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Letter:

Construction of Web-Based Speech Game System "kikimimi"

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In this study, a web application of kikimimi, a game for visually-impaired persons, was created. The game rules were simplified to allow the visually-impaired to easily play it. This was verified in an experiment in which visually-impaired persons actually enjoyed the web application game. Moreover, it was confirmed that even the simplified version of the game was sufficiently entertaining.

Keywords: visual impairment, ADL (activities of daily living), QOL (quality of life), entertainment, self-efficacy

1. Introduction

Games have propagated over modern society as a leisure or communication tool. Most modern games are designed for use of the visual senses, and are not enjoyable for visually-impaired persons. With this background, we have developed kikimimi, a table game requiring no visual senses. However, players have needed various devices to play the game, which must be put away after the game. In this study, we developed a web application of kikimimi, in which players will no longer need to make preparation before the game or put things away after the game.

2. Web Application of kikimimi

2.1. kikimimi

kikimimi is a table game played with the help of sound [1, 2]. Card games with Braille were developed as table games for visually-impaired persons, however, those who did not read Braille, could not play the game. Because sighted persons can see the cards, visually-impaired persons and sighted persons are not on equal footing while playing card games together. As a preliminary version of kikimimi, IC tag cards were developed, consisting of blank cards with IC tags, and a device to read the tags and give speech output. Vocally provided information allowed visually-impaired persons, who could not read Braille, to enjoy the game. Moreover, because blank cards were applied, the sighted persons and visually-impaired persons could play the game on an equal footing. Because the blank cards did not need to be card-shaped, they were changed to three-dimensional pieces, with which we developed the current version of kikimimi.

The pieces used for kikimimi have IC tags and each piece produces corresponding speech when touched on a reader device. Each player uses an ear phone to hear the speech from the reader. Every player can thus know all the pieces discarded on the 'table' from the speaker. The speech of each piece can be changed to follow different rules. The piece is made by cutting a hemisphere, which looks like an equilateral triangle when viewed from above. With the above mentioned configuration, kikimimi does not require the visual senses of players in any part of the game process, and sighted and visually-impaired persons can play it on an equal footing.

2.2. Problems of kikimimi and Development of Web-kikimimi

Throughout the game, visually-impaired persons can play kikimimi without any visual assistance. However, only the help of sighted persons was needed to prepare for the game, e.g., to deal out the pieces and to set the reader devices. This meant a sort of 'barrier' for the visually-impaired in participating the game. Thus, we have developed a web application version of kikimimi (or web-kikimimi), because the web applications are useful for

them who use PC in daily living. This means that not only the visually-impaired can play the game without preparation, but also they can also play web-kikimimi with other players in distant places.

Some visually-impaired persons have said that the rules of the original version of kikimimi were too complicated to remember. Because they have few opportunities to play the game, they need both simplified rules and a tutorial, such that even beginners can easily play kikimimi. Thus, we made two sets of rules for web-kikimimi. The first was ordinary rules (hereinafter referred to as the ordinary version) and the other was the simplified rules for learning the game (hereinafter referred to as the simplified version). In this study, as the first step in the development of web-kikimimi, we checked whether both visually-impaired persons and sighted persons could easily play web-kikimimi with either the ordinary or simplified rule version. Moreover, a requirement for web-kikimimi is that it should be entertaining for players, so that we checked whether the simplified version was as enjoyable as the ordinary one.

Usuda et al. [3] studied a game with a device for visually-impaired persons. It was not a table game, but a game for a single player. Thus, it was not in the same category as kikimimi, which is a table game for multiple players. Caporusso et al. [4] studied a table game, which was a system that assisted visually-impaired persons in playing a game of chess. To play chess, visually-impaired persons are not on equal footing as the sighted persons can easily see the board. In addition, kikimimi has the advantage of easily adjusting the game difficulty.

2.3. Overview of Web-kikimimi

Figure 1 shows the configuration of web-kikimimi. For web-kikimimi, each player operates his/her own computer, which accesses a game server through the network to play the game. In web-kikimimi, players play using virtual pieces sent from the game server to each computer, although in the original kikimimi, players played using hemisphere-like shaped pieces. The players use keyboards to handle the distributed virtual pieces. Pressing the right or left arrow key selects a piece. The selected piece creates its own sound allowing the player to recognize the selection. Pressing the upper arrow key places the piece onto the table, and pressing the lower arrow key extracts a piece from the table. The piece placed on the table creates a sound for all the players, and the piece extracted from the table creates a sound only for the player who extracted it.

In the original kikimimi game, the piece information is provided from a speaker or ear phone. In web-kikimimi, the information is likewise provided from a speaker or ear phone. Web-kikimimi does not require visual senses for players to receive the information, which means visually-impaired persons and sighted persons can play the game together on an equal footing. Moreover, the number of operation keys were minimized to prevent a burden on visually-impaired players when searching the keys. The most important point was that the original kikimimi triggers players' conversation as a communication tool. This communication could be realized in web-kikimimi by using a chat application with a screen reader.

