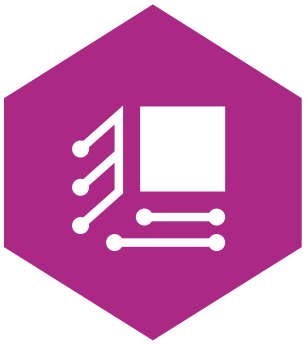

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User Centered Design and Development of a Game for Exercise in Older Adults

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Abstract: Thirty percent of older adults fall every year. One of the most effective methods to help prevent falls is participation in a regular fitness or exercise program to build and maintain capacities. Few exercise programs for older adults utilize the advances in technology and gaming for fitness. Fifteen older adults currently involved in a fitness program for seniors at California State University–Fullerton participated in focus groups. The focus groups explored perceptions of health and wellness, the use of and access to technology, and ideas for the development of a game for fitness. The data were analyzed using open coding and the themes that emerged from the data were used in the design of a prototype game. Nineteen older adults participated in an iterative user testing process of the prototype game. The iterative user testing process involved several cycles of user testing and changes to the prototype. The feedback from the user testing process as well as the focus groups will be summarized and explored in this paper. Details of a preliminary game will be presented with a focus on access to technology for older adults, participation as means for prevention and building capacities.

Keywords: Older Adults, Exercise, Falls, Participation, Game Design, User Testing

BACKGROUND

More than one-third of people over the age of 65 experience a fall every year (Sherington et al. 2008). A fall can lead to serious injury, hospitalization, significant disability, and reduced or lost independence (Tinetti et al. 1995). People who experience a fall are two to three times more likely to fall again (Tinetti et al. 1995). Those who fall are also three times more likely to be admitted to a long-term care facility or nursing home (Tinetti and Williams 1997). Prevention of falls is necessary to maintain independence and health in older adults and decrease the potential healthcare burden to society. Systematic reviews of fall prevention studies have established that prevention programs with a physical activity component can reduce falls (Sherington et al. 2008).

A wide range of physical activities has been explored in fall prevention programs including dance, Tai Chi, strengthening exercises and walking (Sherrington et al. 2008). Many programs include a focus on improving and maintaining balance and muscular strength. Older adults often participate in senior exercise classes or have a membership at a local fitness center. Senior exercise classes are usually tailored to meet the needs of older adults in areas such as weights, number of repetitions, flexibility, balance, and level of effort. However these programs fall short in meeting the needs of the broad older adult population. Older adults who cannot afford group classes or live too far from a center have limited participation. Older adults who have already experienced a fall may have reduced sense of self-efficacy which can further limit their participation in exercise and fitness (Conn 1998). They may also have limitations beyond the normal older adult population in areas such as range of motion or strength. A large group setting

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also limits the frequency and quality of feedback older adults receive regarding their performance on various tasks.

Video games are increasingly being investigated to assess their potential in fall prevention programs, including the Nintendo Wii, Nintendo Wii Balance board and the dance mat (used across several video game consoles) (Laver et al. 2011). Video games, in general, provide a fun, engaging and interactive environment for simple exercises. Video games also allow for a person to play in their home environment and feedback can be provided for individual performance. The newly released Microsoft Kinect movement-sensing device for the Xbox 360 has potential applications in the area of fall prevention. The Kinect device can track multiple joints and limbs in space so it has the ability to incorporate existing fall prevention exercises into game. Researchers have explored the use of off-the-shelf Kinect games for increasing exercise in children and have adapted the Kinect camera for use in computer interactions (Chang, Chen and Huang 2011; Gallo, Placitelli, and Ciampi 2011; Lange et al. 2011a; Lange et al. 2011b; Zafrulla et al. 2011). Being that the Kinect is a relatively new device, researchers are only beginning to explore the uses of the depth sensing device with tailored, customized games. The suite of video games currently available for exercise is rarely adopted by older adults, even if the technology is readily available for use. Furthermore, it is unclear the reasons that older adults are hesitant to adopt such technology and how the positive features of video games can be incorporated into a game tailored for older adults.

