Older Adults' Digital Gameplay: Patterns, Benefits, and Challenges

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Abstract

Background. Empirical evidence suggests that digital gameplay can **enhance social interaction** and **improve cognition** for **older adults**. However, if digital games are to be effectively used as interventions to address age-related challenges, it is important to explore **older adults' experiences** in playing them.

Aim. The purpose of this survey design study was to **identify digital gameplay patterns**, perceived socio-emotional and cognitive **benefits,** and **difficulties** encountered in the gameplay experiences of **older adults**.

Method. Adults aged 55 or older, recruited from seniors' centers and local shopping malls in a Canadian city, responded to a printed, mainly closed-ended **questionnaire**.

Results. 463 respondents reported that they actively play digital games**.** Most played alone rather than with others, and most rated themselves as intermediate or expert players. Players self-reported **cognitive benefits** but few **socio-emotional benefits** and few **difficulties.**

Conclusions. The results of this study show **promise** for the use of digital games to provide innovative and engaging activities **for enhancing older adults' aging**

processes. Significant associations were found between player skill level and reported benefits.

Recommendations. To perceive these benefits, older adults need to play frequently enough to **develop beyond a beginner level. Education, facilitation, and support** may be needed to encourage older adults to realize socio-emotional benefits from digital gameplay.

Keywords

digital games; videogames; older adults; seniors; cognitive benefits; socio-emotional benefits.

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Background

Population aging is a part of life and a global trend. By 2050, one in five people in the world will be 60 years of age or older (Akitunde, 2012). In fact, this population segment is growing faster than any other age group and is predicted to reach two billion by 2050 (Aalbers, Baars, & Olde Rickert, 2011; WHO, 2002). Aging adults face declining physical and cognitive capacities, shifts from career or family focus to different interests and activities, loss of long-term companions and social supports, changing living arrangements, and increasing likelihood of chronic and debilitating illness (Kaufman, 2013). Maintaining an independent, positive, healthy, and meaningful quality of life is an ongoing challenge for older adults and yet is paramount for individual older adults and for societies. Cognitive and social capacities have been identified as important aspects of older adults' quality of life (Kelley-Gillespie, 2009) and are the focus of this paper.

Researchers have long considered physical and cognitive declines to be natural results of aging. However, emerging neuroscience evidence suggests that appropriate training or therapeutic techniques can slow these trends in some ways. For example, Green and Bavelier's (2008) review of cognitive training regimens concludes that some types of

training experience, including digital games, could have widespread effects on perception, motor skills, and cognition. In a randomized controlled study with booster training, Willis et al. (2006) found significant long-term improvements in the abilities trained, although these did not generalize to other tasks. Hall, Chavarria, Maneeratana, Chaney, and Bernhardt's (2012) systematic review found that most studies reviewed reported significant positive effects on health outcomes from digital gameplay, while Zhang and Kaufman's (2015) meta-analytic review concluded that "playing digital games is effective in improving older adults' physical balance, …balance confidence, … functional mobility, … executive function, … and processing speed" (p. 1).

Although we lack a single clear definition of *positive aging* (Lee, Lan, & Yen, 2011), gerontology researchers have demonstrated that cognitive and social factors may sometimes outweigh physical conditions in determining life satisfaction and quality of life. Cognitive health is an important factor, and researchers generally agree that aging is associated with a decline in many cognitive processes. However, recognizing that the rate of cognitive decline is not fixed, many have begun to explore life factors and interventions to prevent or slow reduction in cognitive functions (e.g., Hedden & Gabrieli, 2004; Kueider, Parisi, Gross, & Rebok, 2012; Mahncke et al., 2006; Wang et al., 2006).

Similarly, researchers have consistently identified social interaction and support as key aspects of older adults' quality of life. Social connectedness is an important component (Ristau, 2011; von Faber et al., 2001). Declining social capacities are linked with declines in physical, cognitive, and emotional functions (WHO, 2002) and consequently with disease, dependence, and poorer life quality. A qualitative, interview-based study by Reichstadt, Sengupta, Depp, Palinkas, and Jeste (2010) identified self-acceptance and engagement in life as primary themes for successful aging. Rowe and Kahn (1997) agree, arguing that, based on a survey of MacArthur Foundation research, active engagement is key to successful aging, which they define as low probability of disease and disease-related disability, high cognitive and physical functional capacity, and active engagement with life. Adams, Leibbrandt, and Moon's (2011) critical review of 42 studies concluded that informal social activity was the activity domain that showed the most evidence of influence on older adults' wellbeing. Forsman, Nyqvist, Schierenbeck, Gustavson, and Wahlbeck (2012) concluded from a survey of over 6300 older Nordic adults that both frequency of contact with friends and trust in friends were significantly related to lower levels of depression.

Technology has great potential to support older adults in living well by addressing their physical, mental, and social challenges and by providing them with stimulating,

meaningful and enjoyable activities (Allaire et al., 2013; Sixsmith, Gibson, Orpwood, & Torrington, 2007). In particular, technology-based games promise many benefits to older adults (Astell, 2013), although research has not yet provided clear conclusions about whether and how these can be realized, in particular due to a lack of rigorous research methodologies (Bleakley et al., 2015).

