Family Matters: The Role of Intergenerational Gameplay in Successful Aging

Sanela Osmanovic(✉) and Loretta Pecchioni

Department of Communication Studies, Louisiana State University, Baton Rouge, USA
{sosman3,lpecch1}@lsu.edu

Abstract. Successful aging in Western cultures is associated with remaining independent based on physical and mental health while also remaining engaged with others. Video game play has been found to enhance physical and mental health in older adults, however engagement with others has received less attention from scholars. This study examines the multiple reasons older adults provide for playing video games with family members, focusing on how this process maintains intergenerational relationships. While design issues and negative attitudes may prevent some older adults from playing video games, we offer solutions to overcome these barriers.

Keywords: Older adults · Successful aging · Video games · Intergenerational · Gaming · Interpersonal relationships

1 Introduction

Although the vast majority of older adults live independently and are financially secure, with advanced age they are at greater risk of isolation due to physical and financial limitations [1]. The consequences of becoming housebound include depression, lower quality of life, and shortened life expectancy [2]. New technologies, however, may reduce social isolation and its resulting negative consequences. As technologies become both more affordable and user-friendly, they are more easily adaptable to the needs of older adults. One aspect of technology that may be of particular benefit in fighting these negative consequences are social video games. In this study, we examine the experiences of intergenerational game-playing by older adults, the attitudes that create barriers to such play and conclude with recommendations for game design that might enhance their experiences and potential for more successful aging.

1.1 Successful Aging

Gerontologists Rowe and Kahn [3] identified the key components of successful aging in Western cultures as: (a) freedom from disease and disability, (b) high cognitive and physical functioning, and (c) social and productive engagement. In Eastern cultures, social belonging is ranked by older individuals as more important than independence [4]. Older adults identify maintaining interpersonal connections as crucial to the quality of their lives [5–7].

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This sense of connection with valued others is often fostered through shared activities, such as playing games [8]. In previous generations, those games may have required physical proximity for the game players to gather around a table to play cards or a board game [9, 10]. With the advent of digital games and on-line game playing, physical proximity is no longer a requirement. As families become more geographically dispersed, being able to maintain emotional connections may rely on being able to share activities through mediated means [11].

1.2 Video Games and Older Adults

Video games are frequently perceived as an arena for young revelers [12]. However, considering that the population who were the focus of game developers in the late 1980s are now on the brink of their 50s and in large part continuing to play games, the gaming demographic is changing rapidly. Between 1999 and 2011, the percentage of gamers older than 50 has increased from nine to 27 percent [13, 14]. In Europe, 15 percent of those aged 45–55 and 11 percent of those aged 55–64 reported playing video games [15].

The number of older gamers may be growing, but the research on video games and the population above the age of 50 has largely focused on rehabilitation or prevention of physical and mental decline. Studies have shown that casual video games can enhance reaction time, processing speed, and general cognition in older population [16], help in stroke rehabilitation [17, 18], and improve interaction with caregivers [19].

While most of the research on older adults and gameplay has focused on the aspect of successful aging related to physical and cognitive abilities, a few studies have found that older adults play games to entertain themselves, to relax, to escape, and to socialize. Schultheiss [12] reported that older adults prefer accessible games that combine knowledge and entertainment, and their solvency and tendency to invest in high-end technologies makes them a perfect audience. Nap et al. [20] found that older adults stay faithful to the games they play, citing fun and relaxation as the main motivator for playing, closely followed by escape from reality and staying in touch with society. Pearce, however, reported that older adults enjoyed more demanding, intellectually challenging games with rich narratives, and large, involved communities in which they can take part – "in short… they just want to have fun" [21, p. 171].

One common theme threads through most of the above research – older adults enjoy the social side of gaming [12, 20, 21]. This aspect was corroborated by De Schutter and Vanden Abeele, whose research placed an emphasis on the connectedness that video gameplay offers even across great distances, providing a "means to spend time together apart… a means for requesting help and attention from sons, or something to structure the conversation with friends" [22, p. 90]. Not unexpectedly, Gajadhar et al. [23] found that older adults reported the highest levels of satisfaction in playing with another person, with physical presence taking precedence over mediated co-play. Participants reported more pleasure, fun, and challenge when playing side-by-side. These findings were supported by De Schutter [24], who found that social interaction was the most important predictor of length of gameplay for older adults. With social engagement being one of the core aspects of successful aging, we turn to social interaction in families and its perpetuation through gaming.

