Wizard of Wii : Toward Understanding Player Experience in First Person Games with 3D Gestures

Salman Cheema
Interactive Systems and User Experience Lab
University of Central Florida
Orlando, Florida, 32816
salmanc@cs.ucf.edu

Joseph J. LaViola Jr.
Interactive Systems and User Experience Lab
University of Central Florida
Orlando, Florida, 32816
jjl@eecs.ucf.edu

ABSTRACT

We present a user study that begins to explore aspects of players experience in first person games that use 3D gestures for interaction. Our study uses Wizard of Wii, a video game prototype that has players perform a set of 25 distinct gestures over the course of four different game quests using the Nintendo Wii Remote. Our results indicate that players' ability to recall gestures improved with repeated play and they believed themselves to be performing better in the game. However, while the recognition accuracy improved significantly with repeated play, players were unable to perceive the difference.

Categories and Subject Descriptors

K.8.0 [**Personal Computing**]: General—*Games*

Keywords

3D Gestures, Player Experience, Video Games

1. INTRODUCTION

Guidelines are available for game developers in relation to traditional aspects of game design e.g., level design, artificial intelligence, etc [3]. Additionally, aspects of player experience in traditional video games have been explored in the past [1, 4]. However, the recent prevalence of peripherals that enable 3D spatial input (e.g. Kinect, Wiimote, etc) has posed interesting challenges in terms of both novel applications [5] and toward understanding of player experience. The effect of new gestural interfaces on gameplay experience is generally not well-understood. Questions such as what gestures are suitable for different genres of games or how accurate does gesture recognition need be for a satisfying gameplay experience have now become important for video game designers.

In this paper, we make initial strides toward an understanding of these issues. Specifically, our focus is on improved understanding of player perception of gameplay performance in conjunction with aspects of 3D gesture recognition in a first person game. We address the following important questions: How do players perceive their performance given a certain level of gesture recognition accuracy? How do players' ability to recall gestures and perception of gameplay performance change with repeated play?

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Figure 1: One of the quests in Wizard of Wii.

2. WIZARD OF WII : AN OVERVIEW

We have designed and developed a video game prototype, Wizard of Wii (See Figure 1), a linear, first person adventure game with its gameplay based entirely on 3D gestures performed with a Nintendo Wiimote. Players are placed in the role of a wizard on an adventure and are required to complete a series of four quests in order to win. The player interacts with the world using 3D gestures to cast spells, wield a sword, and teleport between quests. The player moves automatically from the start to finish in a linear fashion. Gameplay tasks are presented to players at predefined points, with visual cues to alert players that they are required to perform a gesture. Each visual cue, in the form of an image, also tells players which gesture to perform and how to perform it. Limiting players' freedom to move and perform gestures enabled us to predict when a gesture was to be performed and subsequently determine if it was recognized correctly.

We used the scheme and gesture set suggested by Hoffman et al. [2] for in-game gesture recognition. This method involves using a linear classifier trained in a user dependent configuration with 15 training samples per gesture, and shows a recognition accuracy of over 95% across all gestures. In-game gestures are performed by holding a Nintendo Wiimote in different starting orientations and making a motion in the air.

Some gestures have a clear mapping to sword manipulation. These include 'Parry', 'Slash', 'Slice', 'Stab', 'Zorro', and 'Chop'. Additionally, gestures with simple flicking motions were adapted to vertical and horizontal sword cuts ('Left', 'Right', 'Forward', and 'Stop'). Gestures depicting lines (Line to 'Left , Right, Up, Down') are very easy to perform and were adapted to allow the player to teleport between quests. The 'Square' gesture was mapped into drawing a virtual window in the world, where players could see the quest information. All remaining gestures were mapped to spells.

At each point where players were expected to perform a gesture, we limited the player to a maximum of 5 mistakes. This feature was introduced after a pilot run of the experiment, during which one person was unable to proceed in the game due to poor recognition accuracy. Also, before each quest in the game, players were required to summon a quest description by use of the 'Square' gesture. This screen displayed the storyline for the quest and described the quest tasks in terms of gestures to be performed by the player. The quest description screen also served as a practice area where players could recall and practice the appropriate gestures before starting the quest. To make it easier to remember gestures, no more than seven gestures were required for each quest.