Researchers are beginning to explore the development of games for older populations and falls (Annema 2010; Gerling, Schlid, and Masuch 2012; Uzor, Baillie and Skelton 2012). However, very few studies focus on fall prevention (rather than rehabilitation). Furthermore, few researchers and design teams approach the whole game design process with methodological rigor and very few adapt a user-centered game design process. Uzor and colleagues involved seniors in the design of a video game for fall rehabilitation, employing principles and techniques from scenario and participatory design (2012). Similarly, the purpose of this study was to create a prototype game for fall prevention in older adults through a needs assessment and user-centered game design process.

Methods

Methodology

The User Centered Design Process (Figure 1) has recently been used in the design of games and video games for non-traditional populations and settings; rehabilitation and education (Fullerton 2008, Lange et al. 2010; Lange et al. 2011a; Lange et al. 2011c; Lange et al. 2011d). It is an iterative process that leverages a multi-disciplinary team and incorporates key stakeholders throughout the process, especially at critical junctures. In order to provide an effective end-user experience with the game, the current experience of the stakeholders should be fully explored and used to drive the game design process (Flynn et al. 2008; Lange et al. 2010; Lange et al. 2011a; Lange et al. 2011c; Lange et al. 2011d). We have successfully employed this process in the creation of other games for rehabilitation. The User Centered Design Process was the foundation for the development of the prototype exercise game for fall prevention in older adults.

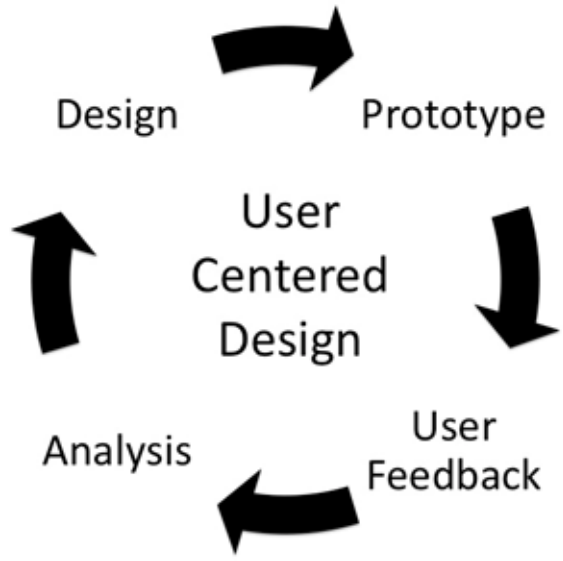

Figure 1: The User Centered Design Cycle

The initial exploration into the experiences of the stakeholders followed more traditional qualitative methodologies, specifically a grounded theory approach (Strauss and Corbin 1997). This specific qualitative approach fits well with the iterative cycle of game design. One of the key components of grounded theory methodology is that the initial data generate insights and hypotheses that are explored through further data generation. In essence, through repeated user testing, focus groups and interview, we are able to test initial theories, or theoretical propositions, and generate further data. This also adds rigor through constant member-checking. The end result, the "game", represents achievement of saturation of data (Strauss and Corbin 1997).

The focus groups explored the experiences of the stakeholders; older adults currently involved in an exercise program. The overarching questions that guided the development of the specific focus group questions (Appendix A) were:

1. What is the experience of the aging older adult with respect to health and wellness activities?
2. What is the experience of the aging older adult with games, both technology-based and non technology-based?

The user testing process involved both qualitative and quantitative components. The focus of the testing was less on understanding the experience of the stakeholder overall and more on understanding the experience of the stakeholder's interaction with a specific product. Usability, even in the early stages, is a main concern along with enjoyment, engagement and appropriateness for the target audience. The user testing process in this study followed those methods employed by triple A game companies and software companies such as Microsoft. This process involves a mix of questionnaires, interviews and think-aloud product interaction.

Participants

Focus Groups

Fifteen older adults participated in a total of 3 focus groups. Participants were included if they were: 1) over the age of 18; 2) able to communicate effectively with or without external support; and 3) exercised at least one day a week.

User Testing

Nineteen older adults participated in iterative user testing. Participants were included if they were: 1) over the age of 18; 2) had no physical or mental limitations that would prevent them from interacting with a video game; 3) had no medical conditions that prevented watching TV or playing video games; and 4) exercised at least one day a week.

This study was approved by the Institutional Review Board at the University of Southern California.

