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What is This?
Putting Fun Into Video Games for Older Adults

By Anne McLaughlin, Maribeth Gandy, Jason Allaire, & Laura Whitlock

Playing games is integral to human culture, whether it is children playing freeze tag or Garry Kasparov and Deep Blue matching wits at chess. Increasing numbers of people play games electronically, and advances in technology have brought the video game experience close to that of traditional physical games. However, the new technologies used in video games may pose barriers to certain populations, such as seniors or those with accessibility needs.

In this article, we describe how expectations of the game as well as initial experience may strongly affect game adoption and how designers could approach creating games for older players.

MOTIVATING CHOICE

We propose that the decision to play a game is analogous to a scale, whereby the balance can tip toward playing the game (and putting forth effort while accepting frustration) or using one’s time otherwise. Motivation and barriers are especially important for understanding the decision to try a new game that contains unknown costs and benefits. Melenhorst, Rogers, and Bowhuis (2006) codified this type of behavior toward new technologies as motivated choice. Although this model was initially developed in reference to new technology, we believe it might also apply to the adoption of video games as a leisure activity.

The motivated choice model supposes that there are costs and benefits associated with the adoption of every technology. Costs can include effort, frustration, time taken away from enjoyable activities, and monetary cost. Benefits from the adoption of technology are those that are not available without the technology, such as waking up to e-mails with embedded pictures of family members rather than waiting for a letter to arrive. When these benefits outweigh the costs, seniors are often able and willing to adopt the technology (Sharit, Czaja, Perdomo, & Lee, 2004). However, the mere existence of benefits is not sufficient; they must be perceptible to the users to have a role in the motivated choice to adopt.

The same can be true of video games. If games do not appear to offer benefits beyond board games or other activities, there is little reason to invest in learning to play. For example, if a grandfather does not understand how a video game such as Wii Sports could provide a social, beneficial, and entertaining way to spend his time, there will be little motivation for him to bring it into his life.

POTENTIAL BENEFITS OF GAMES FOR OLDER ADULTS

Playing video games has benefits beyond mere entertainment. Studies involving younger adults have shown that video games can significantly improve a variety of mental abilities, including reasoning (Wood & Peneé, 1987), mental rotation (Feng, Spence, & Pratt, 2007), and spatial attention (Green & Bavelier, 2006). The extent of plasticity in older adult cognition is unknown, but this pattern of results may also extend to older adults. A recent study showed significantly improved task switching, working memory, visual short-term memory, and reasoning in older adults as the result of playing a video game (Basak, Boot, Voss, & Kramer, 2008). Other studies showed improved reaction time (Dustman, Emmerson, Steinhaus, Shearer, & Dustman, 1992) and executive control of ability (Clark,兰fheur, & Riddick, 1987).
Video games are increasingly becoming social activities, and prior research has also shown that social interaction is related to maintenance of cognitive functioning in older adults (Barnes, Mendes de Leon, Wilson, Bienias, & Evans, 2004; Lövdén, Ghisletta, & Lindenberger, 2004). Active social interaction negatively correlates with Alzheimer’s disease (Hultsch, Hertzog, Small, & Dixon, 1999) and is positively related to self-reliance, self-efficacy, and well-being (Smith, Fleeson, Geiselman, Settersten, & Kunzmann, 1999; Stine-Morrow, Shake, Miles, & Noh, 2006). Older adults with active social lives are better able to deal with stress (Eisenberger, Taylor, Gable, Hiltmert, & Lieberman, 2007) and have a longer life expectancy than those who do not (Maier & Klumb, 2005).

Promoting social interaction is an area in which video games can excel. Because video games are popular with all age groups, they encourage different generations to play together. In addition, video games can be played online, allowing those who are unable to leave their homes because of disabilities or illness to have meaningful social interactions. Furthermore, these interactions are under the players’ control rather than subject to the schedule of a visitor. Game interfaces can be altered to make them accessible for those with disabilities. These reasons may explain why seniors are adopting online social media at a higher rate than any other age group (Madden, 2010).

Finally, video games enable players of varying skill levels to participate together by offering different levels of play that challenge each player appropriately. Because older adults are more heterogeneous in their abilities than younger adults (Nickerson, 1992), this adaptability of difficulty can increase enjoyment for more players and prevent those with less ability or experience from being excluded.