3. USABILITY STUDY

3.1 Subjects and Apparatus

A total of 25 participants (23 male and 2 female) were recruited from the University of Central Florida for participation in the investigation. Participants' ages were between 18 and 28 years. 22 participants were right-handed while three were left-handed. Each participant took 60-90 minutes to complete the entire experiment and was paid $10 for his/her time.

The experiment was conducted on a computer equipped with an Intel Core-i7-920 processor, and an nVidia GeForce 460 graphics adapter. For display, we used a 50in Samsung DLP 3D HDTV with the resolution set to 1680x1050 pixels and a refresh rate of 60Hz. The participants stood approximately 4-6 ft from the display and performed gestures while they were standing.

3.2 Experiment Procedure

The experiment was split up into two parts. Participants first performed each gesture 25 times, a random 15 of which were used for training the in-game recognizer in each session. To prevent fatigue during the data collection phase, participants were asked to take frequent breaks. Participants could delete gesture data if they discovered they had done gestures incorrectly. Additionally, a proctor monitored participants at all times and pointed out mistakes, if any. The data collection session lasted 30-40 minutes.

During the second part of the experiment, participants were required to play Wizard of Wii. Two gameplay session were required from each participant. Each session lasted approximately 10-15 minutes with a few minutes break between sessions. After each session, participants were asked to fill out a questionnaire. After the first gameplay session, the questionnaire included a few extra questions because it asked participants to compare their performance between sessions and also included a few free-response questions seeking suggestions from participants.

3.3 Gameplay Metrics

Five metrics were analyzed in each gameplay session. Actual recognition accuracy and the number of recognition errors were automatically logged during each player's session. A recognition error denotes an instance where the expected gesture does not match the recognized gesture. This occurs in two ways. Either a player performed a gesture incorrectly or the recognizer failed to recognize a correctly performed gesture. Given our experimental setup, it is impossible to distinguish the two cases. We attempted to minimize the first possibility by using visual cues to aid gesture recall and by limiting the number of gestures in each quest, but it may not have eliminated all cases of player error due to incorrect recall. Actual recognition accuracy in each round was computed as the ratio of gestures correctly recognized in the first attempt to total gestures performed. Three other metrics were collected via player responses in gameplay questionnaires: perceived recognition accuracy, perceived gameplay performance and ability to recall gestures. A 7-point Likert scale was used for these metrics.

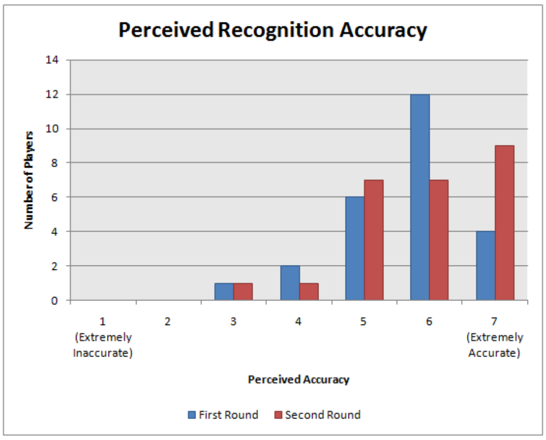

Figure 2: Frequency Table showing how the players' perception of recognition accuracy changed between the two gameplay sessions.

4. RESULTS

We performed pairwise Wilcoxon Signed Rank tests on gameplay metrics, in order to see if the change in each metric's distribution was significant between gameplay sessions. In the first session, mean recognition accuracy across all players was 69.33%, which improved to 79.2% in the second session ($z = -3.664, p < 0.01$). The mean number of recognition errors per player decreased from 19.8 to 14.24 between the two gameplay sessions ($z = -2.649, p < 0.01$).

