Usability an Important Goal for the Design of Therapeutic Games for Older Adults

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Abstract. The importance of usability for older adults in therapeutic games has not been well explored. Aspects of game-related usability that go beyond typical considerations are a need for challenge, complexity, adoption by novices, motivation for extensive use, and enjoyment. Benefits to considering usability as it pertains to this special population may have long-term benefits for personal independence, maintenance of skills, and rehabilitation from injury. We outline areas we deem critical as a first step to utilizing what we know of older adult use of games for training purposes to facilitate a conversation between designers and researchers for creating and improving games for older players.

1 Overview of Therapeutic Games

Usability for older adults has been considered across many technologies, from ATMs [1] to home automation [2]. Improvements in these technologies often generalize to making many more systems and products easier to use. However, little attention has been given to age-related usability issues with digital games, despite the increasing use of game technologies in therapeutic and leisure environments.

In 2010, the number of adults aged 65 years or older represented 13.1% of the U.S. population. In the United States alone, one million individuals turn 65 each year and by the year 2020 almost 30% of the population will be over 65 [3]. Fortunately, these advancing years can be increasingly vibrant, with older persons living longer independently, often due to advances in technology. Such technologies include memory aids, such as medication reminders [4], home automation controls [2], and technologies that engender social connections and physical/mental activities, such as home sensors that communicate with loved ones [5]. The approach researchers and designers take to ameliorate the effects of age-related cognitive, perceptual, and movement changes through technology will impact an increasingly large older population. Usability of many of these technologies has made great strides, but this is not true with regard to the usability of digital games.

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Games are a unique and important area of study for many reasons, one of which is their potential for therapeutic applications. For example, games have been used as an intervention to improve certain aspects of cognitive functioning in older adults [6]. Hoffman and colleagues found that the use of an immersive virtual reality (VR) could reduce pain in burn victims undergoing undergoing painful treatments [7]. Although the participants in this study tended to be younger, pain management is a concern for many older adults [8]. Games have also been used to rehabilitate patients with motor impairments [9]. Harley and colleagues created a system in which the affected arm of a stroke victim could engage in physical therapy sessions using motion tracking while playing a computer game. The goal of the game therapy was to encourage straightening of the limb, accomplished by matching that activity to the in-game goal of moving an object. The need to move a virtual object created a physical goal that allowed distraction from the effort and physical pain caused by trying to achieve that goal. Rewards built into the game promoted effort toward that goal.

Despite the positive health outcomes listed in these studies, games are not a panacea for the cognitive, perceptual, affective, and movement changes that tend to occur with age. Successful game design requires attention to the accessibility, usability, and playability of such interfaces for older adults. General guidelines exist for the design of systems for older adults [10][11] taking into consideration typical age-related changes. However, these guidelines are not specific to the creation of games or game interfaces as they do not consider the amount of challenge or the balance of skill and luck required for a game to be playable and fun. For example, most design guidelines are aimed at reducing effort, thinking, frustration, or indecision - yet these are all attributes that can be desirable in a game [12]. In this paper we consider past research on what makes games compelling and integrate this with general knowledge of older players and their needs.

2 Enjoyment, Motivation and Social Interaction

Motivation to continue play is a desirable design attribute as therapeutic games may require extensive use to produce benefits. Tyree and McLaughlin [13] examined the types of motivations older adults had for their everyday voluntary activities - these activities were not limited to the digital world though many participants mentioned digital games and online activities. Using the nine types of motivations in the Forbes [14] framework, older adults reported being most motivated for activities that gave them feelings of achievement, which often came from overcoming challenges or increasing skill to meet a challenge. This finding bodes well for game design as older players should not be thought of as passive recipients of therapy, but engaged players seeking challenges appropriate to their skill levels. In the same study, older adults reported being the least motivated by social interactions in their chosen activities. This was not to say they were not motivated by social interaction, only that most of their activities were not motivated by it. For particularly social activities they chose to list, social interaction was a significant motivator. This finding, that older persons did not choose activities based on social motivation was surprising, given the

long-standing findings of socio-emotional selectivity theory [15] and underscores the complexity of social interaction as a motivator and the need for further investigation.

Other studies found that social interaction during gameplay has important protective functions. For example, it was found that cognitive abilities predicted game success, which was calculated using the scores provided by a commercial game [16]. This result alone might mean that the game should be made easier for older players, especially those with lower cognitive functioning. However, the study also included a social condition where the same game was used, but played with another person. In the social condition, cognitive ability no longer predicted game success - all players achieved success commensurate with the high ability individual players. Feelings of flow told a similar story. 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" [17]. McLaughlin, Whitlock, and Allaire [18] found that feelings of flow suffered when players were given a complex version of a game to play compared to a simple version. However, those players assigned to the social interaction condition maintained higher reports of flow no matter what level of difficulty they were given. Other studies with older players found similar results using virtual competitors and human competitors [19] where human competitors increased feelings of immersion and positive affect. In conclusion, social games and activities were most motivating when the goal was to experience social interaction, protective of the rewarding feelings of flow when difficulties arise, and may support performance for older persons who have experienced age-related declines.