A recent survey found that more than one fifth of adults older than 65 reported playing video games, and those who played did so more often than their younger counterparts (Lenhart, Jones, & Macgill, 2008). However, it is not known what games they have chosen to play or how many different games are played by these seniors compared with younger adults. When asked how they would like to spend time with their grandchildren, grandparents overwhelmingly reported leisure activities (Aguiar & Hurst, 2007).

Despite the potential benefits of engagement and social interaction, there are a number of costs that can bar older adults from electronic games. In this article, we present our experiences with older game players as a case study about overcoming costs and magnifying the benefits for potential senior gamers. We also provide connections between our observations of usability issues in one game to the types of interactions offered in many modern games.

We gathered information on the challenges faced by older players through two gaming focus groups of adults older than 60 and a research study involving the Nintendo Wii.

Although the overall study was designed to investigate how games may offer cognitive benefits through play, we also had the opportunity to observe extensive game play during the 15 days each participant spent in the study. These qualitative observations illustrated the challenges faced by older players and captured their perceptions of the costs and benefits of play and what aspects of the game offered satisfaction, delight, or frustration.

**OBSERVING AND ANALYZING PLAY**

Well-established metrics of game play include traditional usability measures, such as measures of frustration and preference, time and accuracy of completing subtasks, and biometrics such as heart rate, heart rate variability, and galvanic skin response (Mandryk & Atkins, 2007; Mandryk, Inkpen, & Calvert, 2006; Yannakakis & Hallam, 2006). However, games pose a unique testing challenge for researchers because of the challenge, surprises, and rewards often required for games. Game-specific measures of usability (often called “funativity”) have included measures of flow and immersion in the game, feelings of presence, and measures of emotion indicated by posture and pressure on input devices (e.g., Sweetser & Wyeth, 2005; van den Hoogen, Ijsselsteijn, & de Kort, 2008; see Pagulayan, Keeker, Wixon, Romero, & Fuller, 2003, for a review). These metrics can contribute to both the development and the evaluation of games.

We first collected qualitative data through two focus groups of 13 adults older than age 60 (M = 75). Their comments increased our understanding of their perception of games and helped us to choose a game for the subsequent study. After the game was chosen, we observed interactions with that game and specifically noted when typical age-related differences in affect, perception, and cognition corresponded to the costs and benefits our players experienced. Some of the metrics we used included established game usability and “funativity” metrics, such as survey questions and a flow questionnaire.

We also performed a qualitative analysis of the unprompted comments made by our players throughout the study. The experiences we believe were most related to game adoption and enjoyment were often related to cognitive and perceptual age-related changes, which frequently reflected usability problems with the interface, and to other affective phenomena, such as stereotype threat (the fact that fear of failure often promotes failure; see Schulz, 2006) and emotional selectivity.

We recorded more than 30 players ages 65 and older (average age 82). Our players reported rates of experience with video games similar to those in other studies of their age group; approximately 25% had played games (Lenhart, Jones, & Macgill, 2008). The games they listed as playing prior to the study fell into four genres: puzzle games (Tetris, Bejewelled), computerized versions of word games (Boggle, Crosswords, Yahtzee), computerized versions of card games (Solitaire, FreeCell, Spider Solitaire), and virtual analogues of physical sports (Wii Bowling, Wii Tennis). Most players reported playing only one of these games.
The variety and number of games played by these participants were far more limited than those of younger gamers, who play an average of eight game genres (such as racing, puzzle, action, adventure, rhythm, and strategy), each of which contains many different games (Lenhart, Kahne, Middaugh, Rankin, Evans, & Vitak, 2008).

Boom Blox, the game our participants played in the current study, was designed for all ages and required motor control, reasoning, and some amount of reaction time. It differed from games our players had experience with, in that they contained more complex, multistep problems and were not a direct analogue of a physical game. We knew that the game we chose would have to interest our older players enough for them to return for 15 days, and the game succeeded—no participants dropped out because of the game, though some did drop out because of scheduling conflicts.