1.3 Social Intergenerational Gaming

Older adults are not alone in finding that playing video games with another person is more conducive to enjoyment and length of play [23, 24], younger generations also report that social interaction is one of the strongest motivators to play video games [25]. For example, co-playing video games has positive effects among adolescents: playing with family members decreases the level of internalizing and aggressive behavior, and increases prosocial behavior [26]; while playing with friends maintains and enhances their relationships [27]. Parents in the United States [14] and Europe [15] report playing games with their children because it is fun and gives them an opportunity to socialize with their children.

Very little research, however, has focused on whether older adults play video games with family members, nor how this co-play is performed and how it affects intergenerational family groups. Of the few studies available, Voida and Greenberg [28] identified more passive gameplay behavior by older players in the presence of children, suggesting some older adults are more likely to give gameplay priority to younger partners. Additionally, Gajadhar et al. [22] found that compared to younger players, older adults are less competitive and take on a more supportive role. In turn, younger adults doubt older adults' ability to successfully partake in the game, and take time to explain and help when their playing partner asks for aid [28, 29].

In spite of these apparent challenges, intergenerational gameplay proves to be satisfying, with participants enjoying social interactions with their partners (which was demonstrated during gameplay by shared laughter and remarks that is was fun to play) and being willing to play again [29]. Osmanovic and Pecchioni [30] found that older adults who regularly play video games with their families find the experience enjoyable, fun, and a source of bonding, providing opportunities to generate talk. Younger adults saw intergenerational gameplay as a means of maintaining or deepening the relationships with older family members, to spend time together, and to talk about simple and complex topics in a setting they find comfortable and comforting [30].

1.4 Purpose of the Study

Throughout history, as games have added enjoyment to everyday life, the perceived fun-factor was both the reason we engaged in them and rarely took them seriously. Goffman [31] emphasizes the necessity to treat fun seriously, underlining that games abide by formal regulations of societal engagement and are thus no different than other aspects of social life.

As noted above, previous research reveals that older adults enjoy both the serious and more leisurely aspects of video gaming; see also Loos and Zonneveld [32]. As a result, in this study we want to address the questions of the effect of intergenerational gaming within families on the experience of aging. Concretely, we seek to find whether playing games with family members provides a path towards successful aging. In other words, the goal is to begin to examine if and in what ways intergenerational family game playing may help stave off disease and disability, maintain high cognitive and physical functioning, and maintain meaningful social connections.

2 Method

In order to gather information on gameplay experiences and compare those experiences, participants were recruited from two sources: older adults who report playing video games with family members, and older adults who do not report such play.

The participants were recruited from three sources after receiving approval from the appropriate Institutional Review Board. Older adults who play video games were recruited through the research system at a large university in the southern United States, as well as through online gaming forums at King.com, Gamesdreams.com, and IGN.com. These websites were chosen as they cater to audiences of varying ages and gaming interests, including casual social games such as Facebook and phone games. Older adults who do not play video games with others were recruited locally from a southern United States community. The participants did not receive any compensation for taking part in the research.

Data collection from the participants who play video games was divided into two parts. In the first part, researchers held short 10 min interviews with participants, either face-to-face or through a mediated format. The participants were asked general questions about their gaming habits (e.g. "What games do you play most frequently?", "Who do you play with and why?"). The interviewees who reported regularly playing games with their family members were asked to fill out a questionnaire in which they were asked about outcomes of intergenerational gaming with family members (e.g. "What do you enjoy about playing video games with family members?").

Of the 38 older adults who were interviewed, 33 were asked to take part in the follow-up questionnaire. The participants in this group who chose to disclose their geographic location were from Western Europe and North America, and the group consisted of 19 females and 14 males, ages 55–70 ($M = 60.97$, $SD = 4.48$). The questionnaire was distributed online, together with the digital consent form. The questionnaire took approximately 30 min to fill out.

Participants who reported not playing video games were recruited through snowball sampling – one participant recruited her friends – and were not separately interviewed. All six participants took part in a focus group and all were female and ages 59 to 68 ($M = 65.17$, $SD = 3.19$). The participants in this group were from the U.S. Their discussion was video and audio recorded, and transcribed.