Digital games and older adults

Older adults take part in many leisure activities using Information and Communications Technologies (ICTs), including playing digital games (e.g., video, computer, and online games). De Schutter (2011), investigating the use of digital games among 124 gamers between 45 and 85 years old, found that 16.1% played digital games more than 2.5 hours per day and 29.5% played one to 2.5 hours per day. In 2005, 18% of gamers (about 1.7 million) in the UK were aged between 51 and 65 (Pratchett, Harris, Taylor, & Woolard, 2005). In 2011, 29% of digital game players in America were aged 50 and over (Entertainment Software Association, 2013a). Twenty-five percent of Americans aged 65 or older played digital games in 2015 (Duggan, 2015).

Many older adults are already active technology users and can readily learn and use digital games (Duggan, 2015; Pew Internet and American Life Project, 2011). Digital games hold significant promise for enhancing the lives of older adults. IJsselsteijn, Nap, de Kort, and Poels (2007) identified four potential areas for games to contribute to improving

seniors' quality of life: (1) relaxation and entertainment, (2) socializing, (3) sharpening the mind, and (4) motivating healthy behaviours such as physical activity. Using a positive psychology approach, Astell (2013) confirms this viewpoint, arguing that games offer social interaction, cognitive exercise, and physical activity to help seniors maintain health and wellbeing. Hall et al.'s (2012) 13-study systematic review found evidence of significant mental, physical, and social health outcomes for older adults. In a specific example, Torres (2011) found that the use of digital games led to a decline in cognitive deterioration in comparison to control groups. Also, Gerling, Mandryck, and Linehan's (2015) observational study concluded that motion-based video games, if designed and offered in ways that address older adults' specific needs, can provide appealing leisure activity and promote positive self-esteem among long-term care residents.

Games satisfy a variety of needs for older adults (De Schutter, Brown, & Vanden Abeele, 2015; De Schutter & Malliet, 2014). Adults play games for many reasons, and their motivations vary with their previous game exposure and their physical and cognitive abilities (Brown, 2012, 2014). Zonneveld and Loos (2015) confirmed this, finding that playing a fitness exergame served not just a therapeutic role, improving physical and social wellbeing, but also provided entertainment, excitement and fun as reported by the subjects of the study. Hausknecht's (2013) online survey of 50 World of Warcraft players aged 55+

found that mental exercise, enjoyment, escape from daily life, and social interaction were each seen as benefits by at least 40% of respondents, with the first three of these reported by at least half.

Games for fun and pleasure

Digital games hold promise for improving seniors' subjective wellbeing and offer an enjoyable way of spending time (Whitcomb, 1990). It is well known that games are engaging and promote flow experience (Csikszentmihalyi, 1990; Dupláa & Taiwo, 2013; Marston, 2013). Recognizing that the intrinsic value of play and fun for older adults is an important concern, research is confirming that digital games play a role in satisfying older adults' individual needs, whether for achieving useful outcomes or for experiencing pleasure for its own sake (Brown, 2014; De Schutter & Malliet, 2014; De Schutter & Vanden Abeele, 2010; Iversen, 2016; McLaughlin, Gandy, Allaire, & Whitlock, 2012; van Leeuwen & Westwood, 2008).

Socio-emotional factors and digital games

Increasingly, digital game playing involves social interaction (Mahmud, Mubin, Shahid, & Martens, 2010). Studies have shown that the social interaction while playing digital games is important to older players (De Schutter & Vanden Abeele, 2010; Khoo & Cheok, 2006; Whitcomb, 1990; Wollersheim et al., 2010). Prior epidemiological, cross-sectional and longitudinal research has shown that older adults with higher frequencies of

social interaction report more positive wellbeing. For example, Glei et al. (2005) examined how changes in cognition over time are related to social participation and the extent of social networks. Data drawn from this population-based, longitudinal study revealed that respondents who engaged in one or two social activities failed 13% fewer cognitive tasks than those with no social activities, and those who participated in three or more activities failed 33% fewer cognitive tasks. Glei et al. also indicated that social interaction outside the family might have a bigger impact on cognitive function than social contacts with family. In addition, social connectedness provides opportunities for older adults to deal with stress, receive social support, and connect with friends.

Games offer opportunities for social interaction through group or online play (Hausknecht, Schell, Zhang, & Kaufman, 2015; Kaufman & Sauvé, 2010; Schell, Hausknecht, Zhang, & Kaufman, 2016). Playing digital games can promote positive health outcomes associated with alleviating depression, feelings of loneliness, and isolation (Kahlbaugh, Sperandio, Carlson, & Hauselt, 2011; Li, Theng, & Foo, 2014; Wollersheim et al., 2010). Digital gameplay also provides a venue for developing social capital that strengthens strong social ties both on- and offline (Trepte, Reinecke, & Juechems, 2012).

