

A Virtual Escape Game for Older Adults' Interaction and Social Engagement: A Report on The Design And Usability

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Abstract

In this ongoing study, the effectiveness of a human-centered design for developing a virtual escape game for older adults was explored and the usability of the prototype game is being tested. The game design was informed by our investigation of older adults' needs and interaction patterns in real-life escape games. During the design process, older adults tested the game and it was refined based on their feedback and the research team's observation of their play. It was found that incorporating older adults into the design process can significantly improve the design, as they provide insights that would not be available otherwise. It was also concluded that older adults' involvement throughout the whole design process can result in an end product which is better tailored to their needs. Currently, the refined game is being tested for usability and playability by older adults. The results of this phase will be reported in due course.

Introduction

Research has shown that playing digital games has cognitive and socio-emotional benefits for older adults [1-3]. However, the majority of digital game choices for older adults have not been specifically designed for them – a fact that could diminish their self-efficacy and result in their disengagement from the medium. With advanced age, older adults may suffer from cognitive decline [4,5]. Moreover, older adults are drawn to stories and games that are often different from what the available, off-the-shelf video games offer. Above all, for older adults, interacting with other players has shown to be more important than completing the game. Therefore, it is imperative for researchers and developers to create digital games tailored to the capabilities, interests, and needs of older adults in an attempt to keep them cognitively active, help them interact with other generations in a meaningful way, and give them opportunities to use digital technologies.

One of the best ways to develop digital games that are genuinely engaging for older adults is to design the game in collaboration with older adults. Human-centered design (HCD) seems to be an appropriate approach to achieve this. HCD is an "approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability

knowledge and techniques" [6]. International Organization for Standardization (2010) also the following characteristics for HCD:

- i. The inclusion of multidisciplinary skills and perspectives
- ii. A clear understanding of users, tasks, and environments
- iii. User-centered evaluation driven design
- iv. Consideration of the whole user experience
- v. Involvement of users throughout the design process
- vi. Iterative process

Accordingly, this study explored a human-centered game design to develop a virtual escape game targeted at older adults of 65 years of age and older. Virtual escape game is a digital simulation of real-life escape rooms. Escape rooms, also known as escape games, are collaborative, adventure games in which a group of players are locked in a room with the goal of escaping the room by solving a series of puzzles and finding clues within a time limit [7]. Escape games seem to offer a good environment for meaningful interaction, because the players are physically involved in the narrative of the game.

I. More specifically, the goals of our game design project were as follows

- i. Empowering and engaging older adults to use technology
- ii. Providing a social interactive experience
- iii. Designing a model and creating reusable assets for future game development
- iv. Providing an educational experience through various activities in the game in a familiar literary setting for older adult.

To engage older adults, it was decided that the game should incorporate a learning purpose, since previous research has found that older adults tend to use new technology if they perceive positive outcomes [8]. It was of outmost importance that the type of the game, its learning content and art style should be suitable for older adults. Aside from the goals of our game design project, five affordances were set for the game. These affordances are

- i. Social engagement: the game should allow for players to collaborate in playing the game.
- ii. Cognitive challenges: puzzles should follow an ascending order of difficulty to ensure engagement and avoid frustration.
- iii. Emotional benefits: the game should be fun, low-stress, rewarding, non-threatening to the senior user’s confidence/self-esteem.
- iv. Self-efficacy: that is, the user’s belief in their ability to successfully play complete the tasks in the game. The game should increase the user’s self-efficacy.
- v. Life-long learning: self-reflection and considering technology for learning.

In order to measure the extent to which the game can achieve the proposed goals, an empirical usability test is being conducted on its end users – older adults. The International Organization for Standardization (ISO) (1998) defined usability as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” (n.p.). According to Rubin and Chisnell (2008), “usability testing employs techniques to collect empirical data while observing representative end users using the product to perform realistic tasks” (p. 19). For the purpose of this study, we are using a less formal testing approach, employing an iterative cycle of tests intended to expose usability deficiencies (Rubin & Chisnell, 2008). We choose this approach because it is rigorous and user-centered, has fewer constraints, and provides both quantitative and qualitative data that would inform our design and help us further refine it [9,10].

Game Presentation

The virtual escape game we created is called “Tale of Tales.” It is a collaborative game that provides a virtual social experience different from mainstream video games by engaging older adults through literary themes and the use of new technologies. It is a multi-platform game that can be played on PC, Mac, iOS, and Gear VR. The objective of the game is to engage older adults through elements of real-life and online escape games, including interactive storytelling, and virtual reality. The game consists of three chapters, each with a different theme and storyline. The prototype game has only one chapter. The theme we chose for this chapter borrows elements from Lewis Carroll book, Alice in Wonderland. The reason for choosing this theme was our belief that older adults’ familiarity with the story would reduce their stress and allow them to go through the game play with less confusion.