In the game, players were given a goal, such as knocking down a stack of blocks with a projectile. After a player chose a target with the Wii input device, he or she threw a virtual projectile via a throwing movement of the arm. The display reacted similarly to the physical world; where a structure was hit determined how and where it fell. The challenge came from trying to use as few projectiles as possible, or other goals specified for each game level. Older players could draw from experiences accumulated across a lifetime to solve the physical puzzles in the game but needed to apply that knowledge in a new, virtual environment.

The older players discussed in this article were randomly assigned to play alone or with another participant. When comparisons between those groups are meaningful, we present them. We recorded our participants playing with a system created for this study, dubbed the “Wiicord.” Two cameras, one front and one side, recorded player actions and expressions while the game display was captured and all integrated into a single video (bottom screen in Figure 1) with accompanying audio. Transcriptions from the videos combined with surveys provided the insights into motivated game play that we present here, and we propose that the findings can be generalized to other games with similar interfaces, mechanics, and game play.

COSTS

Older gamers may face different potential costs than those experienced by younger ones, although there is likely some overlap (Figure 2). We discuss some of the costs we observed in terms of perceptual, cognitive, and affective difficulties associated with the game. We follow the discussion of each cost with potential solutions for game designers.

Costs attributable to physical changes. Although the fun of games comes from challenge, perceiving or operating the interface should not be challenging. Despite providing a much larger screen (42 in.) than most participants had in their homes, we observed difficulties among our participants in reading text, identifying objects, and being able to separate the interface elements and display from the scene behind them.

Although the Wii mote is a fairly direct pointing device, the icons and display elements were difficult to activate by our players. For example, even when a player could steady the cursor on an icon, the act of pressing the button on the top of the Wii mote often moved the pointer down and off the icon before it could be clicked (Figure 3). Some of the most currently popular games share these attributes. For example, the two top-selling console games of 2010 (Call of Duty: Modern Warfare 2 and New Super Mario Bros.) have interfaces and displays overlaid on a game world, and that world is acted on by pointing with an indirect input device (Entertainment Software Association, 2010). These games differ from Boom Blox by having more emphasis on speed, accuracy, and bimanual coordination.

Many perceptual costs could have been avoided with a game designed for and tested by older users. There are a number of practitioner-oriented publications on design for aging (e.g., Pak & McLaughlin, 2010; Fisk, Rogers, Charness,
Czaja, & Sharit, 2009) as well as on creative ways to make interface elements accessible to those with motor difficulties (Mandryk & Gutwin, 2008; Worden, Walker, Bharat, & Hudson, 1997). These resources provide guidelines for size, color, contrast, audio, and many other elements of interface and display, as well as instructions for including older adults in usability tests.

Costs attributable to cognitive changes. Game interfaces, including Boom Blox, often pose memory demands for the user. Sometimes these demands come from using unlabeled icons to which a meaning must be assigned and remembered for a picture or symbol. In the title New Super Mario Bros., this convention is common, whereby game items (such as a mushroom) have various effects on the game state. The convention used in the current game was to provide a number of identical screen icons that the user could “mouse over” with the cursor to display more detailed information. Our participants had difficulty holding the cursor steady long enough to read the detailed information, and if the cursor slipped off, their reading comprehension task had to begin again (Figure 3).

Players also needed to juggle multiple mental models for the interface, as most of the actions were “point and click” whereas others required participants to press a specific button on the controller without pointing (Figure 3). This form of interaction is common in other games as well. For example, in the top-selling title Call of Duty: Modern Warfare 2, an allocentric “minimap” shows the current location of the player. This map must be continually matched to the egocentric viewpoint used to maneuver through the game effectively.

Again, designers who wish to create games for older users should take note of these potential problems and be aware that unpredicted issues may be found with usability testing. Although many of our participants had difficulties with this portion of the interface, we imagine that younger players would also benefit from an interface that placed less demand on memory.

Affective costs. An example of a cost that may be experienced by older gamers is stereotype threat. This fear is a pitfall for many groups and might apply especially to older adults who are trying a video game for the first time. The theory of stereotype threat is that mental resources are consumed with...
the expectation of failure brought about by some stereotype of group membership (Schulz, 2006). To experience stereotype threat, the individual needs to know of the stereotype and care about his or her performance. Although no research has specifically investigated the effects of stereotype threat on initial video game performance, older adults in our studies reported that they were not “supposed” to like or be able to play video games. Example comments included the following:

“We aren’t wired this way. We . . . play bridge. . . . The 3-year-olds can do so much more than us on a computer.”
“It’s harder to gain that agility when you’re older.”
“I just think I’m too old for this.”

