findlay, 2003). Next, considering the recommendations presented in this paper, follow-up studies should examine game expansions, different workshop content, and randomized groups. Furthermore, factors contributing to the digital divide (e.g., socioeconomic background, medical history, and cognitive function) could be considered to investigate how these factors influence the experience and adaptation of digital gaming interventions.

Conclusion

We showed that for older adults, eliciting meaningful digital interaction with unknown others is challenging and might require explicit in-game instruction or prompts that guide players toward having meaningful communication. Photo-Snake might be a valuable app to communicate with family and friends, although it may be less suitable for weak-tie interactions. In-person workshops are essential for digital technology adaptation, especially for social purposes.

Declarations

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