Cognitive function and digital games

There is some evidence that gameplay can improve aspects of cognition, including cognitive control (Anguera et al., 2013), executive control functions (Basak, Boot, Voss, &

Kramer, 2008), and processing speed (Zhang & Kaufman, 2015). Games that require players to make progressively more accurate and more challenging judgments at higher speed, and to suppress irrelevant information, can drive positive neurological changes in the supporting brain systems (Belchior et al., 2013). Since most digital games require hand-eye coordination, sustained attention to a task and the ability to quickly process visual information by locating specific areas on the screen, players' visual-spatial and multitasking skills can develop with gameplay practice (Abbott, 2013; Latham, Patston, & Tippett, 2013; Spence & Feng, 2010).

Challenge is one of the main motives that older adults have for playing digital games; thus, digital games and cognition are deeply intertwined and connected (Gamberini et al., 2008). Recently, digital game researchers and developers have focused on improving different aspects of older adults' cognition (Basak et al., 2008; Bleakley et al., 2015; Whitlock, McLaughlin, & Allaire, 2012). Large commercial game companies have produced games that are meant to enhance cognition (e.g. Brain Aged: Train Your Brain in Minutes a Day (www.nintendo.com) and Lumosity (www.lumosity.com)), while game-based research projects such as ElderGames (Gamberini et al., 2006) and HERMES (Buiza et al., 2009) have studied ways that digital games can enhance cognitive function and help seniors overcome age-related difficulties. However, experimental studies on digital games

and cognition have so far suffered from methodological and theoretical difficulties leading to inconsistent experimental results (Baniqued et al., 2013). Evidence so far seems to indicate that gameplay (as for other activities) only improves skills associated with the specific activity, and the improvement is not likely to last if players stop using the game. Stronger claims have not been proven and there is controversy about the claims made in marketing games for brain training to older adults (Stanford Center on Longevity and Max Planck Institute for Human Development, 2015).

Digital games can facilitate learning (Garris, Ahlers, & Driskell, 2002; Green & Bavelier, 2008). They can also support learning through a variety of motivational features, such as content-based challenges and graduated levels of practice (Kaufman & Sauvé, 2010; Nap et al., 2015). A meta-analysis by Wouters, van Nimwegen, van Oostendorp, and van der Spek (2013) found that digital games were more effective for learning and retention than were conventional instruction methods, particularly when supported by other instruction methods, multiple sessions, and group work.

Debriefing after the gameplay experience is important for supporting learning (Crookall, 2010). In fact, many consider debriefing, or the review and analysis of events that occurred in the game, to be the most critical part of the gaming experience (Crookall, 1995). If our purpose is to develop games that are instructive, the debriefing process allows

us to transform game events into learning experiences. Some authors assert that debriefing is a fundamental link between game experiences and learning (Garris et al., 2002).

Perceived gameplay benefits and costs

In order to realize potential benefits from digital gameplay, older adults must be motivated and supported to start and continue playing long enough for the benefits to emerge. This involves a tradeoff between the perceived benefits of gameplay and its costs, such as difficulties with using the technology or learning a game and resulting feelings of low self-esteem (Gerling et al., 2015; IJsselsteijn et al., 2007; McLaughlin et al., 2012). Although players are drawn to digital games by subjective experience, relatively few studies have focused on older adults' own experiences and the socio-emotional and cognitive effects on them of playing digital games; these studies have reported mixed results. Marston (2013) determined that older adults experienced flow and immersion while playing interactive sports games, but this was inhibited when they had difficulties with the game interface. McLaughlin et al. (2012) also found that players experienced flow states; benefits such as self-esteem, social interaction, challenge, and achievement were identified in their players' recorded comments during gameplay but were not formally measured. Based on an online survey of players of one casual video game, Whitbourne, Ellenberg, and Akimoto (2013) reported that gamers of all ages played primarily for social reasons, and older adults said that gameplay helped them to improve their visual and spatial

skills and their response time. De Schutter and Malliet (2014) identified cognitive and social connectedness needs as two of five types of gameplay motivation identified by older adults but could not directly relate these to the types of satisfaction that their subjects described.

Gerling et al. (2015) and McLaughlin et al. (2012) suggested that difficulties in learning and playing digital games are among the costs that discourage older adults from engaging in gameplay, but they do not specifically address the benefits perceived by those who have avoided or overcome these issues to become more frequent and/ or skilled players. Given the potential benefits of digital gaming in later life, we wanted to explore the relationships between older adults' gameplay profiles, including self-reported skill level, and the social-emotional benefits, cognitive benefits, and difficulties that they perceive as a result of their gameplay.

Research questions

The survey research was guided by the following questions regarding digital games in general, without a focus on any specific game genres:

1. What are the patterns of digital gameplay (past history, current frequency and duration, playing socially vs. alone, and self-reported skill level) reported by older adults?
2. What are the socio-emotional benefits of digital gameplay reported by older

adults?

3. What are the cognitive benefits of digital gameplay reported by older adults?
4. What difficulties do older adults encounter playing digital games?
5. What associations exist between older adults' skill level in playing digital games and the social-emotional benefits, cognitive benefits, and difficulties that they experience in playing digital games?

Research methods

Participants

The survey targeted adults aged 55 or more who lived in a west coast Canadian city, had played games (non-digital or digital) during past year, and were able to complete the survey (described below) in English. The age cutoff of 55 allowed us to compare younger seniors with older ones.