Methods

Focus Groups

The number of participants in each focus group ranged from n=3 to n=7. A trained researcher led each focus group. A second researcher recorded field notes. Morae Usability Software (www.techsmith.com/morae) was used to obtain audio- and video-recordings of the focus groups. All participants consented to the recording. The Morae Usability Software was also used by the second researcher for documenting synchronous field notes.

Iterative User Testing

User testing sessions were held with nineteen participants. The participants first completed a basic demographic questionnaire and a game-use questionnaire. The participants then interacted with a game. The total time spent interacting with the game was anywhere from 2–20 minutes depending on the prototype being tested. Morae Usability Software was used to audio- and video-record the play testing sessions. The participants then completed a semi-structured interview with a researcher. All questions were open-ended questions with related probes and follow-up questions (Appendix B). Morae Usability Software was used to obtain audio- and video-recordings of the interviews. All participants consented to the recordings.

Materials

Description of the Game

The "Jewel Mine" game was developed using the game engine Unity (www.unity3d.com). The game was run on a laptop connected to a Microsoft Kinect camera mounted on a stand. The application used the Open NI/NITE Framework to communicate with the Kinect camera and to translate user movements into game actions. The initial set-up of the game involves a user calibration to place the game targets within reach. The participants were also encouraged to place the targets just outside of their base of support in order to challenge their locus of stability (Figure 2).

Figure 2: A Screen Shot of the Jewel Game

Data Analysis

The focus group data were coded using the Morae Usability software with the process of open coding (Strauss and Corbin 1997). Two trained researchers coded the data separately, allowing the codes to emerge from the data. To increase rigor, the researchers continually met to ensure authenticity of meaning. The codes were continually refined as new meanings emerged. Under the two broad research questions, themes emerged from the data and were refined with the addition of new data.

The user testing data was analyzed in a similar fashion but with less emphasis on the emergence of themes and an increased focus on the features in the game. The Morae Usability software was used for data analysis of the user testing data.

Results

Focus Groups

The results from the focus groups are presented in Figure 3. Four distinct themes emerged from the data: Effects of Aging, Current Health and Wellness Activities, Factors That Influence Participation and Looking to the Future. A fifth theme centered around the link between the health and wellness needs of older adults and interaction with technology.

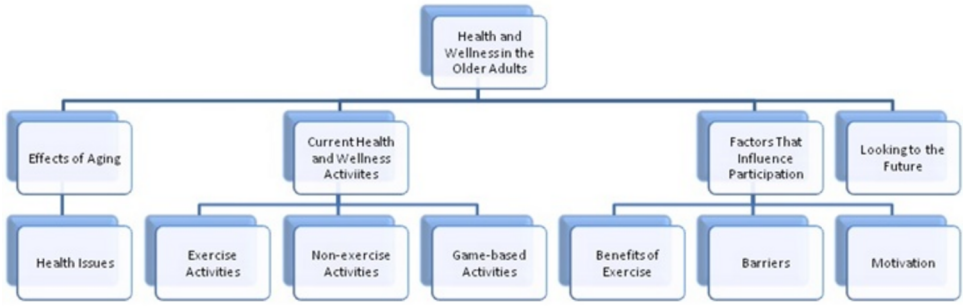

Figure 3: Themes and Subthemes that Emerged from the Focus Group Data Around the Concept of Health and Wellness in Older Adults

Effects of Aging

Health Issues

Participants discussed a variety of health issues that they had experienced in the past several years and the impact on their daily life. These issues ranged from traumatic events (a fall, automobile accident) to medical (fibromyalgia, stroke, idiopathic head pains, foot surgeries, knee problems). Some used devices such as canes and walkers before starting the exercise program at California State University-Fullerton.

Along with health issues that the participants experienced, they also discussed how aging had affected their overall health and daily functioning. Many said that they felt they were "slower now" and it "takes me longer to do things". One woman said she "can do two things per day but not three big things". Some stated that the effects of aging had crept up on them recently and they often chose to ignore it. One participant said, "We see ourselves as the perpetual 23 year old that is invincible" and another stated, "you don't notice it but it creeps up on you". When discussing changes over the course of 5 years, the participants were varied in their responses as some felt that they had declined over the past year but other felt that they had improved. Those that felt they had improved had either started the exercise program in the last 5 years or had overcome a major illness or injury. One participant said that, "five years makes a lot of difference the older you get". Many talked about the idea of maintenance: "At our age, when you are the same [in health] a year later, that's fabulous" and "Even if I am in the same place next year, I am still better because I am a year older".