4.1 Perception of Recognition Accuracy

Figure 2 shows the change in players' perception of gesture recognition accuracy between gameplay sessions. The mean perceived recognition accuracy changed only slightly from 5.64 to 5.88. Although the increase is not statistically significant ($z = -1.255, p = 0.210$), Figure 2 indicates an increase in the number of players reporting higher perceived accuracy in the second session. It is interesting to note that although actual recognition accuracy increased significantly between sessions, the increase in mean perceived accuracy was not significant, indicating that most players' perception of recognition accuracy varied little from their initial impressions formulated during the first session.

4.2 Perception of Gameplay Performance

The mean perceived gameplay performance increased from 5.20 to 5.92 between sessions ($z = -2.578, p < 0.05$). A deeper look at the decrease in recognition errors also revealed that players needed fewer attempts in the second session before a gesture was recognized correctly. This may explain why players perceived better gameplay performance during the second session, even though they were not able to perceive a significant increase in recognition accuracy.

A majority of players reported that their gameplay performance had improved between sessions. When asked about the impact of recognition accuracy on gameplay performance, responses varied from player to player. A common complaint was the frustration players felt when the recognizer failed to correctly recognize gestures, resulting in distraction and decreased immersion for a small number of players. Some reported that good recognition accuracy increased their immersion in the game and they actually felt as if they were wielding a sword or a wand. Interestingly, a few players reported that the accuracy of recognition did not impact their gameplay performance at all.

4.3 Perception of Gesture Recall

There was a significant increase in player's perception of their ability to recall gestures in the second session. The mean response changed from 5.52 to 6 between sessions ($z = -2.178, p < 0.05$). This finding is in agreement with earlier results that indicate that gesture recognition accuracy improved between sessions while both the number of recognition errors and attempts for correct recognition decreased.

4.4 Gesture Preferences

After each session, players were asked which gestures were easy or difficult to recall, and which gestures were suitably adapted to the game environment. Analysis of the responses indicates a few common themes. Most participants felt comfortable using simple and smooth motions, e.g. wrist flicks ('Left', 'Right', 'Down', 'Stop') and lines ('Line To Left, Right, Up, Down'). Some participants disliked gestures describing geometric patterns or shapes ('Circle','Open Door', 'Lasso', 'Twister', 'Triangle', 'Square' and 'Figure 8'). Several players reported confusion and frustration with gestures involving similar motions. Examples of such gestures include 'Lasso', 'Circle', 'Open Door', 'Twister', all involving one or more circles. Other gestures such as 'Triangle', 'Square' or 'Figure 8' were disliked by some participants on the grounds that geometric patterns didn't suit the fantasy setting of Wizard of Wii and therefore detracted from the experience.

The majority of participants reported they would like to see 3D gestures used in video games if recognition errors could be eliminated. When asked which games could benefit from having 3D gestures, most of the participants responded with similar answers: First Person Games, Adventure Games, Role Playing Games, Fighting Games, and Sports Games.

5. DISCUSSION

We were able to achieve a maximum recognition accuracy of 79.2%, which is far below the expected accuracy of over 95% suggested by [2], which was achieved over gestures collected in a data gathering environment. The decrease in recognition accuracy can be attributed to stress induced by the game environment, which may impair gesture recall and also introduce more variation in the gestures themselves. Our results indicate that players were able to better recall gestures with repeated play and also perceived an improvement in their gameplay performance. With repeated play, players' gestures were correctly recognized in fewer attempts. This may have contributed to a perception of higher gameplay performance in the second session. Gesture recognition accuracy improved significantly between gameplay sessions, possibly due to improved gesture recall. Interestingly, *Players were unable to perceive the increase in recognition accuracy*, indicating that first impressions were fundamental to their perception of recognition accuracy. This is an important finding from a game designer's perspective because it seems to imply that games using 3D spatial input should attempt to make a good initial impression in terms of recognition accuracy.

6. CONCLUSION

We have presented an initial investigation into aspects of player experience involving a linear, first person adventure game, Wizard of Wii, using 3D gestures as a core mechanic. Our results indicate that with repeated play, recognition errors decreased and players were able to better recall gestures. This coincided with an increase in perceived performance, even though players were unable to perceive a significant increase in recognition accuracy.

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