Instrument

This research draws on data from a cross-sectional survey on digital and non-digital game playing that was approved by the local university ethics board. The study used a print-based, mainly closed-ended, questionnaire that was designed by reviewing instruments from the literature, adapting various questions, and creating new ones. The survey questions were reviewed by members of the research team using an iterative

feedback process to ensure that they tied into the research questions and the literature and were clearly worded. The questionnaire was then pilot tested with ten older adults and minor revisions were made.

Using nominal and ordinal categories, the questionnaire asked about leisure activities, digital game-playing patterns, and gameplay benefits and difficulties. Input variables relevant to this paper include respondents' reported gameplay patterns (past history, current frequency and duration, playing socially vs. alone) and their self-reported skill level in play digital games (beginner/ low, intermediate/ middle, and expert/ high).

Outcome variables (Table 1) were the socio-emotional and cognitive changes that respondents self-reported as attributed to their gameplay (15 items, rated increased, stayed the same or decreased). Individual survey questions are shown in the tables below that report on results for each research question. The cognitive benefits section focused on five broad areas often considered by researchers on digital games and older adults: attention, memory, reasoning, problem solving, and reaction speed. Although this is not an exhaustive list, and each entails a number of cognitive subtasks, these categories are useful for the self-reporting required here.

Table 1
Outcome Variables and References

Variable	Reference(s)

What do you think are the greatest benefits of playing digital games?	
• Mental exercise • Social interaction • Enjoyment (fun) • Escape from daily life	Bleakley et al., 2015; De Schutter & Maillet, 2014; De Schutter & Vanden Abeele, 2010; Schell et al., 2016; Zonneveldt & Loos, 2015
In your opinion, has playing digital games increased or decreased the following for you:	
Social and emotional capabilities:	
• Developing new friendships • Connecting with current friends • Connecting with family • Connecting with various age groups • Developing self-confidence • Dealing with loneliness • Dealing with depression	De Schutter & Vanden Abeele, 2010; Gerling et al., 2015; Li et al., 2014; McLaughlin et al., 2012; Schell et al., 2016; Wollersheim et al., 2010; Zonneveldt & Loos, 2015;
Cognitive capabilities:	
• Focusing attention • Memory • Reasoning • Problem-solving • Speed in reacting/ responding	Anguera et al., 2013; Basak et al., 2008; Green & Bavelier, 2008; Zhang & Kaufman, 2015

To clarify terms, the questionnaire defined *non-digital games* and *digital games* as in Table 2. All respondents completed the first section of the survey, dealing with non-digital gameplay, and the third, which asked about their personal backgrounds. Those who answered that they played digital games completed the second section.

Table 2

Game Descriptions Used in the Survey Instrument

Non-digital games	Non-Digital Games refer to all types of games that don't require the use of digital devices to play. Some examples include social games such as Trivial Pursuit, Monopoly, Concentration, Clue, card games such as Patience, Bridge, Hearts, Crazy Eights, Checkers, and Chess. Casino games such as slot machines are considered as non-digital games since skill is not required.
Digital games	Digital Games refer to all types of video games and computer games, whether played on computers, handheld devices, video game consoles or other means.

Recruitment and data collection

Using a convenience sampling process, we recruited participants from older adults' independent and assisted living centers, local community centers and seniors' centers (with permission of center directors), and local shopping malls (with management permission to publicly solicit participants). Each potential participating organization received a recruitment letter asking the director or manager to reply in writing by email or letter if they agreed to participate.

Older adults were approached in the various settings and asked if they ever played any games (non-digital or digital, alone or with others), for example, card games or board games. If they answered positively, they were asked to take 10 to 15 minutes to fill out a printed questionnaire about the nature of their gameplay. If they agreed, they were asked to first read and sign a consent form that explained procedures to ensure privacy and then to

complete the questionnaire. If they completed the survey, they were given a $10 coffee shop gift certificate and the option of providing their contact information on a separate postcard to become eligible for a random draw for three $100 cash prizes.

It was clear that the financial incentives provided much of the motivation for participating in the survey. Nearly all those who responded positively about having played games agreed to complete the questionnaire.

Data analysis

We used SPSS software (version 19) for the data analysis. Descriptive statistics (frequencies and percentages) described the sample as well as the benefits and difficulties reported. Chi-squared statistics examined whether the perceived cognitive benefits were associated with participants' self-rated skill levels in playing digital games.

Results

Participants' personal characteristics

Four hundred sixty-three participants responded to the digital games part of the questionnaire. Table 3 presents survey respondents' personal characteristics. Almost two-thirds (62%) of respondents were female. Respondents ranged in age from 55 to over 90 years, with half in the 65-74 age group and just 13% aged 75 or older. Slightly over one-third (36%) lived alone, and the great majority lived at home and were retired. Almost two-

thirds (62%) were not working at all, while more than one-third (38%) were working part- or full-time.