The game starts with a unique storyline involving a story “thief,” who is called the Ink Monster (see Appendix A) leading the players to explore famous works of literature through virtual worlds, puzzles and interactions with characters from notable works of literature, such as Sherlock Holmes and Alice in Wonderland. In the prototype game (Figure 1), however, the player could only choose Alice in Wonderland. As the players open the door, they see a monster made of ink, drinking the words out of the pages of their favorite stories. The monster sees the players and jumps into a portal inside a book. It is the players’ duty to recover the stories the Ink Monster has stolen. They follow him and dive right into the wacky world of Alice in Wonderland, where the Ink Monster has wrecked havoc on poor Humpty Dumpty.

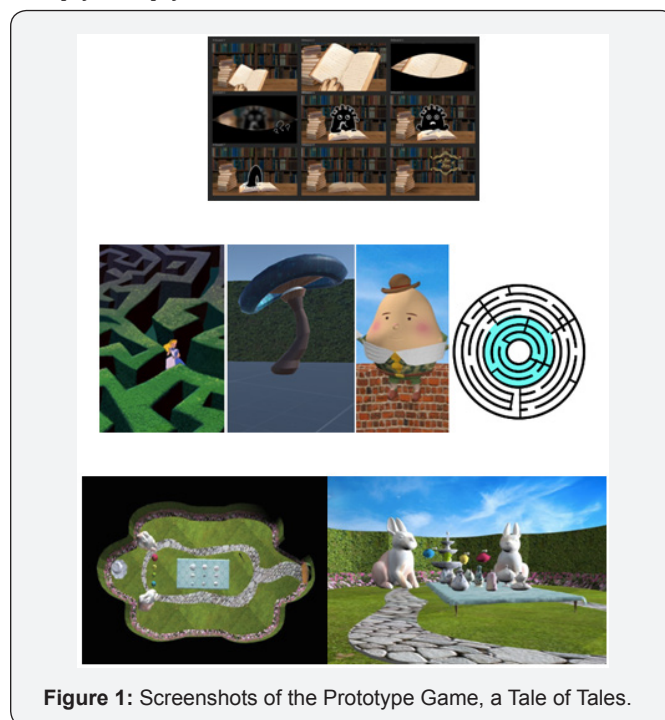


Figure 1: Screenshots of the Prototype Game, a Tale of Tales.

There are many rooms and characters awaiting the players with riddles and puzzles to solve. The p[layers will need help to make it through all the rooms and get back the story from the Ink Monster. To play the game, two players need to pair up online using VOIP to talk to each other. One player is the navigator who has a birds-eye view of a maze and navigates the other player who is inside the maze. Similarly, in solving the puzzles, the two players will see different screens and have different roles. For example, in a crossword puzzle, one player sees the crossword table and the other has the clues to the words.

Research Questions

- i. What are the needs of older adults in an escape game that is designed for them?
- ii. How useful is a human-centered design procedure for designing a digital game for older adults?
- iii. To what extent does the prototype game achieve the specified goals?
 - a. To what extent does the game initiate meaningful social engagement?
 - b. How do older adults perceive playing the game?
 - c. What type of collaboration occurs between the players?
 - d. What are the emotional benefits of the game?

Method Participants

The target population was mobile and cognitively normal older adults of 65 years of age and older. Initially, ten older adults were recruited from Simon Fraser University's senior programs to participate in real-life escape rooms for the first phase of the study. The participants completed a demographics survey, in which they answered questions about their social and academic background and their experience with digital games. The same procedure was followed to recruit 12 older adults for the second phase of the study. It should be noted that some of the older adults who participated in the second phase had also participated in the first phase. Finally, for the third phase, 25 older adults will be recruited from Simon Fraser University's senior programs, as well as senior centers in Greater Vancouver, BC.

Research Design

To answer the research questions, we used an exploratory case-study design. The study was divided into three phases. In the first phase, ten older adults played two real-life escape games with different themes and storylines at Smarty Pantz escape room facility in Vancouver, BC, followed by a focus group interview after each game. In the interviews, they were asked about their experience in the game, including the most engaging and the least interesting aspects, what they would do to improve

the game, and their overall view of the game. This phase was intended to learn about older adults' perceptions of playing an escape game and observe the way they interact in it. This helped us identify older adults' playing patterns and their needs in the game.

The second phase was the human-centered design of a virtual escape game. For this phase, our research team collaborated with five graduate students training in digital media at the Centre for Digital Media (CDM) – a multidisciplinary graduate institution in Vancouver, British Columbia – as well as 12 older adults who tested the early designs of the game twice. The design process took 13 weeks, during which our research team met with the CDM students for brainstorming, feedback on their ideas and design, and laying out the next steps. Together, we created a theme for the game, sketched the game play, and discussed the possible puzzles and what educational content to embed into the game. The CDM team used the Unity game engine and Adobe Photoshop to design the game. We also met with older adults several times to test it with them and improve it based on their feedback. It should be noted that some of the older adults we consulted were the ones who had participated in the first phase of the study and could provide us with valuable insights that will be discussed later in this report.

In the third phase, which is currently in progress, we are testing the prototype game with 30 older adults, in order to further refine the game by observing older adults' interactions, receiving their feedback, and pinpointing the game's flaws including technical glitches and any problems with the content.

