

User Experience and Health Benefits of Serious Games for Elderly Adults

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Abstract— The population is aging rapidly and maintaining healthy body and mind is more important than ever. This report explores the cognitive and mobility gains for elderly adults by improving serious games' user experience by identifying the health benefits and barriers for them to enjoy games. It attempts to find possible solutions for user experience improvements by reviewing the current literature. Adequate instructions with a start guide, simple to learn game play, and a non-competing social aspect could be used to eliminate barriers which elderly adults currently face when they play video games.

1 INTRODUCTION

The world population is aging rapidly and the age group over 60 will be double by 2050 (World Health Organisation, 2022). Maintaining healthy mind and body will become more important to live an active enjoyable life for elderly populations. This report will discuss the health benefits that video games can bring to elderly adults and explore possible solutions to improve user experience by addressing barriers that exist in serious games (video games with a purpose other than entertainment) such as exergames (fitness video games that promote exercise) for elderly adults.

1.1 Cognitive Health Benefits

A healthy mind is a key factor for living longer healthy lives as dementia is one of top causes of death among Australians aged 75 and over (Australian Institute of Health and Welfare, 2022b). Physical activity can bring improvements to age related cognitive decline including dementia (Groot et al., 2016). Exergames using gesture-based game platforms such as Wii and Xbox Kinect which make it possible for elderly people to enjoy physical activities in indoor settings regardless of the weather (Barg-Walkow et al., 2017; Brox et al., 2011). In addition to exergames, general video games can improve executive control functions (Basak et al., 2008). Video games are suggested to improve episodic memory for both young and older adults and it is long lasting (Clemenson et al., 2020). It can also be used to exercise impulse control and attention for elderly age groups (Anguera et al., 2013).

1.2 Exergame Mobility Benefits

Declines in physical abilities are inevitable. One third of hospitalised injuries in Australia are by people over 65 years old and can lead to death (Australian Institute of Health and Welfare, 2022a). For those older adults, video games can bring benefits by strengthening physical capability and mobility. Nintendo Wii Fit video games can improve seniors' balancing ability in a month (Maixnerová et al., 2017) and there is also research to suggest that improved sway movements for older adults by prescribing an 8-week Step Pad training program using a video game (Schoene et al., 2013) can mitigate fall accidents.

1.3 Mental health benefits

Having good social connections is a key factor of living a healthy life. Elderly adults who have compassionate relationships can reduce reacting to stress in daily life (Eisenberger, 2007). Social engagements can be supported by a multiplayer functionality in video games (De Schutter & Vanden Abeele, 2010). Furthermore, Nintendo Wii sports exergames can be a feasible way to treat depression for older adults by significantly improving symptoms of depression as well as cognitive function and general mental health (Rosenberg et al., 2010).

1.4 Barriers/challenges for elderlies to play video games

As mentioned in the previous sections, video games have many health benefits for elderly adults and serious games using Wii and Xbox Kinect are good examples for regenerative interventions. However, there are several obstacles delivering adequate user experience to elderly adults for initiating the trainings and continuous use. Microsoft Xbox Kinect demonstrated the use of gestures as an input interface via cameras and sensors which has the potential to be user friendly for older adults and could be used for physical training similar to Wii Fit games. Despite the potential, most games are too difficult for older

adults to navigate through convoluted screens because they are designed for younger generations (Marinelli & Rogers, 2014; Harrington et al., 2015). In the experiment of Harrington et al. (2015), even though elderly participants expressed positive attitudes toward exergames using Xbox Kinect, they encountered frequent input errors due to misunderstanding the onscreen instructions and poor capabilities to find and select buttons. The participants shared their concerns of ambiguous instructions that were difficult to understand. Not limited to video games, elderly adults need well supported instructions to use new technologies for their cognitive function levels (Halmdienst et al., 2019).

2 FINDINGS

Improving user experience in video games for elderly adults is essential for them to access the health benefits that video games can offer. This section exhibits findings from literature to investigate possible solutions to address the challenges that senior adults currently face in playing video games.

2.1 Instructions and Start Guide

Providing sufficient instructions is essential for elderly adults to gain the confidence to play and enjoy video games which becomes more important when gesture-based Xbox Kinect is used as a serious game or exergame (Barg-Walkow, 2017). Serious games have clear purposes for users but are challenged with balancing intricacy and useability. An experiment by Nakai et al. (2015) was conducted to assess the usability of a Kinect based serious game with five different levels of difficulty. While the game was easy enough to play, the participants' level of enjoyment and motivations were high, however, as the game entered the last level with high complexity, the participants recorded more negative emotions indicating that the difficulty level negated their enjoyment level. They concluded that a serious game should provide good instructions in the game, in addition, prior instructions should be provided before the start of the game to maintain the balance between difficulty and enjoyment to keep users' motivations high in order to deliver the proposed benefits.

A start guide can be sufficient to provide serious game users prior instructions. Harrington et al. (2017) developed a start guide prototype for elderly people to support playing Kinect gesture video games. They identified tasks that were difficult for elderly adults to play games. Then they developed design specifications to address the identified issues. These issues included locating buttons, sensor range, and activating buttons (see Table 1). Based on the issues, they developed design specifications for the start guide by categorising tasks, and labelling difficulty levels. The final prototype contains a drawing of Xbox, controller, and sensor with descriptions of parts and buttons along with troubleshooting, instructions of starting the machine and steps to start a game on the front side (see Figure 1). The back side has instructions of frequently used gestures with graphics. They concluded that the developed start guide will be useful for all users not limited to elderly users and should be effective for exergames and serious games developed on a gesture-based system.