Table 3

Participants' Personal Characteristics (N=463)

Background Variable	% of Respondents
Sex	
Male	38
Female	62
Age	
55-64	37
65-74	50
75-90+	13
Living arrangement	
Alone	36
In a couple	36
With family	24
With others	4
Residence	
Private home	83
Assisted-living	8
Other	9
Retirement status	
Retired	80
Not retired	20
Working situation	
Not working	62
Working part-time[1]	28
Working full-time[1]	10

[1]*Paid or voluntary*

Digital gameplay patterns by age group

Table 2 shows participants' gameplay patterns by age group in terms of past history, current frequency and duration, playing socially vs. alone, and self-reported skill level. About half (50.4%) of all participants reported playing for five years or more; the oldest age group had slightly more long-time players, although this relationship was not significant.

In terms of gameplay frequency, most participants (85.6%) had played digital games during the past month, and 88.2% reported playing one day or more per week on average. Over 40% reported playing at least two hours per day when they did play. There were no significant relationships across age groups for these responses.

Online play with others was relatively infrequent, with only 9.2% of respondents playing role-playing games online with other players, and only 27.5% playing social games online with others. Only 15% of respondents reported having met new people while playing online games. Again, there were no significant differences across age groups. The most frequently mentioned digital game genre that was played (not shown in the table) was puzzle games (33.3%), followed by card/ board/ tile games (17.6%).

When asked with whom they played digital games, most participants (81.9%) reported playing digital games alone. Just over one-third (33.7%) played with family members, with significantly more players doing so in the youngest (55 – 64) age group

($\chi^2_{(df=3)}$= 7.63, p=.022). Similarly, 22.8% played with friends, with significantly more of these in the youngest age group ($\chi^2_{(df=3)}$= 8.35, p=.015). Just 2.1% of all respondents reported playing with those other than family, friends, or fellow club members.

When asked to self-assess their skills level in playing digital games, 62.6% rated themselves as intermediate or expert. (The two were combined because only 35 respondents rated themselves as expert.) This percentage increased with older age groups, with the relationship approaching significance ($\chi^2_{(df=5)}$= 5.84, p=.054).

Table 2

Participants' Gameplay Patterns vs. Age (n=463): Frequency of Play, Social vs. Solitary Play and Skill Level

		% of Respondents			
Responses[1]	All	Age 55-64	Age 65-74	Age 75+	χ^2
For how many years have you been playing digital games?	*n*=442	*n*=195	*n*=165	*n*=82	
Less than 1 year	19.5%	23.1%	14.5%	20.7%	11.92
1-4 years	30.1%	29.7%	35.8%	19.5%	(*df*=6)
5-9 years	19.0%	15.4%	21.2%	23.2%	*p*=.064
10+	31.4%	31.8%	28.5%	36.6%	
Have you played digital games during the past month?	*n*=438	*n*=192	*n*=164	*n*=82	
Yes	85.6%	83.3%	88.4%	85.4%	1.86
No	14.4%	16.7%	11.6%	14.6%	(*df*=5)
					p=.395

During the past month, on how many days per week on average have you played digital games?	*n*=440	*n*=194	*n*=165	*n*=81	
0	11.8%	14.9%	8.5%	11.1%	12.24
1-2	34.1%	37.6%	34.5%	24.7%	(*df*=8)
3-4	20.2%	16.0%	24.2%	22.2%	*p*=.141
5-6	11.6%	9.3%	12.1%	16.0%	
7	22.3%	22.2%	20.6%	25.9%	
During the past month, when you played digital games, for how many hours per day on average did you play?	*n*=420	*n*=185	*n*=156	*n*=79	
1 hour or less	58.8%	61.6%	57.7%	54.4%	9.60
2-3 hours	34.8%	31.4%	37.8%	36.7%	(*df=8)*
4-5 hours	4.3%	4.3%	3.8%	5.1%	*p*=.295
6-8 hours	1.4%	1.1%	0.6%	3.8%	
More than 8 hours	0.7%	1.6%	0.0%	0.0%	
Have you played role-playing games online with other players?	*n*=412	*n*=181	*n*=156	*n*=75	
Yes	9.2%	9.9%	8.3%	9.3%	0.26
No	90.8%	90.1%	91.7%	90.7%	(*df=5)*
					p=.878
Have you played social games online with other players?	*n*=437	*n*=194	*n*=162	*n*=81	
Yes	27.5%	26.8%	26.5%	30.9%	0.58
No	72.5%	73.2%	73.5%	69.1%	(*df=5)*
					p=.748
Have you met new people while playing these online games?	*n*=433	*n*=194	*n*=160	*n*=79	
Yes	15.0%	16.5%	10.6%	20.3%	4.45
No	85.0%	83.5%	89.4%	79.7%	*(df=5)*
					p=.108

With whom have you played digital games?[2]					
Alone	*n*=436 81.9%	*n*=192 79.7%	*n*=163 84.7%	*n*=81 81.5%	1.48 *(df=3)* *p*=.477
Family members	*n*=436 33.7%	*n*=192 40.6%	*n*=163 29.4%	*n*=81 25.9%	7.63 *(df=3)* *p*=.022
Friends	*n*=435 22.8%	*n*=191 29.3%	*n*=163 17.8%	*n*=81 17.3%	8.35 *(df=3)* *p*=.015
Members of a club or association	*n*=436 4.6%	*n*=192 4.2%	*n*=163 3.1%	*n*=81 8.6%	3.98 *(df=3)* *p*=.137
Others	*n*=434 2.1%	*n*=191 2.1%	*n*=162 1.9%	*n*=81 2.5%	0.10 *(df=3)* *p*=.950
What is your skill level in playing digital games?[3]	*n*=438	*n*=192	*n*=165	*n*=81	
Beginner (Low level)	37.4%	41.1%	38.8%	25.9%	5.84
Intermediate (Middle level) or Expert (High level)	62.6%	58.9%	61.2%	74.1%	*(df=5)* *p*=.054