Current Health and Wellness Activities

Exercise Activities

All of the participants were involved in the exercise programs at California State University-Fullerton. Many were also very active outside the program. The most common form of exercise outside of the program was walking. Some walked with a friend, spouse or pet. Other used equipment such as a treadmill or weights.

Non-exercise Activities

The participants were also very active in a variety of volunteer positions, travel, art, etc. One participant said that she "needs a 48 hour day to sleep 12 hours and then have the rest of the time to be able to do everything else". Some participated in activities similar to their previous

employment while others explored interests they did not have time for while they were working. Many worked part-time or volunteered their time. Hobbies spanned from ceramics to reading to gardening and electronics. Family-based activities were also important to the participants. Some participants were caregivers either full- or part-time for a family member.

Game-based Activities

Many of the participants incorporated games into their daily life including Bridge, logic puzzles, Scrabble, Sudoku, Uno, Monopoly, Words with Friends, and Angry Birds. Some participants had played video games with only one playing regularly (World of Warcraft on the computer). Most had only tried it once or watched a younger family member play.

Factors that Influence Participation

Benefits of Exercise

Participants discussed how exercise and daily activity had impacted their health and wellness. Many stated that they notice negative outcomes on the days that they do not exercise. One participant said "When you're not doing activity, you're weaker and your pain level skyrockets". A participant with knee problems said that when she does not exercise, she is "in bad shape". Others spoke of how exercise had helped them through injuries and progressed beyond the initial expectations of their health care practitioners.

Barriers

Some of the most obvious barriers to activity or exercise the participants discussed were illness or injury. Others talked about how the changes with aging slowed them down and limited the number of activities they could accomplish in a day. Other participants had caregiving or other activity commitments that limited the time spent exercising.

Motivation

Perhaps the most important concept to understand when considering exercise for any population is motivation. Many participants stated that the social component of the classes provided a significant amount of motivation to attend the exercise classes. Others were motivated to stay because of the benefits to their health (see *Benefits of Exercise*). One participant said that she would simply "tell others I am busy at that time". Another participant stated that exercising provided a sense of competition for them-both internally and externally.

Looking to the Future

Since an important piece of health and wellness for older adults includes maintaining function, the participants discussed their thoughts on the issues and changes they see for the future. The number one concern for participants was not illness; it was a fear of falling. Many provided examples of friends and family members who declined in health after a fall. They were not necessarily afraid of the injury itself but the impact on their ability to stay active. One participant stated that her biggest fear is that "I won't be able to do exercise and fall behind".

Link to Technology

Game Components

Scoring
Many of the participants stated that they enjoyed exercising because they wanted to beat an internal goal. Including a score or scorecard would provide a sense of accomplishment for them.

Inclusion of a Cognitive Component

Most participants agreed that they wanted a cognitive or mental challenge in the game. As one participant said, "As you get older, you want both mental and physical challenges".

Feedback

Some wanted instant feedback such as auditory or visual cues for their movement.

Motivation

There were several key aspects of games that the participants described as increasing motivation to play a game for exercise/balance. These include:

- Variety- of movements, of game types, of challenges
- Scoring
- Rewards
- Games that let out aggression
- Games that let the player have control- "God game" (i. e. Sim City)
- Music-appropriate for the population

Older Adults and Interactions with Technology

The participants discussed the receptivity of the game by the older adult population. One participant shared the story of using a new laptop computer: "What if I push this button and lose everything on a $300 machine?". Another participant said that many older adults have a fear of technology because they were "not brought up by computers". The participants suggested making the initial steps of set-up and playing the game very easy. One participant said that the hardest part of getting older adults to play is the "initial step of getting them to turn it on- that's the key right there". He continued to say that making the initial steps easy will give them [older adults] the "confidence to put the game on and start".