Focus group organization: The investigators greeted the participants, introduced themselves, and explained the purpose of the study. The participants read and signed the required consent forms. After these forms were collected, the investigators initiated the discussion, focusing on three main questions: what games do you play and with whom (or why not), what do you do while playing, and why do you play, i.e. what do you get out of playing.

The first author reviewed the responses, reading and re-reading to identify themes in the participants' answers, looking particularly for similarities and differences in those experiences. Exemplars for each theme were identified and placed in a draft file of findings. The second author then reviewed the draft findings and the two researchers discussed them at length. Agreement on the appropriateness of the themes and exemplars was 100 %. The

researchers then discussed how these findings relate to previous research and agreed on their interpretations of motivations and behaviors which are reported in the next section.

3 Findings

Based on the responses from our participants, we answer our questions about if and in what ways intergenerational family game playing may help enhance experiences of successful aging. These older adults overwhelmingly reported positive outcomes from playing video games with family members – while enjoyment was an important aspect, maintaining connections with each other, and training cognitive and physical abilities were repeatedly emphasized. The concerns of the non-gamers highlight common negative attitudes toward video game play, but also point to ways in which these negative attitudes may be overcome.

3.1 Intergenerational Gameplay in Families

Whether active video game players or not, all of the participants reported that they enjoyed playing games, however, we should note that the members of the group that identified as not being active on-line gamers said they preferred playing card games, either playing with family members or having a regular group of people with whom they played in person. Even though they do not consider themselves to be active on-line, two of the older adults in this group reported that they do play video games on Facebook such as *Candy Crush*, *Bubble Witch*, and *Pet Rescue* and one participant reported playing a puzzle game – *Four Pic One Word* – on her phone. The older adults who identified as active gamers played a variety of casual games, from *Candy Crush* and *Trivia Crack* to Wii games and sports simulations such as *Madden* to complex and immersive games such as *Halo* and *World of Warcraft*. Therefore, these older adults have broad gaming interests and play a wide variety of video games of different levels of involvement and difficulty.

The active older gamers reported mainly playing video games with younger family members, typically children or grandchildren. When asked what drives their family gameplay, 13 participants (39.4 %) cited entertainment, connectedness, spending time together, and sharing in a joint activity. As one female participant, age 59, reported:

> *I play because I want the opportunity to do something with my grandchildren, an activity that allows us to actively enjoy each other's company. It lets me spend time with them and have fun through some good friendly family competition.*

While nearly three-fourths (72.7 %) of our participants reported preferring cooperative gameplay, over one-third (39.4 %) of the older gamers reported also enjoying the competition and showing that old age still carries knowledge and skill. For example, one female participant, age 63, said:

> *They introduced me to the game, they taught me how to play it, and honestly I like showing them that their grandma can beat them every once in a while. It's funny when you beat your grandkids in something because they always think they are better than us old people.*

Only four participants (12.1 %) reported playing with family members because they have not find anyone with gaming interests among their own age group. One male participant, age 63, reported playing with his grandson because "he plays back":

I play with him because he is the only person I know who plays these games.

These players were then asked what they get out of playing video games. Over two-thirds (69.7 %) of the participants listed that game play was fun and/or relaxing, while nearly one-fifth (18.2 %) identified a sense of accomplishment as the most prominent reasons for playing. As a male participant, age 59, explained:

It's like watching a really good movie while still being able to write it yourself. An interactive movie. You get to create and experience the thrill of the story, to have an impact on the story. I am never bored with video games around, I am sometimes frustrated, sometimes accomplished (usually in that order), scared, intrigued, intense…

One-third (33.3 %) also saw it as a way to escape day-to-day routine, but only four (12.1 %) identified escape as the primary reason for playing. As a female participant, age 57, said:

You can do it at your own pace, in your own free time, and you don't have to physically go somewhere. Sometimes I don't leave work for lunch but stay and play, and it makes me feel like I'm getting away even when I'm not physically leaving.

A male participant, age 60, added:

What I enjoy most about playing my game is that it gives me a release and seems to free my mind for a little while. It also keeps the gears turning in my mind, because some levels can be challenging and it really makes me think. It is different from the everyday tasks I perform at work, so it makes my brain operate in different ways.

While 14 participants (42.4 %) said that games keep challenging their cognitive abilities, only 7 (21.2 %) of them listed this as the primary reason for engaging in game play. A female participant, age 59, explained:

Since I am older, I feel like learning to play these games keeps me "up to speed" with technology. I also like playing it because it's entertaining yet challenging, something to keep me sharp.