[1]Item headings are actual survey questions.
[2]Respondents could select more than one category. Percentages indicate the proportion of respondents who selected yes in the category.
[3]Intermediate and advanced levels have been combined due to the low number (7.4%) of "advanced" responses.

Digital gameplay patterns by skill level

Table 3 reports associations between participants' gameplay patterns and self-reported skill levels. Intermediate/ advanced players had played for significantly longer than had beginner players ($\chi^2_{(df=5)}$= 58.60, p=<.000). Fully 41.3% of intermediate/ advanced players had played for 10 or more years, in contrast to just 15.2% of beginners. Intermediate/ advanced players had played significantly more in the past month than had beginners ($\chi^2_{(df=6)}$= 72.21, p=<.000), with 32.4% of intermediate/ advanced players, vs. only 4.9% of beginners, playing seven days per week on average. Intermediate/ advanced players also played significantly more per day ($\chi^2_{(df=6)}$= 22.35, p=<.000),, although only small percentages of both groups played more than 3 hours per day.

Table 3

Participants' Gameplay Patterns vs. Skill Level (n=463): Frequency of Play and Social vs. Solitary Play

	Self-reported Skill Level		
Responses[1]	Beginner	Intermediate or Advanced[2]	χ^2
For how many years have you been playing digital games?	*n=165*	*n*=288	
Less than 1 year	34.5%	10.4%	58.60
1-4 years	35.2%	27.1%	(df=5)
5-9 years	15.2%	21.2%	*p*=<.000
10+	15.2%	41.3%	
During the past month, on how many days per week on average have you played digital	*n*=164	*n*=287	

games?			
0	20.1%	5.9%	72.21
1-2	47.6%	26.5%	(df=6)
3-4	20.1%	20.9%	*p*=<.000
5-6	7.3%	14.3%	
7	4.9%	32.4%	
During the past month, when you played digital games, for how many hours per day on average did you play?	*n*=154	*n*=278	
1 hour or less	72.1%	50.0%	22.35
2-3 hours	25.3%	41.0%	(df=6)
4-5 hours	2.6%	5.8%	*p*<.000
6-8 hours	0.0%	2.2%	
More than 8 hours	0.0%	1.1%	

[1]Item headings are actual survey questions.
[2]Intermediate and advanced levels have been combined due to the low number (7.4%) of "advanced" responses.

Perceived benefits

Table 4 summarizes participants' opinions about the benefits of playing digital games. Mental exercise was the most commonly selected general benefit of digital game playing (83.0%), with the next most common selection being enjoyment (fun) (selected by 70.7% of respondents). More than 25% of respondents saw social interaction and a general escape from daily life as additional benefits.

When asked to what extent they experienced specific socio-emotional and/ or cognitive changes from playing digital games, no participants reported a decrease and only three reported no change. For socio-emotional benefits, they most frequently reported increases in developing self-confidence (41.9%), dealing with loneliness (34.5%), and connecting with family (32.5%). The lowest-rated socio-emotional benefit, dealing with depression, was still reported by 23.9% of participants.

The majority of respondents reported perceived increases in all five specific cognitive benefit areas. The most frequently reported cognitive benefit experienced as a result of playing digital games was focusing attention (71.6%), followed by memory (69.1%), reaction speed (65.6%), problem-solving (64.5%), and reasoning (58.1%).

Table 4

Benefits of Playing Digital Games (N=463)

Benefits[1]	% Selecting
General Benefits	
Mental exercise	83.0
Enjoyment (fun)	70.7
Social interaction	25.9
Escape from daily life	25.9
Increases in Socio-Emotional Areas	
Developing self-confidence	41.9
Dealing with loneliness	34.5
Connecting with family	32.5
Connecting with various age groups	28.1
Connecting with current friends	26.6

Developing new friendships	25.6
Dealing with depression	23.9
Increases in Cognitive Areas	
Focusing attention	71.6
Memory	69.1
Reaction speed	65.6
Problem-solving	64.5
Reasoning	58.1

[1]Respondents could select more than one benefit.

Respondents reported relatively few difficulties in playing digital games (Table 5). The highest ranked difficulty reported was that the games were too complicated (21.1%). About 10% of respondents reported difficulty using the controller and limited or no access to technology.

Table 5

Difficulties of Playing Digital Games (N=463)

Difficulties[1]	% Selecting
Difficulties[1]	
Too complicated	21.1
Difficult to use controller	10.0
Limited or no access to technology	9.6
Privacy	4.9
None	42.3

[1]Respondents could select more than one difficulty.