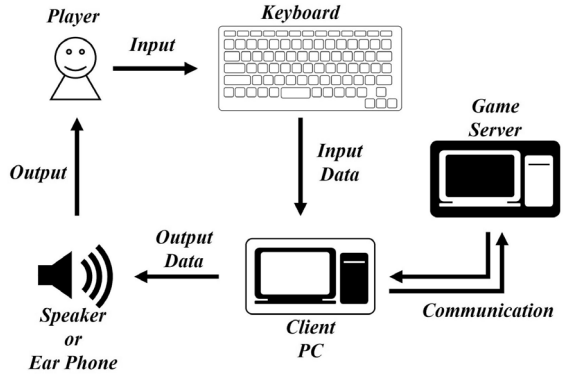

Fig. 1. System configuration of web-kikimimi.

3. Experiments

3.1. Overview

The experiment goals were to see whether visually-impaired and sighted persons can enjoy the game together, and to compare the ordinary version with the simplified version, which was created as an introductory version of the game. Players use 35 pieces of 7 types in the simplified version, while they use 54 pieces of 11 types in the ordinary version. To reduce the number of pieces in the simplified version, the attributes were also decreased in number from four to three. In addition, in the ordinary version, there were two types of attacking pieces. One increased the number of the next player's pieces by two and the other by four. On the other hand, the simplified version only used a single type of attacking piece, which only increased the number of the next player's pieces by two. This was because a preliminary survey showed that it was difficult for some players to know all the pieces, if there were too many pieces. As a result, the rules could be simplified and players could finish the game in a shorter period of time.

3.2. Flow

In this paper, a 'flow' was used to measure the enjoyment of the game. It is a psychological state associated with enjoyment or joy, proposed by Csikszentmihalyi and defined as a "comprehensive state which people feel when being devoted to an actio" [5]. For the measurement of the flow, Jackson et al. proposed a flow state scale (FSS) [6]. An FSS is a question scale created based on questionnaire surveys to athletes. The respondent answers 36 questions by selecting from a grade of one to five. He/she would be in a high flow state, if the score is high. Because the FSS questions were created for sports, we replaced the sport-related terms with game-related terms in the questionnaire survey.

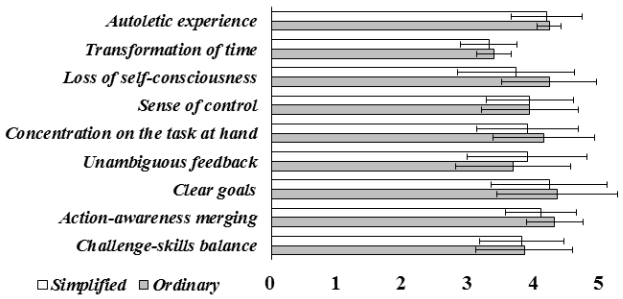

Fig. 2. Comparison of FSS results between ordinary and simplified versions.

3.3. Method and Results

A total of six examinees, i.e., two female visually-impaired persons and four male sighted persons, participated in the experiments. One female visually-impaired person and two male sighted persons played the ordinary version of the game three times after being instructed about the rules and operation. After the games, a questionnaire survey, based on the FSS, was conducted. Then, they played the simplified version three times and the same survey was conducted. The other female visually-impaired person and the other two male sighted persons played the simplified version first, and then, the ordinary version.

The games progressed smoothly. After the games, the examinees were questioned regarding the games and no issues were brought up regarding the game play. **Fig. 2** shows the FSS results for the six examinees. The vertical axis shows the question items and horizontal axis shows the average score for each item with standard deviation bars. One can see from **Fig. 2**, that the simplified version was just as enjoyable as the ordinary version. However, a visually-impaired examinee commented that it would be more enjoyable with more pieces. Therefore, some complexity might be necessary for players to enjoy the game, because the simplified version gave a lower FSS score for loss of self-consciousness. For games played by visually-impaired persons, we need to consider, not only simplification of the rules, but also appropriate rule complexity.

4. Conclusions

We developed web-kikimimi, a web application for visually-impaired persons and sighted persons, which allows the game to be played on an equal footing. In this study, we used two sets of game rules, the ordinary version and simplified version. The ordinary version rules were taken from the original kikimimi game and the simplified version rules were newly created for ease in game play. Visually-impaired persons and sighted persons actually played the game, and it was confirmed that they could play it without any problem. The FSS results showed that even the simplified version of the game could be entertaining for the players. The present study confirmed that even the simplified version was sufficiently enjoyable; however, an additional experiment would be necessary, because no evaluation has been completed on the game operation tutorial. Moreover, based on the results and comments obtained through the present experiments, more detailed experiments will be performed to improve the rules and interface.

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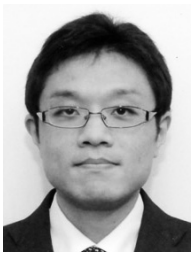

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