User Testing

Prototype Development Process

The user-testing portion of the study was completed following the analysis of the focus group data. The development of the game through the prototype phases followed the iterative User Centered Design Process (Figure 1). The initial prototype (P1) was completed prior to the focus groups. After the focus group data were analyzed, changes were made to P1 to make the second prototype (P2). The second prototype (P2) was used in user testing. The data were analyzed and a third prototype developed (P3). The three prototypes (P1, P2 and P3) are described below along with results of the user testing sessions.

Initial Prototype Game (P1)

The initial prototype was developed through a similar design cycle with rehabilitation clinicians and persons with disabilities. The game had the following characteristics:

- No visual or auditory feedback for the player reaching the target gems (the gems simply disappeared)
- Initial solution implemented for better recognition of depth (forwards and backwards of the player)
- The gems did not light up to signal a target-the player could touch any gem to progress forward in the game
- No on-screen directions-Directions only given verbally by the researcher
- Movement to-from the game menu, calibration set-up and game all required mouse and keyboard strokes by a researcher
- No cognitive component

Second Prototype Game (P2)

The second prototype game (P2) had the following characteristics:

- "Ding" (auditory) and exploding sparkles (visual) as feedback when target was reached
- Implementation of second solution for better recognition of depth
- The gems lit up to indicate a target (color: green)
- Directions for calibration and playing the game written on the screen
- Movement to-from the game menu, calibration set-up and game all required mouse and keyboard strokes by a researcher
- No cognitive component

Third Prototype (P3)

The third prototype (P3) had the following characteristics. This prototype has continued in development and will be presented to participants for more formal user testing:

- "Ding" (auditory) and exploding sparkles (visual) as feedback when target was reached
- Continued implementation of technology for better recognition of depth
- The gems lit up to indicate a target (colors: varied)
- Directions for calibration and playing the game written on the screen-improved from P2
- Some movement to-from the game menu, calibration set-up and game possible with gestures by the player. Other actions still required mouse and keyboard strokes by a researcher.
- Cognitive component-"Simon" game
- Incorporation of varied game backgrounds and target objects
- Score displayed as number of jewels touched (no scoring for the "Simon" game)

User Testing Feedback

Overall

Most players enjoyed playing the game and thought that it was fun. Some included comments such as "It made my body work" and "It's intriguing". One participant said that the movements reminded him of when he was in the Navy signaling with semaphore.

Instructions in the Game

All of the participants agreed that clear, concise instructions in the game were vital to success. Participants suggested everything from visual and auditory directions to tutorials and videos. Others wanted a chance to practice playing the game first to get used to the technology while others said they picked up on it right away. The hardest concept to understand was the 3-D aspect of the game. As one participant stated, "The 3-D nature threw me off. I spent more time figuring out the depth than anything else". A few participants also desired to know the purpose or goal of the game before playing because "Otherwise it seems pointless like 'Why am I doing this?'".

Game Elements

Similar to the focus group participants, the players desired to have a score in the game. They also wanted the game to provide: the time (duration) it took to play the game, a variety of tasks with choices, reminders to drink water, pause button, feedback from other game characters (i. e. Crowd cheering in background), and levels. The participants had a range of responses regarding the level of challenge, pace of the game and opinion of graphics.

Comparison to Exercise/Activity

The participants were asked to compare the game to exercises in their classes and other daily activities. Some felt the game was only similar to cool-down exercises or stretching. One participant noted that it required very little lower body movement and others used this standard for comparison (noting that it was dissimilar). One participant said that she felt she was "not conscious that I'm exercising. It's fun really, isn't it? This is new. You're really concentrating. You can go at your own speed".

Future Use of the Game

Participants were asked to think about how they might play this game in the future and who they would recommend the game to. Many liked the idea of having the game available to play before or after exercise/fitness classes. Other desired to play the game in the privacy of their home. Many participants saw the game as being more appropriate for people in rehabilitation but other felt that their peers would enjoy playing the game, including those in the exercise classes.

Discussion

Linking Health and Wellness to Game Design

As older adults age, they experience a variety of changes including physical, cognitive, and emotional changes. The participants in the focus group voiced these changes as illnesses and injuries and they are representative of the common changes that increase the risk for falls in older adults (Hughes et al. 2011; Rubenstein 2006). The most frequently mentioned change was an increase in the amount of time taken to do an activity, or "slowing". There are a variety of underlying causes for this slowing including decreased muscle mass, delayed response time, and a decrease in overall endurance. All of these causes are risk factors for falls (Rubenstein 2006). Unfortunately, as one of the participants stated, they frequently see themselves as the "invincible 23 year old" and do not always make accommodations for changes in their bodies. Exercise as part of a fall prevention program can make older adults more aware of the changes

occurring and help them capitalize on their strengths (Barké and Nicholas 1990; Bean, Vora and Frontera 2004).

