A VIRTUAL ESCAPE GAME FOR OLDER ADULTS’ INTERACTION AND SOCIAL ENGAGEMENT: A REPORT ON THE DESIGN AND USABILITY

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Abstract

This ongoing study explores the effectiveness of a human-centred design for developing a virtual escape game for older adults and test the usability of the prototype game with regard to the educational goals defined for it, namely, empowering and engaging older adults to use technology, providing a social interactive experience, and providing an educational experience through various activities in a familiar literary setting for older adults. 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 older adults’ involvement throughout the whole design process can result in an end product which is better tailored to their needs. However, although incorporating older adults into the design process can significantly improve the design, as they provide insights that would not be available otherwise, there are several challenges that could affect the design. Therefore, there might be a need for a modified version of human-catered design for designing virtual games. Currently, the refined game is being tested for usability and playability by older adults to empirically validate the game’s usability with regards to the goals defined for it. The results of this phase will be reported in due course.

Keywords: Human-centered game design, older adults, virtual escape game, usability testing.

1 INTRODUCTION

Research has shown that playing digital games has physical, cognitive and socio-emotional benefits for older adults [1][2][3]. It allows older adults to master game skills and develop a sense of achievement [4]. Playing collaborative games provides opportunity for meeting other people, developing personal connections, and decrease the feeling of loneliness [5]. For example, Schell, Hausknecht, Zhang, and Kaufman [6] investigated the social benefits of playing Wii bowling regularly over several weeks for older adults. They found that playing the game resulted in decreased feelings of loneliness and increased social connectedness [6]. Playing Wii also led to more diverse interactions outside the game environment and expanded the participants’ social connectedness beyond the study period [7].

Despite the above findings, the majority of digital game choices for older adults have not been specifically designed for older adults – a fact that could diminish their self-efficacy and result in their disengagement from the medium. With advanced age, older adults may suffer from physical and cognitive declines [8][9]. Moreover, research has shown that social interaction is an important reason why older adults play digital games [10]. 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” [11, p. 2]. International Organization for Standardization [11] also identified the following characteristics for HCD:

- The inclusion of multidisciplinary skills and perspectives
- A clear understanding of users, tasks, and environments
- User-centered evaluation driven design
− Consideration of the whole user experience
− Involvement of users throughout the design process
− Iterative process

Accordingly, this study explored a human-centered game design to develop a virtual escape game targeted at older adults aged 65 years 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 [12]. Escape games seem to offer a good environment for meaningful interaction, because the players are physically involved in the narrative of the game.

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

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

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 [13]. It was of utmost 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, the following affordances were set for the game:

- Social engagement: the game should allow for players to collaborate in playing the game.
- Cognitive challenges: puzzles should follow an ascending order of difficulty to ensure engagement and avoid frustration.
- Emotional benefits: the game should be fun, low-stress, rewarding, non-threatening to the senior user’s confidence/self-esteem.
- 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.
- 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 [11] 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. According to Rubin and Chisnell [14], “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 [14]. 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.

1.1 Research Questions

1. What are the needs of older adults in an escape game that is designed for them?
2. What are the challenges of using a human-centred design procedure for designing a digital game for older adults?
3. To what extent does the prototype game achieve the specified goals?
   a. To what extent does the game initiate meaningful interaction?
   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?
2 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 borrows elements from Lewis Carroll’s 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 gameplay with less confusion.

The game starts with a unique storyline involving a story “thief,” who is called the Ink Monster leading the players to explore famous works of literature through puzzles and interactions with characters from notable works of literature. In the prototype game, 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 into the world of Alice in Wonderland, where many rooms and characters await the players with riddles and puzzles to solve.

The players will need the characters’ 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 a voice call service 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. Please, see Appendix A for screenshots of the game.

3 METHODOLOGY

3.1 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.

3.2 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 SmartyPantz 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 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 gameplay, 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 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.

3.3 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.

3.4 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 – such as demographics and Likert-scale items – 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.

4 RESULTS

The results of the first phase, which helped us answer the first research question, indicated that most older adults found playing a 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 artefacts 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 interview responses in the second phase indicated that the participants mostly enjoyed the collaboration involved in the gameplay. They were also satisfied with the diversity of puzzles, as well as the flow of the game. As for communication with the other players, some players reported that navigating with the other player was not rewarding enough, while others said it became boring at some points. This was especially the case for the navigators, who had a birds-eye view of the game. However, they had little problem communicating in other puzzles. Regarding their favorite puzzle, some liked the crossword puzzle because it was familiar, whereas others preferred the matching puzzle for its novelty. Our observations of the game sessions show that the puzzles were engaging for the older adult players. We also saw that most players required some form of help and guidance from us during the play. 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.

5 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 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 the 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. 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 to help the players in the game. Overall, the prototype game that we developed through our human-centered design was engaging, enjoyable to play. It also showed potential for increasing social connectedness of older adults and keeping the cognitively active. However, several flaws were witnessed and reported that will be addressed in the next iterations of the game.

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 will be collected through observation, surveys, and interviews and the results will be reported in due course.

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REFERENCES


APPENDIX A: SCREENSHOTS OF THE PROTOTYPE GAME, A TALE OF TALES

The Ink Monster

The Maze
The Navigator’s versus the Follower’s view