A relatively small number (4, 12.1 %) reported the physical aspect of gaming as the most rewarding, enjoying both the competitiveness and the accompanying exercise. All of these participants report only playing games focused on physical activity. As a male participant, age 70, reported:

My grandson and I play Wii games frequently, and I must say it is my trying to compete with him that keeps me physically fit. We play several times a week and can get very competitive with each other, but we are also becoming closer through different conversations had throughout trying to complete the latest level. It gets very intense between the two of us.

The vast majority (27 participants, 81.8 %) focused on closeness and connectedness brought on by playing video games together, not only as a common activity for the participants, but a bonding factor, a shared experience. One female participant, age 65, wrote:

I don't really care about the game I play with my granddaughter, I just play to spend time with her. I feel like we are understanding each other better, I feel closer to her generation.

One male participant, age 59, wrote about the gameplay with his son:

I have really enjoyed being able to connect with my son through a different medium. Playing games together has allowed us to grow closer through fun competition. We talk and see each other more. When he comes home to visit for a weekend, we play, and when he calls and checks in on us, the game always comes up in discussion. We share some friendly trash talk to make it more fun, and he usually enjoys more success than I do. It has given us another subject that we can connect on, and I have really enjoyed it.

These findings are similar to previous research, finding that older adults prioritize being able to enjoy time together and maintain their connection with other family members [27, 30].

While the active gamer group reported very positive experiences gaming with family members, the group of older adults who do not play online games expressed concerns about the games their grandchildren regularly play – particularly interacting with strangers and engaging in violent games as well as the time and money devoted to such play.

The capacity of some games to provide a platform for communication with others outside the household raised an uproar of voices who unanimously agreed such access is dangerous. One female participant, age 67, stated:

And they can interact with other people all over the place! And that's scary to me. You don't know who these people are, you don't know their age, you don't know anything about them. And they could be asking questions and back and forth, and my 13-year-old grandson wouldn't realize that they are picking him for information.

They also expressed concerns about the violent nature of many games. The group unanimously agreed with the statement of one female participant, age 66:

My problem is, I don't like the games. There is just too much violence. To me, there is just too much violence, shooting and killing, blood and guts everywhere.

In addition to their concerns about violence, they thought that their grandchildren spend too much time playing video games, and their children spend too much money buying games and the latest consoles.

Their concerns about the negative consequences of digital game play reflect the findings from previous research [see 33, 34]. Unfortunately, the negative effects tend to receive more media attention than do the positive effects. This aspect may be particularly true for violence in games, which has been found in other studies to be of concern to older adults [21]. Helping older adults to understand the potential benefits may be one strategy to help overcome some of the barriers to game adoption.

In spite of these concerns, the participants discussed extensively the games their grandchildren play and time spent watching them play as well as their potential interest in being more actively involved. One female participant, age 66, reported:

My youngest grandson plays this little game where you build things, Minecraft. I would play that with him. I've sat with him, and we've talked about it, but I've never played with him. I do like that game, he plays that a lot. And when we sit together, he shows me and tells me what he is building. It's really kind of fun. But I've never played with him.

Although five of the six members of this focus group said they had never played with their grandchildren, they all reported that in spite of all their reservations, they would

be willing to try playing games with their grandchildren. They are interested in spending time with them and sharing an activity, but they think the games should be more appropriate and accessible. One female participant, age 59, said:

> *I watch my grandchildren play but don't play with them. I probably would, but I have never been invited....Board games, I play with them.*

This more passive role during game play is similar to the findings of Voida and Greenberg [28] who argued that older players may prioritize gameplay time for their younger partners.

Besides these concerns, the group members also expressed concerns about the speed of action in many games which might make it difficult for them to play with their grandchildren. One female participant, age 68, captured their sentiments when she said:

> *Some games are not violent, but it's so fast, it's wham wham wham wham. There is no way I can keep up with that. I'd break things.*

Because of their resistance to playing, we asked what kind of games they would like to see. They proposed games with an educational undertone that contain puzzles, riddles, perhaps even some of their favorite card games in some form – anything but violence. As one female participant, age 66, said:

> *If they had games we enjoy, we would play with them for sure. It would be a good thing, grandparents playing with their grandchildren.*

To summarize, older adults who regularly play video games with their families find the experience fun, relaxing, positively challenging, and a bonding experience. They credit their younger family members for driving them to start and continue playing video games, but rate highly the perceived cognitive and physical benefits of this joint activity, as well as the bridging of the generational gap in families. In contrast, older adults who do not play video games with family members perceive games as violent, and online gaming as dangerous. They take on the role of an audience to their younger family members during video game play, but do not join in because of the violence or the swift tempo of the games. Finally, they collectively identify playing video games with younger family members as a potential bonding experience, and are interested in taking part in this activity provided that the games are accessible, slower, and the content at least in some way educational or beneficial to the children. However, they are waiting to be asked to join in on the fun.