The participants in this study were actively involved in an exercise program and therefore emphasized the benefits of exercise in their focus group discussions. A review on the benefits of exercise for older adults by Bean and colleagues detailed an estimated risk reduction for falls of about 25–50% (2004). Many participants in the current study also spoke about feeling increased fatigue or pain when they did not exercise regularly. Almost all participants stressed the importance of exercise in maintaining their health. For older adults, having another year of life pass by with no change in function is just as good as seeing improvement in a younger person. Research has showed that those who are seeking to maintain a level of physical activity and health only require continued access to activities (Barké and Nicholas 1990). A fall prevention exercise game that was designed in this study can serve those in the maintenance stage by providing another avenue for physical activity.

The activities that the participants were involved in outside of the exercise program were almost always social in nature. Several of the participants mentioned walking as a form of exercise on the days that they did not take part in the formal exercise program. Most walked with another person or a pet. Involvement in volunteer and part-time work activities also had a social component and many talked about feeling a desire to return to socially-focused activities after retirement. Social supports have been identified as effective in strengthening self-efficacy and outcome expectations related to exercise (Resnick et al. 2002). In a game for older adults, including a strong social component through online networking, multiplayer options, leaderboards, and social genre games has the potential to support broad reception.

The social nature of older adults is also one of the barriers to a game for exercise and balance. Most of the participants were engaged in a number of activities throughout the week and had little time for extra activities. They did however recognize the importance of making time for exercise and activities for health. Older adults with higher self-efficacy are more likely to adhere to an exercise program (McAuley, Lox and Duncan 1993). For those with higher self-efficacy, the game can be marketed as simply another method for including in their daily routine.

Not surprisingly, the biggest fear in aging was falling. For this group of older adults, the biggest consequence was a lost ability to exercise and stay active. Rather than using that fear as a motivator for physical activity and exercise, fall prevention programs are geared towards improving self-efficacy (Phillips, Schneider and Mercer 2004; Sherrington et al. 2008). To bolster self-efficacy in older adults, appropriate coaching is a simple strategy and can be readily incorporated into the game through positive feedback, rewards, and detailed tutorials. Providing achievable and clear goals also helps to reduce perceived barriers and motivates individuals to succeed, thus increasing self-efficacy (Phillips et al. 2004). To further promote healthy behaviors and inclusion of wellness activities, flexibility in choice is central to participation (Miller and Iris 2002). The current prototype has been developed with flexibility in game options. These flexible features will be a special focus in the full development of the game.

Linking User Feedback to Game Components

One of the most important aspects of a game to test early on is the playability of the game with regards to following directions. P1 relied on the researchers providing directions to the players while P2 and P3 had on-screen directions that improved with each iteration. The players continually suggested including a tutorial or video (both visual and auditory directions) directions. This suggestion will be implemented in the new game.

Scores and points provide external feedback for players on their performance. It also helps provide a sense of accomplishment and feeds the internal competitive nature for some. A basic score was included in P3. Following the suggestions of the players, a more detailed breakdown

of the score will be included in the game along with the ability to view high scores, personal bests, and track progress over time.

Providing a score or total points is one form of feedback. Players also wanted instant feedback on performance. The players suggested a variety of ways to provide feedback including auditory feedback (cheering fans, "dings", bells, "Great job!") and visual feedback (sparkles, explosions, "Great job!"). These will be implemented and tested in future prototypes, with particular attention paid to the feedback on performing movements correctly.