Outside of social interaction, McLaughlin, Gandy, Allaire, and Whitlock [20] examined unprompted qualitative data regarding likelihood of enjoyment. Their findings suggested that enjoyment relied both on affective experiences such as emotional selectivity as well as the usability of of the game. They suggested that experiencing increased well-being, positive emotions, and "flow" [21] during gameplay would increase the overall enjoyment for older adults. Motivation and effort were positively correlated to feelings of flow, but difficulties due to perceptual or movement deficits abilities negatively associated with flow [20]. Work examining development of flow in a variety of games and activities found that older players developed the most flow in games that could be adjusted incrementally for difficulty [22].

3 Utilizing Older Adult Capabilities

One tactic for game creation may be to take advantage of the strengths and capabilities that come with age to design games that are motivating and rewarding. For example, declarative knowledge (often called verbal knowledge or crystallized intelligence) increases for most of the lifespan [23]. Use of such knowledge in a therapeutic game could be rewarding and encourage continued play even in the face of difficulty with movement, perception, or more fluid abilities such as spatial ability or attentional control. For example, including an occasional need for vocabulary or trivia knowledge to advance in the game may be motivational and provide renewed energy for the more effortful portions of the games.

A second tactic may be to decrease the demands of the game linked to fluid abilities and fine motor skills. Whitlock, McLaughlin, and Allaire [24] found cognitive benefits for older adults in playing World of Warcraft, but the complexity of the game required extensive in-person and remote support to adhere to the training protocol [25]. For example, participants attended an initial in-person two-hour training session followed by a one-hour practice session. After the in-person training session, participants were provided remote support via e-mail, phone, and in-game experimenter support. Without the use of this assistance older adults may not have been able to overcome the complex nature of the game. However, the caveat must be made that many therapeutic games will require high effort and possible discomfort to be effective. Simplifying the game to a too-basic level could undermine the ultimate goal of gameplay and thus, high levels of support may be initially required.

If older adults spend more time feeling frustrated and unmotivated to reach task goals, they are likely to discontinue participation [20]. Fortunately, games can be designed to be rewarding under many conditions and for incremental improvements in skill. Including rewards where needed, particularly in the initial stages as the player is first introduced to the game, will likely increase adherence to therapeutic games. Incentives, such as bonuses or achievements, may help fulfill therapeutic goals by encouraging further participation and practice. By implementing design principles that take into account the abilities of older adults and produce initial rewards for small improvements, we can likely increase adherence and participation.

4 Shortcomings of Current Games

Although many older adults play digital games [26] it is not difficult to see why they might look at the games available today and choose other activities. We believe this is due to a focus on the younger audience as purchasers of games, with a consequence of this belief being the youth-oriented design of instructions, help, support, and lack of flexibility in gameplay. For example, older players experienced the highest flow in a version of one game for the Nintendo Wii where the experimenters deliberately removed complexity from the game [18]. This level of simplicity is not available in even the easiest levels of most commercial games. This is not to say older players cannot achieve high skill or deal with complexity, only that games to not provide an appropriate ramp to the higher complexity levels for these players. As mentioned previously, difficulty changes should be incremental and controllable to be most likely to produce flow [22].

Previous studies have uncovered the lack of training support provided by current games. For example, Whitlock and colleagues [25] provided multiple avenues of support throughout their study and found that utilization of those supports facilitated game play. They concluded that in-person training was crucial, as well as scheduled remote follow-ups to encourage continued participation. Such training supports had two goals. The first was to allow older adults to function properly within the game space by providing a better mental models of virtual space and gameplay with numerous opportunities for practice and viewing of worked examples [27]. The second goal

was to encourage exploration, increase computer self-efficacy, and reduce anxiety. IJsselstein, Nap, Kort, and Poels [28] found that feedback and in-game achievements reduce anxiety. Such a reduction in anxiety may free mental resources to engage in the task [29]. IJsselstein et al. also specified that emphasizing learning goals over performance goals was likely to increase engagement, especially when tasks are complex or require more skill than participants presently possess.

Last, current games may appear to have more costs than benefits to older players. Games, particularly therapeutic ones, need to provide evidence of their benefit to be adopted [30]. One way to do this is to ensure that therapeutic games provide scientifically evaluated benefits. Another way is by considering older adult perception of their need for therapeutic games [31]. If need for a game does not outweigh held values of privacy or independence (and the games appear to violate these values), older adults are not likely to engage. One way this could be applied to games would be to examine the way older adults feel about the utility of a game compared to the social desirability of participating in that game - the game should augment valued activities rather than replacing them [32]. Games need to provide proof of benefits that warrant the time and energy away from other valued activities or become parts of those valued activities to encourage acceptance.

5 Conclusions on the Importance of Usability

The issues raised thus far concerning games may be summarized as global usability concerns. Multiple areas need to be addressed in this regard including complexity, physical requirements, mental models, tutorials, support, and variability in abilities. Though usability principles are important general guidelines, more attention must be paid toward including how these principles are inextricably linked to older adult motivation, enjoyment, achievement, and acceptance of games as a therapeutic options. In circumstances when usability may not be amenable to change, social activity may be a reasonable stop-gap due to the potentially protective effects of social play. However, as these conclusions are based on few studies, more research in understanding social interaction and older adult flow should be performed.

Advancing the understanding of older adult needs with regard to ability, values, and usability in the design field has far reaching implications for the use of games for therapy and leisure. Increasing awareness of aspects of games that fail to meet the needs of the older adult population serves as a starting point for collaboration between researchers and designers. As our world both ages and becomes increasingly technological it is fundamentally important to attend to the special needs of older users and players.

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