3.2 Recommendations for Game Design

Our participants reiterated many of the recommendations for game design that have been suggested elsewhere. These suggestions fall into two broad categories: the content of the game itself and the operation of the technology related to the game.

Games that are violent or highly competitive are less enjoyable for older adults. Our older participants who are not currently playing video games, not only disliked violence in their own gameplay, but preferred that younger family members not engage in violent games. While they might co-play or enjoy watching a grandchild play a game, they avoided doing so when the game was violent. Voida and Greenberg [28] also suggested

that the design of games for older adults should entail aspects that encouraged players working together to accomplish goals. Marston [35] suggested that digital gaming should be designed to enhance social enjoyment, feeling connected, and enhancing kinship.

The pace of the games bridges the content and the technological interface. Games that are fast-paced create greater cognitive load that may become challenging as individuals reach advanced old age. Some of these pacing challenges, however, may have more to do with manipulating the physical interface. Rapid movements of buttons or arrow keys was problematic. Interfaces that draw on larger physical and intuitive movements may help even the playing field across generations [35–37].

As Östlund says, negative stereotypes of aging have inhibited game design that would be appealing to the current cohort of older individuals – "researchers often view older users as 'old' first and 'users' much further down the proverbial list – somewhere after 'physically impaired', 'socially bereft', 'technically illiterate' and 'struggling to use unmodified versions of mainstream technologies'" [38, p. 27]. These negative attitudes are apparent in the design of digital resources for older adults, which as a rule focus on encouraging physical and cognitive activities instead of maintaining them, revealing the underlying assumption that the ageing demographic is immobile, disinterested, and incapable of engaging in these activities without the aid of new technologies.

In previous research, young adults reported that the games they choose to play with older adults are selected for the simplicity of the controls and soft learning curve even if these are games they do not necessarily enjoy playing [30]. They suggested linear multiplayer games with clean yet immersive storylines, with quests that require solving word or picture puzzles, cooperative work, and a "handicap" option so all players could play at their skill level, thus getting greater enjoyment from the game, yet equally contribute to the common game goal. Older adults also expressed interest in playing games they observe their grandchildren playing, but are discouraged by the complexity of the controls and the speed of the gameplay.

4 Conclusion

In this study, we explored intergenerational video game playing - and lack of it - in the family setting, seeking to find whether playing games with family members provides a path towards successful aging. This qualitative approach allowed us to collect detailed accounts and explore the nuances of rich gaming experiences of both older adults who play with their family members, and older adults who are skeptical about gaming they witness.

The social aspect of gaming, the opportunity to stay connected through gameplay was the most prominent element in the involvement in and adherence to gaming for active older players. The time spent together, the bonding and conversations, the bridging of the intergenerational gap resulted in affirmative feelings such as joy, satisfaction, and happiness. In addition, there was a sense of accomplishment in mastering new technologies, as well as spending time on an activity that is perceived as beneficial in enhancing mental or physical capabilities. As high cognitive and physical functioning,

as well as the maintenance of important interpersonal relationships are key to successful aging [3], intergenerational gaming has an enormous potential in improving the lives of the growing population of older adults.

Older adults who do not play video games with family members primarily act as an audience, and from the passive role and the stereotypical view on the games fostered by mass media, they see games as a violent waste of time. This perception likely extends to a large part of the population of older adults, precluding them from taking part in gaming activities that could have a positive effect on their physical, mental, and social wellbeing. Taking this in consideration, it is important to design video games not only with the players, but also with an audience in mind, and in a way that the spectators immerse into the games as well. Games used in increasingly popular esports show that such design is achievable.