Both the participants in the focus group and the user testing sessions desired a cognitive component in the game. This is understandable given the views expressed in the focus groups regarding the cognitive "slowing" they experienced with age. A wide variety of cognitive functions show decline of the adult and older adult lifespan (Salthouse 1996). The most common areas of decline are working memory and processing speed. Recent intervention studies have demonstrated that fitness as well as cognitive training alone can help improve executive processes (including working memory) as well as other cognitive functions (Ball et al. 2003; Colcombe and Kramer 2003). The "Simon" game that was implemented in P3 involves the player following a pattern of lights on the screen, memorizing the position of the lights and then repeating it back through their reaching movements. It is a very basic working memory game and is one example of how a cognitive challenge can be incorporated into a game for exercise. Memory is only one component of cognition and other areas, such as attention, will be explored with the addition of different games and puzzles.

Considering Older Adults and Interaction with Technology

Further down the road, the usability of the technology will be explored through extensive consumer testing. A portion of this testing will look at the usability of the game. This is already being considered in the design of the directions in the game and navigation between menus and the game. Working memory is one of the major cognitive changes with age and a strong predictor of the ability to navigate menu systems (Czaja and Less 2007). Apart from the game, the testing will consider the usability of setting up the technology and initiating (loading) a game. As the participants in the focus group alluded to, the biggest barriers to technology use for older adults is fear of breaking the technology and frustration with a complicated set-up. This fear has been voiced by older adults in other studies that explored the attitudes and experiences of older adults using technology systems (Marquie, Jourdan-Boddaert and Huet 2002). Further exploration of the needs of the users will be essential to creating a game that is usability by the largest population of older adults.

Limitations

This study sample was limited to older adults actively participating in an exercise program. While this has helped gain valuable insight into the motivation behind exerciser for older adults, having a homogenous sample has unintentionally minimized the exploration of barriers to exercise. This study also only explored only two iterations of the prototype game. For future iterations, a more heterogeneous sample with increased numbers of participants will provide diverse feedback.

Conclusion

As adults age, the risk of falling increases and can lead to serious and significant disability. Fall prevention programs can help reduce the risk of falls in older adults. Video games have the potential to be used as a fall prevention program and tool. The feedback from focus groups and user testing sessions with older adults provided several considerations for a video game

for fall prevention. These included a need for clear directions in the game to allow for optimal playability, feedback to promote engagement and motivation and technology that is easy to use and minimally intimidating for older adults. An initial prototype of a game for fall prevention in older adults was well received and the prototype went through 3 iterations of the User Centered Design cycle. Design and development of the game will continue with further iterative user testing before entering a clinical trial.

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Appendix A

Focus Group Questions

To begin with, let's take time to introduce everyone. Tell everyone your first name and a little about yourself.

Let's talk about what you currently do for your own personal health and wellness.

- What activities do you do around the community? (*probe: volunteer, church, paid, groups, social activities*)
- What types of exercise/wellness activities do you participate in? How often/how much?
- Do you have a home exercise program? If so, what types of activities do you do? If not, why not? What are the barriers to using a home exercise program?
- What are some of the barriers or challenges to participating in exercise/wellness activities? (*Probe: Time, money, motivation, personal health/illness*)

Thinking about your overall participation in health and wellness activities, how do you see yourself now as compared to five years ago?

- What is different? Better or worse?
- Where do you see yourself in 5 years in terms of activity and health and wellness?
- What barriers do you foresee that my hinder your participation (Probe: Balance, gait, posture)?

We would like to get a sense of how you use games in your everyday life.

- What games do you play? On the computer? Wii? Xbox?
- Are you a novice game player or more experienced?
- How interested are you in playing games? What types of games do you prefer?
- Do you play physical games (ie. Wii)?
  - If so, why? What do you think about using the Wii? What have been some of the barriers to using the Wii?
  - If not, why not? What are the barriers to use?

Show Demo of Jewel Game

In an ideal world, what would you like to see in a game like this using the Kinect camera?

- What would the game be about? (sports, tabletop games, brain games, puzzles, carnival, recreation)
- What kinds of rewards would you like to have in a game?
- How long should the game play?
- Would you need a pause button to rest part way through the game?
- What features would you like in the game? (eg. Timer, scoreboard, music, multiplayer options, level playing field options)

Do you have any questions for us or anything else you would like to say about the topics we have discussed?

Thank you for participating in our focus group today. Your advice is very valuable to us in the development of useful products for therapy. When we have some prototype games would you like to be contacted about testing them?