A participant directly compared herself to a young relative, stating,

“I saw my 7-year-old [relative] with a broken shoulder, I mean a healing broken shoulder, still in a sling, throwing a ball from third base to first base and it was a true ball, just beautifully done. [pause] But I can’t do this.”

They also cared about their performance, as indicated by their responses on a Likert-type scale from 1 to 7, on which 7 indicated strongly agree, to the items “Overall, I put a lot of effort into this game” (M = 6.0, SD = 1.1) and “I was motivated to achieve a high score in the game” (M = 6.0, SD = 0.9).

Starting to play a new game with beliefs such as these may handicap older players more than might actual age-related decrements in ability. Indeed, their age group is grossly underrepresented in game characters (Williams, Martins, Consalvo, & Ivory, 2009), and studies of underrepresentation of seniors on television have found that this contributes to feelings of exclusion and negative attitudes about aging (Donlon, Ashman, & Levy, 2005).

The presence of stereotype threat can reduce memory abilities, especially when the task is difficult (Hess, Emery, & Queen, 2009). Given that most games incorporate challenge as part of their appeal, avoiding stereotype threat could be essential for older players to employ their full abilities and to reduce early demotivating failures that create a downward spiral of belief in ability and performance.

Materials and feedback could be designed to specifically prevent stereotype threat, perhaps by presenting designs that signal appropriateness for an older audience. Another way to prevent stereotype threat from affecting performance could
be to start players at a level much less challenging than that for a younger audience and to provide early rewards for small accomplishments.

For game design in general, Falstein (2005) advised that “establishing a safe, familiar territory and then inviting players to explore its mysterious boundaries is a proven feature of many successful games,” and older players may benefit even more than younger ones when this advice is followed (p. 76).

Other potential costs included initial frustration, negative internalizations, and expenditure of time. Again, these issues can be addressed by designers when creating the introductory experience of the game. An older adult summarized her avoidance of games with the statement, “I wouldn’t choose a game or anything that would frustrate me.” Such attitudes are in line with research on age-related changes in emotion, whereby older adults tend to avoid negativity and remember more positive emotional events than negative ones (e.g., Blanchard-Fields, 1997; Mather & Carstensen, 2005). We tried to address these costs through extensive scaffolding via training and by having a research assistant present during play to answer questions and troubleshoot issues that arose with the system. However, these issues would not have been present if our participants purchased the game themselves.

Table 1 (next page) illustrates some example comments from participants that illustrated the potential costs and benefits of choosing to play games.

Despite the costs, our players were committed to playing for 15 days by volunteering to participate in a research study. Their comments came from extended experience with the game, experience a person would not have if he or she did not choose to play because of a perceived lack of benefit or high perceived costs. For this reason, materials and training could especially affect perceived benefit. Materials, including instructions, can convey some of the potential benefits in an effort to encourage playing a game so that players can experience the benefits our participants described. We created and delivered such support for our participants, but ideally the game itself would provide these materials.

Training and sharing the process of learning with others can reduce the perceived barriers to entry as well, which we found in a previous study in which older adults learned to play the online game World of Warcraft (Whitlock, McLaughlin, & Allaire, 2010). In the current study, one of our players commented to her gaming partner, “I’m glad we’re in this together – then we can appreciate each other’s situation.” It was easier for her to overcome the perceived costs when paired with a partner. Game partners not only contributed to the social interactivity of the game; they assisted and motivated each other as well, as can be seen in the following conversation:

Player 1: What is wrong with me?
Player 2: It isn’t with you, it’s with the blocks. They’re misbehaving.

[Player 1 locks on target and drags block out. Gray blocks fall and display shows “Penalty Blox Hit!” and 8 at the top left corner.]
Player 2: Ha ha ha . . . that was funny.
[Both players laugh at what is shown on display.]
Player 1: Just forget it.
[Player 1 locks on target and drags block out. Blocks fall and display shows “Penalty Blox Hit!” Shortly after, display shows “YOU WIN!” Both players laugh at what is shown on display.]