5 Implications

With each year, the population of older gamers grows. If our goal is to enhance lives across generations, designing games that encourage involvement by and with older adults would be beneficial – to individuals and their families as well as the gaming industry. While researchers have long acknowledged the physical and cognitive benefits of particular design choices, the social aspects should receive more attention in the future. Given that the maintenance of important interpersonal relationships and social and productive engagement are imperative to successful aging, video games have the potential of improving the lives of millions.

6 Limitations

As with any research, this project has its limitations. The number of participants was relatively small, and mainly from the United States and Western Europe. As a consequence, we should not over-generalize our findings. In addition, social desirability may impact what was and was not shared during the focus group session. Future research should address the limitations to this study, as well as examine more specific aspects of rewards. Design that allows for greater interaction among the generations should also be studied. These additional motivations are important to developing a better grasp of what games should be developed and how they should be delivered.

References

1. Federal Interagency Forum on Aging-Related Statistics: Older Americans 2012: key indicators of well-being. Federal Interagency Forum on Aging-Related Statistics. Government Printing Office, Washington (2012)
2. Fisher, C.L., Canzona, M.R.: Health care interactions in older adulthood. In: Nussbaum, J.F. (ed.) The Handbook of Lifespan Communication, pp. 387–404. Peter Lang, New York (2014)
3. Rowe, J.W., Kahn, R.L.: Successful Aging. Pantheon, New York (1998)

4. Phelan, E.A., Anderson, L.A., Lacroix, A.Z., Larson, E.B.: Older adults' views of 'successful aging'—how do they compare with researchers' definitions? J. Am. Geriatr. Soc. **52**, 211–216 (2004)
5. Depp, C.A., Jeste, D.V.: Definitions and predictors of successful aging: a comprehensive review of larger quantitative studies. FOCUS **7**, 137–150 (2009)
6. Reichstadt, J., Sengupta, G., Depp, C.A., Palinkas, L.A., Jeste, D.V.: Older adults' perspectives on successful aging: qualitative interviews. Am. J. Geriatr. Psychiatry **18**, 567–575 (2010)
7. Montross, L.P., Depp, C., Daly, J., Reichstadt, J., Golshan, S., Moore, D., Sitzer, D., Jeste, D.V.: Correlates of self-rated successful aging among community-dwelling older adults. Am. J. Geriatr. Psychiatry **14**, 43–51 (2006)
8. Kennedy, G.E.: Shared activities of grandparents and grandchildren. Psychol. Rep. **70**(1), 211–227 (1992)
9. Hoppes, S., Hally, C., Sewell, L.: An interest inventory of games for older adults. Phys. Occup. Ther. Geriatr. **18**(2), 71–83 (2000)
10. Hoppes, S., Wilcox, T., Graham, G.: Meanings of play for older adults. Phys. Occup. Ther. Geriatr. **18**(3), 57–68 (2001)
11. Hiller, H.H., Franz, T.M.: New ties, old ties and lost ties: the use of the internet in diaspora. New Media Soc. **6**(6), 731–752 (2004)
12. Schultheiss, D.: Entertainment for retirement?: Silvergamers and the internet. Publ. Commun. Rev. **2**(3), 62 (2012)
13. ESA: 2004 essential facts about the computer and video game industry (2004). http://www.theesa.com/facts/pdfs/ESA_EF_2004.pdf
14. ESA: 2015 essential facts about the computer and video game industry (2015). http://www.theesa.com/facts/pdfs/ESA_EF_2015.pdf
15. European Summary Report: Videogames in Europe: consumer study (2012). http://www.isfe.eu/sites/isfe.eu/files/attachments/euro_summary_-_isfe_consumer_study.pdf
16. Kueider, A.M., Parisi, J.M., Gross, A.L., Rebok, G.W.: Computerized cognitive training with older adults: a systematic review. PLoS ONE **7**(7), 1–13 (2012)
17. Broeren, J., Claesson, L., Goude, D., Rydmark, M., Sunnerhagen, K.S.: Virtual rehabilitation in an activity centre for community-dwelling persons with stroke. Cerebrovasc. Dis. **26**(3), 289–296 (2008)
18. Cameirão, M.S., Bermúdez i Badia, S., Duarte, E., Verschure, P.J.: Virtual reality based rehabilitation speeds up functional recovery of the upper extremities after stroke: a randomized controlled pilot study in the acute phase of stroke using the rehabilitation gaming system. Restorative Neurol. Neurosci. **29**(5), 287–298 (2011)
19. Boulay, M., Benveniste, S., Boespflug, S., Jouvelot, P., Rigaud, A.: A pilot usability study of MINWii, a music therapy game for demented patients. Technol. Health Care **19**(4), 233–246 (2011)
20. Nap, H.H., de Kort, Y.A.W., IJsselsteijn, W.A.: Senior gamers preferences motivations and needs. Gerontechnol. **8**(4), 247–262 (2009)
21. Pearce, C.: The truth about baby boomer gamers: a study of over-forty computer game players. Games Cult.: J. Interact. Media **3**(2), 142–174 (2008)
22. De Schutter, B., Vanden Abeele, V.: Designing meaningful play within the psycho-social context of older adults. In: Proceedings of the 3rd International Conference on Fun and Games, pp. 84–93 (2010)
23. Gajadhar, B.J., Nap, H.H., de Kort, Y.A.W., IJsselsteijn, W.A.: Out of sight, out of mind: co-player effects on seniors' player experience. In: Proceedings of the Fun and Games Conference, Leuven, Belgium (2010)