Table 6 reports associations between participants' self-rated skill levels in playing digital games and perceived benefits and difficulties. Although a higher percentage of advanced players reported general benefits, the only significant differences in general benefits in favor of the advanced skill group were in mental exercise ($\chi^2_{(df1?)}$= 18.56), *p*=<.000), and enjoyment (fun) ($\chi^2_{(df=1)}$= 4.95, p=.026). Regarding difficulties reported, a significantly higher percentage of beginners compared to advanced level players selected the difficulties *too complicated* ($\chi^2_{(df=1)}$= 19.57, p=<.000), *difficult to use controller* ($\chi^2_{(df=1)}$= 8.30, p=.004), and *limited or no access to technology* ($\chi^2_{(df=1)}$= 12.55, p=<.000), although the numbers were relatively low. However, more than double the percentage of advanced players (54%), compared to beginners (23.8%), responded *none* to the list of difficulties ($\chi^2_{(df=1)}$= 37.80, p=<.000).

For six of the seven socio-emotional factors, skill level was not related to reported increases. For the factor *connecting with various age groups*, a significantly higher percentage of the intermediate/ advanced group reported an increase ($\chi^2_{(df=1)}$= 9.02, p=.011).

A greater percentage of intermediate/advanced players, compared to beginners, experienced statistically significant increases in five of the six specific cognitive skills. The

only skill showing no difference across groups was *memory*; however, it was the cognitive skill rated as increasing by the greatest percentage (66.2%) of *beginner* respondents and almost three-quarters (72.1%) of *advanced* skill players.

Table 6

Relationships Between Self-Rated Playing Skill and Perceived Benefits and Difficulties of Playing Digital Games (n=463)

	% Selecting			
Benefits and Difficulties	Beginner Skill Level	Interme-diate or Advanced Skill Level	χ^2(df=1)	*p*
General Benefits				
Mental exercise	73.2	89.0	18.56	.000
Enjoyment (fun)	65.3	75.1	4.95	.026
Social interaction	21.4	28.1	2.47	.116
Escape from daily life	22.6	28.8	2.08	.149
Difficulties				
Too complicated	32.3	14.4	19.57	.000
Difficult to use controller	14.9	6.5	8.30	.004
Limited/ no access to technology	15.5	5.4	12.55	.000
Privacy	3.1	5.8	1.59	.207
None	23.8	54.0	37.80	.000
Increases in Socio-Emotional Areas				
Developing self-confidence	40.0	44.1	0.68	.713
Dealing with loneliness	33.1	36.9	0.81	.668
Connecting with family	31.1	33.5	4.14	.126
Connecting with various age groups	25.7	29.6	9.02	.011
Connecting with current friends	26.0	28.8	2.26	.324
Developing new friendships	26.0	25.3	2.76	.251
Dealing with depression	18.1	27.2	4.22	.121
Increases in Cognitive Areas				

Focusing attention	64.7	76.7	8.61	.013
Memory	66.2	72.1	2.06	.357
Reaction speed	59.9	69.3	7.11	.029
Problem-solving	48.4	74.6	30.51	.000
Reasoning	44.6	66.7	23.15	.000

Note: Almost no one reported a decrease. Some reported no change

Discussion

Participant backgrounds, gameplay patterns, and skill levels

These survey results provide new insights into gameplay patterns and perceived benefits and challenges of digital gameplay for urban older adults. Our 463 volunteer participants were typically female and retired; we suggest that these characteristics reflect females' greater prominence at the sites at which the data were gathered. This is also consistent with our experience that females are often more willing to help with surveys such as this one. Over 80% of respondents lived at home, indicating that they were relatively healthy and independent.

Our results suggest that many in this group of older adults are actively playing digital games, broadly defined, on a regular basis. Their most frequently played games, puzzle games and card/ board/ tile games, echo other current research findings on game preferences (Allaire et al, 2013; Entertainment Software Association, 2013b).

It is interesting to note that although half of the respondents to this survey had played digital games for five years or more, the other half were relatively new to the world

of digital games. We had hypothesized that more of the long-term players would be from the baby boomer group, who were born in 1946 or later) and might have had greater exposure to games when they were younger. Instead, our two younger age groups had greater percentages of players who had played for four years or less. This suggests that longer periods of digital gameplay might simply be associated with older adults' increased free time, or shifts in activity choices, as they retired or grew older. However, age group was not significantly related to frequency of gameplay.

Socializing has frequently been identified as an important gameplay benefit for older adults (De Schutter & Vanden Abeele, 2010; Khoo & Cheok, 2006; Whitcomb, 1990; Wollersheim et al., 2010), so we were surprised to find that over 80% of our respondents played alone. This might reflect their preference for puzzle games. Younger players played significantly more with family and friends; we could not speculate on the reasons for this except to guess that they might have had more exposure and practice with online social connections in general. Clearly more in-depth investigation might help to uncover the dynamics at work here.