Player 2: Well, you won.
Player 1: I don’t think so.
Player 2: Well it says so . . . You got 24 points, you got a gold.
Player 2: What’d you get last time?
Player 1: Thirty.
Player 2: You can do it.

Such social interaction during game play was frequent and appeared motivating to the players. Players also worked together to solve tough problems or to understand the constraints in the world of the game, as in the following interaction:

Player 1: There’s something holding this up, I don’t know what it is.
Player 2: But it’s almost looking as if they have to come off one at a time from the top. [pause] Now that’s . . .
Player 1: Maybe you’re right.
Player 2: I haven’t figured out any alternative. [pause] Unless you . . . I wondered about those black things. They’re just going to hang there. This thing’s not built on gravity. I think those black blocks stay where they are.
Player 1: You think that one’s not going to move?
Player 2: I don’t think so. I think . . .
Player 1: Well let’s try that anyway. Oh, you’re right.

We asked the players to rate the frequency of their social interactions on a scale from 1 to 7, 1 being not at all and 7 being always. Players reported watching their partner play, $M = 6.6 \ (SD = 1.2)$; offering help and encouragement, $M = 6.1 \ (SD = 1.5)$; and planning their next turn by observing their partner’s attempt, $M = 5.8 \ (SD = 1.8)$.

**BENEFITS**

In our study it was not enough merely to decrease the cost of learning a new game; the benefits of playing had to be sufficiently high and apparent to the player. Indeed, previous work examining telephone menu systems shows that benefits were more important than the costs of poor design for aging (Sharit et al., 2004). Ijsselsteijn and colleagues also mentioned the potential importance of increasing the benefit of video games for older adults in a 2007 article summarizing the
development of the Eldergames project, an effort to create usable and enjoyable games for older adults (Ijsselsteijn, Nap, de Kort, & Poels, 2007). We illustrate the importance of benefits through examples from the literature and observations from our current study.

Experience with video games has been shown to promote feelings of success, achievement, and self-esteem for older players (Goldstein et al., 1997; Hollander & Plummer, 1986), even for those with serious impairments (McGuire, 1984; Weisman, 1983). Affective feelings of success, achievement, and self-esteem were included in our model of motivated choice for game adoption, but we were aware that not every game would produce such benefits. Games that are initially off-putting or that delay experience of benefit would likely not result in game adoption. We examined how our players interacted with the virtual world of *Boom Blox* to identify elements we believe enabled them to succeed and experience the affective benefits of play.

Several characteristics of the game appeared to increase the benefits of play for our older players: simple interaction, low physical demand, novel sensory experience, a social component, a reward system, and performance scaffolding through initial experiences with the game. These characteristics are shared with other video games that are popular with seniors, such as *Wii Bowling* and *Solitaire*, and we believe they are critical for the adoption of game technology.

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**Table 1. Quotes From Older Players Illustrating Costs and Benefits of Game Play**

