Does a Sonar System Make a Blind Maze Navigation Computer Game more "Fun?"

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ABSTRACT

As part of the Blind Programming Project at Southern Illinois University Edwardsville, we are investigating ways to make programming more fun for school aged blind children. We are beginning this search by creating and empirically analyzing a number of different auditory computer games. These games are being analyzed to see if we can make them customizable (programmable), using blind programming environments, and to see what kind of strategies work best when designing video games in general for blind users.

In this work, we explored the creation of a zombie-killing maze navigation game for the blind. Specifically, we were curious whether a sonar based system would be more *fun* for users when trying to navigate the maze as compared to a navigation system that literally told the user which way to travel. We hypothesized that the sonar system would be more fun, as it provided a playful challenge. Unlike most auditory games for the blind, which typically use screen readers, we made high quality voice recordings of the entire user interface for our game. Overall, results did not show that the sonar based game was more fun, however our game was rated so highly by users, that the navigation system itself appears less important than careful user design and innovative and fun auditory feedback.

Categories and Subject Descriptors: K.4.2 Social Issues: Assistive technologies for persons with disabilities

General Terms: Human Factors, Experimentation

Keywords: Auditory Games, Accessibility

1. INTRODUCTION

Computer gaming has become a mainstay for at-home entertainment. Large corporations invest significant capital into creating entertaining and captivating products. Modern computer games, more typically called *Video* games, however, were designed almost exclusively for sighted users. Modern systems from major manufacturers are continuing this trend, focusing on movement systems and other highly visual methods of interaction. While exciting and captivating for sighted users, these new systems leave blind users cold.

While largely in the research community, a number of universities are considering how to create computer games for the blind. The predominate approach is to copy an existing game (e.g., guitar hero [4], Rock Band [1], Second Life [2]), but adapt its use to non-visual modes of interaction, either through auditory or tactile feedback. In our lab at Southern Illinois University Edwardsville, our purpose is slightly different. We are working on the Sodbeans project [3], to create programmable video games for blind children. In essence, this would allow blind children to both play computer games and learn to program a computer in tandem, allowing them a more fun educational pipeline in which to learn. The first version of our game (which is not yet programmable), is being distributed to the Washington State School for the Blind in July of 2010 as part of a conference involving the programming tools.

As a first attempt at writing an auditory game system, we have created a maze navigation game called The Dark Labyrinth. The objective of the game is simple: to navigate successfully from point A to point B, using one of two alternative navigation systems. In the first navigation system, we devised a spatial auditory system that indicates the appropriate direction in the maze by the direction in which