Challenge	Support Need
Could not locate button	Diagrams of console; help navigating instructional screens
Button not completely triggered	Instructions on proper gesture performance
Out of range of sensor	Instructions on gesture performance; diagram of Kinect sensor range
Unable to discern instruction from activity	Help navigating instructional screens
Kinect sensor not activated	Help with sensor activation
Navigating out of error	Instructions on proper gesture performance

Table 1 Challenges with gesture games (Harrington et al., 2017)



Figure 1 Start guide prototype (Harrington et al., 2017)

2.2 Preferences by Elderly Adults

For delivering better user experience, preferences of elderly adults in video games must be examined. A survey conducted by Salmon et al. (2017) revealed what elderly adults seek in video games by comparing the preferences of young people and older adults. The elderly people emphasised ease of learning and playing games as well as games to be challenging enough to excite them at the same time. They expressed quality artwork and a good story were less important contrasting to young people's preference. The favoured genres of game by the elderly adults were strategy, puzzle, and educational. Most of them play video games alone which shows a similarity to young people, although, the young people also played with friends. Television and desktop computer were among the most used media devices by the older adults, and they use fewer portable devices such as laptops, smart phones, and cell phones compared to the younger groups. The research concluded that video games for elderly people should be designed easy to play but challenging enough to maintain their enjoyment level, perhaps with different difficulty levels. For multi-player games, older adults prefer helping each other over contending.

2.3 Multiplayer, Network Games for Elderly Adults

Multiplayer and network functionalities can be incorporated into serious games for elderly adults to bring social engagement to games. Gajadhar et al. (2010) conducted an experiment to measure differences when elderly adults play video games with a virtual player, a human player online, and a human player onsite (see Figure 2). They revealed that the participants were more attentive with human players, and they had more social interactions when they played next to each other. They did not show interests in competing nor winning. Elderly adults prefer cooperative playing to help each other, which differ from the research conducted earlier with young participants (Gajadhar et al., 2008; Gajadhar et al., 2009). For older generations, a social connection exists in verbal communications or visual presence, therefore, they dislike technologies that replace these real social aspects (Gajadhar et al., 2010). Research to date, however, has not identified whether social connections within gaming have the same benefits as real-life engagements.



Figure 2 Virtual player, human player online, and human player side-by-side (Gajadhar et al., 2010).

3 DISCUSSION

Instructions in video games are an important factor for delivering better user experience for elderly people and can be challenging for serious game designing. As the finding indicated, a delicate balance between intricacy and enjoyability is the key to deliver an effective serious game for older adults. To achieve the balance, instructions in the game should translate what users should be doing at a precise moment especially for gesture-based games. A start guide can be a good solution to give instructions of general use of game functionalities and gestures prior to playing video games. A printed guide can include graphics such as illustrations and pictures to describe hardware components as well as gestures to perform in game play.

Games are generally designed for a young population and serious games targeting older populations should have a different approach to cater to their preferences as the findings in section 2.2 highlighted. Games for elderly adults should have a clean and easy to navigate user interface and flow with different

difficulty levels to cater for a variety of skill and cognitive or physical levels to be challenging enough to entertain users.

To deliver social benefits, multi-player or social functionality can be considered to implement in video games for elderly adults. Considering that the age group prefers cooperative game play over competition, a game could incorporate a theme to help others or achieve something together. In addition, showing each other's face via cameras and talking over microphones may increase connectedness as they prefer to have face-to-face or verbal communications. Since elderly adults embrace virtual reality technologies and are less likely to suffer from VR sickness (Huygelier et al., 2019), multi-player games can be placed in a metaverse environment whereby players can see and talk to each other. That could be a great option for those who cannot have a companion to play games together on site. However, evidence of the social benefits directly linked with video games for elderly adults is limited and future research is needed to confirm the effect.

With the above-mentioned improvements and customisations, video games could deliver much improved user experience to elderly adults who are eager to embrace the technology for their health benefits. When improved serious games for elderly adults become successful and the common ingredients to develop games are shared, future developments of games with newer technologies could become easier to incorporate as improvements build on prior discoveries. In addition, future elderly generations will have been exposed to video games and technologies. The barriers for them could become less than what they are for the current elderly generation, although, decline of capabilities by age may still warrant consideration.

4 CONCLUSION

The findings exhibited that improving serious games' user experience for elderly can eliminate the barriers they face. Serious games have clear purposes and they can bring health benefits such as cognitive and mobility improvements to the age group. At the same time the balance between intricacy and user experience needs to be well-adjusted. Although many video games are designed for a younger population, designing games to cater for elderly adult preferences can improve the experience for them. By keeping the game simple yet challenging enough, and providing adequate instructions, player enjoyment can drive better engagement. The implementation of multiplayer and network functionalities can be achieved, as long as it represents how the elderly perceive real social interactions. To optimise any possible social benefits, more research is needed on what the precise mechanisms are and how they affect health. We all age and will need to cope with the maturing process. Serious games offer a promising potential for us to engage in healthy ageing strategies in a fun way.

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