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial frustration</td>
<td>“Oh I forgot to hold. I forget all that.”</td>
</tr>
<tr>
<td>Stereotype threat</td>
<td>“You’ll just have to accept my blunders. After all, what do you expect of a [redacted] year old?”</td>
</tr>
<tr>
<td>Emotional arousal</td>
<td>(Shakes head) “I’m pitiful.”</td>
</tr>
<tr>
<td>Usability challenges</td>
<td>“And then this sign gets in the way.” [Instructions appear over and hide the play area] “I think they’re doing that to frustrate you.”</td>
</tr>
<tr>
<td>Time/Elimination of another activity</td>
<td>“I do too many things. I just moved in last fall and you know today I had an [redacted] meeting. And my outside activities – but I guess I have to look. I really don’t want to give up the time. I’m getting out with my friends.”</td>
</tr>
<tr>
<td>$$$</td>
<td>“… spending money you don’t have for them [games].”</td>
</tr>
<tr>
<td>Poor design for aging</td>
<td>“I can’t lock. Just pressing the button down makes it move.”</td>
</tr>
<tr>
<td>Feelings of clumsiness</td>
<td>“My hands are shaky anyway.”</td>
</tr>
<tr>
<td>Negative internalizations</td>
<td>“What is wrong with me?”</td>
</tr>
<tr>
<td>Lack of control</td>
<td>“It has a mind of its own.”</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>“Ah ha ha . . . Now, I hit to win.” [Display shows “YOU WIN!”]</td>
</tr>
<tr>
<td>Physical activity</td>
<td>“Not bad. Woo woo woo!” [Shakes her body and hands briefly] “Ha ha ha ha.”</td>
</tr>
<tr>
<td>Social interaction</td>
<td>“I’m glad we’re in this together.”</td>
</tr>
<tr>
<td>Increased well-being</td>
<td>“Great!” [Raises hand in a cheering motion] “That is great!”</td>
</tr>
<tr>
<td>Fun</td>
<td>“You can have lots of fun with this thing. Gee.”</td>
</tr>
<tr>
<td>Positive emotions</td>
<td>“I like this one.”</td>
</tr>
<tr>
<td>Learning</td>
<td>(Locks in to green block and swings again. Blocks fly in every direction. Display shows “YOU WIN!”) “Did it that time. Two out of two.”</td>
</tr>
<tr>
<td>Engagement and “flow”</td>
<td>“We’re on fire.”</td>
</tr>
<tr>
<td>Status</td>
<td>“You put it back. You put it perfectly in line.” (Laughs) “How’d you do that?”</td>
</tr>
<tr>
<td>Challenge and success</td>
<td>[Raises left hand up and down] “Mm hm hm hm. One shot, not too bad.”</td>
</tr>
<tr>
<td>Achievement</td>
<td>“I think that’s the best I’ve done on that one.”</td>
</tr>
</tbody>
</table>
Simple interaction was a benefit of having few ways to operate the game interface. For example, after the throwing movement was mastered, it was used again and again throughout play. This same movement was used in many ways, such as lobbing paint balls at colored objects on the screen or throwing objects with varying weights to topple structures. Thus, the puzzles within the game could increase in difficulty, but the operation of the interface did not change. Also, after a level started, there was no change to the type of operation needed; players did not switch between throwing and grabbing in a single level (even if those techniques changed in the interim between levels). This characteristic was also similar to Wii Bowling and Solitaire, in which a single movement operated the game mechanic throughout the game.

Low physical demand allowed players of different movement ability to achieve similar performance. For example, throwing an object in the game could be done with a raised arm or a flick of the wrist. We observed older players with limited motor ability adapting the throw to their own range of motion, with some making large throws and others keeping their arms close to their bodies.

Rewards in a video game provided a novel sensory experience as well as feelings of achievement for our players.

Although we are speculating, we believe one of the unintended benefits of the Wii is that it allows such adjustment on the part of the user. Requiring more realistic motion, such as the movements tracked by some Microsoft Kinect games (for which there is no controller except the human body), could prevent some less able older players from participating. Again, this result appears to be a side effect of the Wii technology rather than an intended feature, but such a feature could be integrated into other game systems.

Rewards in a video game tended to be immediate and obvious and consisted of graphics and audio, such as a fireworks display and positive words and phrases like “You win!” or “Correct!” These kinds of rewards provided a novel sensory experience as well as feelings of achievement for our players. Designers describe these rewards as “juicy” elements that make “the player feel powerful and in control of the world, and it coaches them through the rules of the game by constantly letting them know on a per-interaction basis how they are doing” (Shodhan, Kucic, Gray, & Gabler, 2005, p. 3). Although players of board and card games experience wins and losses, those outcomes are not accompanied by the sounds and visuals incorporated into many video games.

It might be argued that older adults would not perceive benefit from cartoonish graphics or sensory stimulation, that they are interested only in “serious” information. However, our players greatly enjoyed the positive reinforcement provided by explosions, fireworks, and cartoon characters that had consistent behaviors. They frequently referred to the animated characters with emotional language, such as “There’s a chicken! . . . I really would like to blast the chicken,” and “It was so funny, I was telling [name] that I was trying to clear all the cows and tip the cow and one was a chicken. I was trying to snatch that chicken out of the back, it was very unhappy!”