With regard to skill level, a high proportion (nearly two thirds) of participants rated themselves as intermediate or expert players. More respondents in our oldest age group placed themselves in these categories, consistent with their more frequent gameplay. Skill

level was significantly associated with all levels of play activity (years played, recent time, played, and hours per day played). These findings appear to reflect our recruitment methods, which were designed to maximize the number of participants despite difficulties in recruiting older participants (De Schutter & Malliet, 2014) for this initial exploration. Our use of volunteers found in settings that would attract active older adults probably led to greater numbers of enthusiastic digital game players.

Digital gameplay benefits and challenges

Respondents to our survey most frequently saw *enjoyment* as a general benefit from digital gameplay. De Schutter and Brown (2016) reported a similar result from interview-based studies in the US and Belgium, arguing that gameplay as a route to pleasurable experiences (what they termed *hedonic enjoyment*) motivated gameplay for all of their participants. Older females in their studies emphasized that gameplay for them represented downtime, relaxation, and free choice after a busy lifetime of caring for their families. Thus, this Canadian survey is consistent with recent results in the US and Europe and confirms that games intended to produce health benefits or learning, if they are to be successful, must first and foremost be enjoyable for their target players.

Gameplay as a useful activity (what De Schutter and Brown termed *telic enjoyment*) was a second motivator in their studies, particularly as a vehicle for mental stimulation and

exercise. This was especially true in the U.S., and these authors speculated that American older adults had been influenced by intensive U.S. marketing of brain training games. Our findings are similar in that mental exercise was the high-level benefit cited most often after general enjoyment, suggesting that older adults in Canada may be motivated by similar desires to use games as a way to fight against cognitive decline. Some appear to be achieving this, with many subjectively experiencing specific benefits ranging from memory (66.2%) down to reasoning improvement (44.6%).

The relatively low reporting of general and specific socio-emotional benefits (about 20-35%) is consistent with the less than 30% of players in our sample who played with others. Self-confidence was the exception, reported by nearly 42% of respondents, but this could reflect players' increased technological competence as they developed greater gameplay skills.

We were surprised by our results for socio-emotional benefits and suggest that further research in this area is warranted, particularly in the area of intergenerational games. These can build on the somewhat large numbers of older adults in our sample who played with family and friends by connecting older adults (e.g., parents, grandparents) with children through play (Loos, 2014; Mahmud et al., 2010).

The clearest findings from our survey were the strong associations between self-reported skill level and the cognitive benefits experienced by participants. Older adults who rated their digital game playing skills as intermediate or advanced rated their improvements significantly higher than did beginner players in five of the six specific cognitive skills (memory was the exception). This would be expected, since playing digital games at a higher level requires greater mental effort and cognitive processing. It suggests that older adults can experience increased cognitive competence as they spend more time playing digital games and developing higher skill levels. However, it is possible that the more experienced participants are more likely to perceive positive benefits due to their increased self-efficacy. For future research, it would be important to evaluate empirically whether this is true. Also, more research is needed to explore the effects of debriefing following gameplay for older adults, especially as it relates to cognitive benefits. This is particularly true for the casual gameplay that is so common for older adults (De Schutter, 2011).

Very few difficulties were reported by participants in this study, suggesting that constraints that limit digital gameplay, and consequently its benefits, are not an issue for this group of active players. Instead, they appear to have overcome any difficulties associated with learning to play Low self-esteem is frequently identified as a *cost* of digital

gameplay for older adults (Gerling et al., 2015; IJsselsteijn et al., 2007; McLaughlin et al., 2012). The improved self-confidence cited by our respondents is likely to indicate that many in this group had overcome the negative feelings typically associated with learning new technology for the first time.

Study limitations

This research was limited in several ways. First, respondents were volunteers found in locations frequented by active seniors, so we cannot extend these results to those who have more limited physical, cognitive, or social capacities. Second, our data collection did not allow us to link perceived benefits or difficulties to particular types of games played or to whether or not respondents were "hard-core" or casual gamers. Finally, all benefits and difficulties are self-reported and so reflect respondents' prior experience, perceptions, and interpretations of the survey text.

Conclusions

Digital gameplay has the potential to enhance older adults' quality of life by providing general enjoyment and fun and by improving their physical, socio-emotional, and cognitive capacities.

The results of this survey design research support the use of digital games as innovative and engaging activities to enhance older adults' quality of life in several ways. The results suggest that benefits, particularly from enjoyment and perceptions of improved

cognition, increase with greater gameplay skill. The relatively large sample in this study provides support for our findings.

However, the relatively low perceived benefits of digital games in socio-emotional areas are a concern. To realize the socio-emotional benefits that are cited in the literature for intergenerational games (e.g., see IJsselsteijn et al., 2007), and those of digital games in general, it is likely that promotion, education, and facilitation are needed to support and encourage older adults to play digital games with others. More research on characteristics and preferences of digital game players by age would be useful to increase our understanding of the factors at play.

Finally, we should view the conclusions reached in this study optimistically yet cautiously, since the data are based on participants' self-reports. Further research is needed using stronger research designs. These should include, where possible, randomized controlled trials and quasi-experimental designs using valid and reliable scales and more objective measures such as performance data. Also, there are many rigorous qualitative research methods that could greatly enhance our understanding. The investigation of digital games played by older adults is a new area and we have much more to learn about how best to realize aging-related benefits, whether experienced or objectively measured.

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