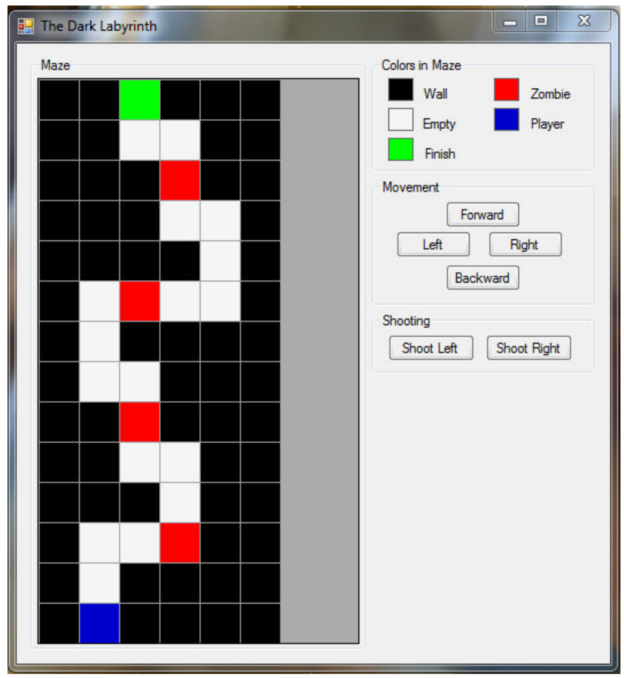

Figure 1: GUI of The Dark Labyrinth

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sound is coming from in a surround sound speaker setup. This, we hypothesized, would probably be the simplest navigation system, as it effectively tells the user where to go in the maze. We also suspected that this would be less fun, as the interface is relatively simplistic. Second, we developed an auditory sonar system, which gave the user the ability to "ping" in a certain direction by pressing a button on the Nintendo Wiimote. If the user, for example, pressed the directional pad up, the user might hear 4 clicks, which would indicate that there are four open spaces in the maze in the forward direction. Figure 1 shows a graphical representation of the maze, along with buttons to control movement of the player, which is shown in blue. Since this is a computer game for the blind, the participants cannot see the screen, but the GUI was useful for testing and evaluating the performance of the players.

2. AUDITORY DESIGN

After analyzing current auditory games, we decided that ours might be more enjoyable if we record high quality voice acting and include these recordings at all phases of the game. In other words, we never switch over to a screen reader—we have high quality audio at all times. Contrast this with programs like TextSL [2]. While making games like Second Life accessible is genuinely difficult, partly because of the variety of text that must be spoken, and partly because many objects in the Second Life universe are effectively not accessible, these games ultimately *sound* rather mechanical.

In our auditory game, it is the opposite. Whenever the user enters an area where there is a zombie, we output zombie-like noises. All interactions with the interface (even menus) have high quality voice acting. Explanatory text is done the same way. Gunshots make gun sounds and walking sounds like foot steps. In effect, we have tried to pay as much attention to the sounds in our game as commercial developers do in theirs, with the exception that we provide additional cues for blind users and sonar or other techniques for navigation.

3. EXPERIMENTAL EVALUATION

We evaluated our game in an informal empirical study at Southern Illinois University's Engineering Open House. Our study lasted about 5 hours on a Saturday in the Spring Semester of 2010 and largely involved children under 18. This was as close as we could get to our target population (blind children), before we pilot test our game this summer with the actual population. Twenty-nine people took part in our study and twenty-four were videotaped. Of the video taped participants, 19 were male and 5 were female. Almost all participants were children, although a few brave parents participated. All participants signed age appropriate wavers that were approved by our Institutional Review Board.

Each participant was given a brief explanation of how to play the game which described what controls to use and how to react to certain sounds. The players were allowed to play the Sound Maze (directional sound only) first and the Sonar Maze (no directional sound, "ping" the walls for direction) second. If the player was having difficulty at any point in the game, advice was given so the user would be able to complete the test. After the participant played both mazes, they were asked to fill out a survey, which asked them to rate how "fun" that round of the game was on a Likert scale from 1 to 10 (10 is the most fun). Out of a sample of $N = 29$ surveys, our results show that the amount of fun our participants had playing the sound maze on a 10-point scale ($M = 7.93$, $SD = 1.33$) is not significantly different to the sonar maze ($M = 7.96$, $SD = 1.37$), $t(54) = -0.10$, $p = 0.92$. Effectively, how one navigates mattered very little. However, we received some valuable feedback from the users, which is helping us improve the program.

Specifically, we can improve the quality of the sound effects used by making them more distinct and explaining the meaning of the sounds beforehand. We can improve the overall user experience by allowing the player to point the Wiimote in a certain direction and shoot, instead of the two buttons on the Wiimote that control shooting in two directions. Some participants mentioned that they forgot the controls during the game. We could have a spoken tutorial that explains the controls when the player presses a 'help' button. Although we tested a basic version of the game, we suspect our game would be more fun by making it more difficult to kill zombies and have a variety of weapons for the player to use. We also had a very young girl who played our game and was frightened by the loud sounds. We might consider making a version of the game that would be more appropriate for younger children.

4. CONCLUSION

In this paper, we presented an auditory game study which compared two navigation systems. The study shows that there is no detectable difference between the two systems in terms of how "fun" they are rated by participants. Our plans for future development include making a more developed game with more ambiance noises, health meters, weapon/item upgrades, and other features. All of these improvements are aimed at creating a game that is comparable entertainment-wise to a visual game.

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