Feelings of flow and engagement are also viewed as rewarding and are commonly listed as reasons for game play (Hsu & Lu, 2004). Flow has been defined as “a positive experiential state [that] occurs when the performer is totally connected to the performance, in a situation where personal skills equal required challenges.” Flow may be measured via a standard questionnaire containing both overall flow metrics and subscales, such as those for concentration and frustration (Jackson & Marsh, 1996, p. 17). It has been investigated frequently as a feeling that emerges when performing a well-learned procedural activity, such as a sport or a hand-eye coordination game (Csikszentmihalyi, 1990), but flow has also been used successfully as a measure for experience with virtual worlds and video game experiences (e.g., Inal & Cagiltay, 2007; Nacke & Lindley, 2008; Sweetser & Wyeth, 2005; Webster, Trevino, & Ryan, 1993; Zhang, Fang, Chan, & Zagal, 2010).

Our players reported experiencing the rewards associated with flow but more for some subscales than for others. Their scores on the questionnaire indicated they had feelings of flow, with a mean score of 3.58 on a 5-point Likert-type scale. Of the nine subscales for flow, older players scored highest on the scale for concentration (M = 4.10, SE = 0.16), with questions such as “My attention was focused entirely on what I was doing.” They scored lowest on the merging of action and awareness (M = 2.97, SE = 0.21), which measured subjective feelings of performing automatically. This finding was not surprising, given the length of time required for older adults to achieve automaticity in a task compared with the short time spent in the study. These results are in line with previous work that measured flow in a game for older adults (Hwang, Hong, Jong, Lee, & Chang, 2009).

We acknowledge that flow states could be higher in a game designed specifically to enable flow for older players, but we are excited that this first step indicates that flow can occur in a game not specifically designed for seniors.

Feelings of flow correlated positively with self-reported motivation and effort as measured through questions on an exit interview with Likert-type scales from 1 = strongly disagree to 7 = strongly agree. Reports of motivation, including motivation to achieve a high score in the game, related to higher feelings of flow, r(32) = .63, p < .001. Reports of greater effort also related positively to flow, r(32) = .54, p = .001. However, when participants had physical or perceptual difficulties with the game, their flow scores suffered. Answering “it was difficult to see what was going on in the game” negatively correlated with flow scores, r(32) = -.54, p = .001. We concluded from this finding that usability was an important part of allowing older players to experience the rewards of flow.
DESIGNING VIDEO GAMES FOR OLDER ADULTS

In this article, we provided a look at how video games can offer benefits to older players but how their needs are not adequately addressed by current games, even those for “all ages.” The recommended usability techniques for game design (Pагulayana et al., 2003) apply to games for older adults but may require “tweaking” in some areas to account for the wider variety of age-related changes in perception and cognition experienced by older adults. Furthermore, these individual differences would require testing specifically with older players (and likely larger sample sizes of these players) after initial evidence-based design of game components informed by the aging literature.

In terms of design for older players, we provided examples of usability and motivational issues discovered in a study of lengthy, involved video game play by adults older than 65 and provided guidelines in those areas. With regard to adoption of games by older adults, we discussed motivated choice and ways to promote benefits and reduce perceived costs. The take-home message of motivated choice is that costs and benefits are not given equal weight. For example, simply decreasing costs is likely insufficient to result in play. However, a high perceived benefit can encourage older adults to devote the resources necessary to overcome many levels of cost. Knowing the costs, benefits, and avenues to decrease and increase each is surely the first step.

When the qualities of a video game provide benefit, seniors will play that game. For example, Wii Bowling has risen in popularity because of ease of play but also the social connection it offers. Seniors across the United States in independent and assisted residences participate in the National Senior League, which maintains team rankings. At the time of this writing, there were more than 120 teams of six to eight players each, most with custom T-shirts and names such as “In Our Prime” and “Dynamite Methusenites.” Such empowerment is the goal of many senior programs, and video games can offer a path to achievement.

In conclusion, the social opportunities afforded by video games have the potential to offer great benefits in the lives of senior citizens. It is up to game developers to understand the capabilities, limitations, and interests of older players to create game stories and mechanics that are likely to succeed with older players. It is up to those in the human factors/ergonomics field to ensure that these games have an adequately low barrier to entry and that older adults know the benefits and what makes games special, all while preserving the challenge required to make games fun.

REFERENCES


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