24. De Schutter, B.: Never too old to play: the appeal of digital games to an older audience. Game Cult.: J. Interact. Media **6**(2), 155–170 (2011)
25. Sherry, J., Lucas, K., Greenberg, B.S., Lachlan, K.: Video game uses and gratifications as predictors of use and game preference. In: Vorderer, P., Bryant, J. (eds.) Playing Video Games: Motives, Responses, and Consequences, pp. 213–224. Erlbaum, Mahwah (2006)
26. Coyne, S.M., Padilla-Walker, L.M., Stockdale, L., Day, R.D.: Game on… girls: associations between co-playing video games and adolescent behavioral and family outcomes. J. Adolesc. Health **49**(2), 160–165 (2011)
27. Wohn, D.Y., Lampe, C., Ellison, N., Wash, R., Vitak, J.: The "S" in social network games: initiating, maintaining, and enhancing relationships. In: Proceedings of 44th Annual Hawaii International Conference on System Sciences, Kauai, HI (2011)
28. Voida, A., Greenberg, S.: Console gaming across generations: exploring intergenerational interactions in collocated console gaming. Inf. Soc. J. - JUAICS **11**(1), 45–56 (2012)
29. Rice, M., Yau, L., Ong, J., Wan, M., Ng, J.: Intergenerational gameplay: evaluating social interaction between younger and older players. In: CHI 2012 Extended Abstracts on Human Factors in Computing Systems, pp. 2333–2338 (2012)
30. Osmanovic, S., Pecchioni, L.: Beyond entertainment: motivations and outcomes of video game playing by older adults and their younger family members. Games Culture Spec. Ed.: Games Ageing (2015)
31. Goffman, E.: Encounters: Two Studies in the Sociology of Interaction. Bobbs-Merrill, Indianapolis (1961)
32. Loos, E.F., Zonneveld, A.: Silver gaming: serious fun for seniors. In: Human Aspects of IT for the Aged Population. Design for Aging. Second International Conference, ITAP 2016, Held as Part of HCI International 2015, Toronto, 17–22 July 2016. Proceedings. Springer, Berlin (accepted)
33. Anand, V.: A study of time management: the correlation between video game usage and academic performance markers. Cyberpsychol. Behav. **10**(4), 552–559 (2007)
34. Burgess, S.R., Stermer, S., Burgess, M.R.: Video game playing and academic performance in college students. Coll. Student J. **46**(2), 376–387 (2012)
35. Marston, H.R.: Design recommendations for digital game design within an ageing society. Educ. Gerontol. **39**(2), 103–118 (2013)
36. Bianchi-Berthouze, N., Kim, W.W., Patel, D.: Does body movement engage you more in digital game play? And why? In: Paiva, A.C., Prada, R., Picard, R.W. (eds.) ACII 2007. LNCS, vol. 4738, pp. 102–113. Springer, Heidelberg (2007)
37. Khoo, E.T., Cheok, A.D.: Age invaders: inter-generational mixed reality family entertainment. Int. J. Virtual Reality **5**(2), 45–50 (2006)
38. Östlund, B.: Design paradigms and misunderstood technology: the case of older users. In: Jæger, B. (ed.) Young Technologies in Old Hands: An International View on Senior Citizen's Utilization of ICT, pp. 25–39. DJØF Forlag, Copenhagen (2005)