Appendix B

"*Now we are going to talk about the game you just played here. We are seeking your honest appraisal of each game you have tried. There are no right or wrong answers.*"

What did you think of playing the game?
When you started playing the game what was different from what you expected?
If so, how was it different? e.g. *I expected the words would be larger*
What characteristics of the game helped or hindered you in using it?
How did you feel about the instructions on how to play the game?
Were the instructions clear and easy to understand?
How did you feel about the logic of the Game rules?
How did you feel about the Pace of the game?
What did you think about the Scoring and Rewards in the game? Probe: Were they motivating or distracting?
Tell me about your experience using the controller
Tell me about the ease of playing the game.
How complicated was it to play the game
What did you think about how the items were arranged on the screen?
Were the items on the screen hard to reach?
How did you feel about the (Probe: Tell me about any challenges you had with the)

Game rules
Position of images on the screen
Graphics, artwork
Sounds and Music

Describe the art or scene elements that felt busy or confusing.
Describe your reaction to the theme of the game: (e.g. fun, interesting, boring, dull, childish)
Describe how a tutorial or introduction of the game would have helped you understand and play the game.

Motivation

Did anything about the game distract you from being immersed (absorbed) in the game?
How would you rate the challenge of this game compared to your skills? (Too easy, too hard, about right)
Did the artwork and music encourage/discourage you to play the game more or less?
Tell me about your confidence in playing the game
What did you think of the quality of the game?
Whom would you recommend this game to? *(e.g. as your social group changes the meaning of your interactions changes)*
How did this compare to activities you currently do or have done previously in the clinic?

How do the activities compare with your regular therapy or regular exercise?
Did it make you work harder, the same or not as hard?
Would you prefer it over traditional therapy or exercise?

How do you feel about using video games as part of your therapy in the clinic (in the home)?
How do you feel about using video games for general exercise in the clinic or in the home?
How confident do you feel setting this up in your home and using it in your home?

Would you prefer to play a video game or have hands on or traditional manual therapy in the clinic?

ABOUT THE AUTHORS

Rachel Proffitt: Rachel Proffitt, OTD, OTR/L. University of Southern California, USA. Rachel Proffitt received her OTD from Washington University School of Medicine in St. Louis, where she was part of the Human Performance Laboratory under the guidance of Dr. Jack Engsberg. Dr. Proffitt completed her Apprenticeship for the OTD at the Institute for Creative Technologies (ICT) at USC under the guidance of Drs. Belinda Lange and Skip Rizzo, and is currently active in the Game-Based Rehabilitation Lab under the direction of Dr. Lange. Dr. Proffitt was previously an Adjunct Assistant Professor of Clinical Occupational Therapy at the USC Division of Occupational Science and Occupational Therapy, where she taught courses in Qualitative Research and Assistive Technology. Dr. Proffitt is currently a postdoctoral fellow in the Division of Occupational Science and Occupational Therapy at the University of Southern California, with funding through the T-32 TREET: Training in Rehabilitation Efficacy and Effectiveness Trials. Her current research focuses on the development and testing of video games for effective stroke motor rehabilitation.

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The International Journal of Technology, Knowledge and Society explores innovative theories and practices relating technology to society. The journal is cross-disciplinary in its scope, offering a meeting point for technologists with a concern for the social and social scientists with a concern for the technological. The focus is primarily, but not exclusively, on information and communications technologies.

Equally interested in the mechanics of social technologies and the social impact of technologies, the journal is guided by the ideals of an open society, where technology is used to address human needs and serve community interests. These concerns are grounded in the values of creativity, innovation, access, equity, and personal and community autonomy. In this space, commercial and community interests at times complement each other; at other times they appear to be at odds. The journal examines the nature of new technologies, their connection with communities, their use as tools for learning, and their place in a "knowledge society".

The perspectives presented in the journal range from big picture analyses which address global and universal concerns, to detailed case studies which speak of localized social applications of technology. The papers traverse a broad terrain, sometimes technically and other times socially oriented, sometimes theoretical and other times practical in their perspective, and sometimes reflecting dispassionate analysis whilst at other times suggesting interested strategies for action.

The journal covers the fields of informatics, computer science, history and philosophy of science, sociology of knowledge, sociology of technology, education, management and the humanities. Its contributors include research students, technology developers and trainers, and industry consultants.

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