Data Collection

This study used an exploratory case study to answer the research questions. Qualitative data were collected through two surveys (a demographics survey and a survey on older adults' experience with the game); semi-structured, focus group interviews to elicit richer responses about their experience and perceptions; and observation of the game sessions through filming the game sessions.

Data Analysis

The majority of the data we collected in the first and the second phases were qualitative and, hence, required qualitative analysis. However, some of the data from the surveys were quantitative. Therefore, descriptive statistics were first generated for the quantitative data from the surveys. Second, the interview responses were transcribed and the transcripts, as well as the open-ended survey responses, were coded and thematically analyzed. Moreover, the game session observers, who were the research assistants in our team, took field notes that were used to triangulate the data. Finally, all the results were converged and interpreted. Similar data analysis procedure will be followed for the third phase of the study.

Discussion

This is an ongoing study intended to explore a human-centered design procedure for developing a virtual escape game for older adults. It was conducted in three phases: (1) need assessment in real-life escape rooms; (2) designing the game in collaboration with older adults; and (3) testing the usability of the prototype game. The results of the first phase, which helped us answer the first research question, indicated that most older adults found playing real-life escape room “fun,” “rewarding,” and “challenging in a good way.” The novelty of their experience was also something most of them reported. However, they noted that the game got frustrating when players couldn’t work efficiently as a team or when solving a puzzle took too long. Moreover, they believed that their play suffered from lack of a leadership, because no one would take the role of the leader. Some attributed this to Canadian’s tendency to defer to others.

This finding is consistent with our observation of their game, where sometimes people were either exploring the room and its artifacts on their own or just standing by observing others. The players were also not comfortable with the “poorly lit” rooms, although darkness was an element of the room’s theme. Their suggestions for improvement included assigning roles to players, more detailed guidance before the game, easier communication with the staff for hints, better lighting, more diverse puzzles, and extended time limit. Almost all participants said they would like to play a virtual version of escape rooms.

The findings of phase one informed the design of our virtual escape game that took place in the second phase in collaboration with the CDM design team and older adults. To answer the second research question regarding the usefulness of human-centered design, we relied on our experience as collaborators and observers of the design process, as well as the usability of the game, which was tested in the third phase of the study. As mentioned earlier, the design process took 13 weeks, during which we adopted a multidisciplinary, human-centered approach, which satisfied all the characteristics of HCD, except that older adults were not involved in brainstorming sessions and in the early stages of the design. According to the principles of HCD, this was a limitation that might be the cause of some flaws in the prototype game, such as lack of sufficient guidance and problems with controlling the game via the computer keyboard.

The feedback we received from older adults during this stage improved our design in several ways. First of all, players reported frustration over communication with their partners. This was especially the case for the navigators, who had a bird-eye view of the game. Some of them reported that navigating the other player was not rewarding enough, while others said it became boring at some points. Nevertheless, they thought that the collaboration in the game was fun and satisfying. To address the communication issue, we decided to embed a

VOIP service into the game and also switch the screen at some point in the middle of the game, so that the players experience both the navigator’s and the follower’s roles in a game. These improvements have not been realized yet. Second, older adults were shown to be more comfortable with stories and puzzles familiar to them. Therefore, we decided to include puzzles like crossword puzzles and a bingo-like puzzles, which worked quite well with them. Third, the tests showed that the game lacks sufficient instructions to guide older adult players throughout the game. Therefore, the next iteration will have real-time guidance that will help the players in the game. Moreover, the players believed that succeeding in the game is not rewarding, as there is no point system to show them how successful they were. Finally, the players suggested that the game could have been more engaging if it were more story-oriented, rather than puzzle-oriented.

The third research question is to be answered in the third phase. Currently, we are applying the above feedback to the prototype game in collaboration with two programmers at CDM. Our plan for the third phase is to further test the usability of the refined game with 30 older adults. The data for this phase will be collected through observation, surveys, and interviews and the results will be reported in due course.

Conclusion

The findings of the first two phases of this study had several implications for researchers and developers. First of all, the findings suggest that an exhaustive needs assessment is an integral precursor to a successful game design. The needs assessment in this study involved getting older adults to play real-life escape rooms and provide us with feedback on their experience and how to improve it. It also allowed us to analyze and document their interaction patterns. Second, developing digital products, including digital games, for older adults requires their collaboration in the design process. In this study we collaborated with them in the later stages of development, which significantly improved our design. Furthermore, usability testing should be a formative practice, rather than a summative one; that is, the feedback should result in iterative refinement of the design several times during the development process.

Despite the useful results this study yielded, it had some limitations that we hope our future research will avoid. As mentioned above, this study failed to incorporate older adults into the whole design process. It is still not known whether it would be practical, efficient, or productive to integrate older adults into the whole design process, including the major design decisions. In addition, the demographics of our participants showed that they were mostly educated, middle-class, white, north American older adults. More research is needed with a larger, more diverse sample of older adults to further investigate the usefulness of our HCD process.

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