KINECT TRAINING GAME FOR OVERTURN SAFETY OF OLDER PERSONS

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ABSTRACT

The daily training for avoiding the overturn is very important for the elderly persons in their daily living. The internal reasons of the overturn in the daily life are classified into the internal one such as athletic performance and the external such as the structural design. The main internal reasons are the reduction of elderly persons’ athletic performance and cognitive ability. Some reports pointed out that the training for dual task performance is very effective for enhancing both athletic performance and cognitive ability. In the dual task, the persons do the cognitive ability and physical trainings simultaneously.

The aim of this study is to design the training game for enhancing dual task performance by using Microsoft Kinect. In this task, the persons control a character on a screen through the Kinect to count numbers and alphabets on the screen in turns. Controlling the character on the screen and counting numbers and alphabets are effective for enhancing physical trainings and cognitive ability, respectively. The difficulty of the dual tasks is beginner, intermediate and advanced levels.

Undergraduate students tried the training games. The average times for the task accomplish were 54.6 seconds for intermediate level, and 65.6 seconds for advanced level. Therefore, the target times for elderly persons were estimated as 158.8 seconds for intermediate level, and 202.4 seconds for advanced level.

Keyword: Overtturn safety, Dual Task Performance, Kinect.

INTRODUCTION

Japan National Livelihood Survey reports that the main reasons why the elderly persons need the long-term care are stroke, dementia, aging debility and fracture and overturn [1]. The bone fracture due to the overturn makes the elderly persons’ body function worse and moreover, evolves the aging debility. Therefore, the daily training
for avoiding the overturn is very important for the elderly persons in their happy daily life.

The reasons of the overturn in the daily life are classified into the internal one related to the elderly persons and the external one to the design of structures, town and so on. The main internal reasons are the reduction of elderly persons’ athletic performance and cognitive ability. Some researchers pointed out that the training for dual task performance is very effective for enhancing both athletic performance and cognitive ability performance [2]. In the dual task, the persons do the cognitive ability and physical trainings simultaneously.

The aim of this study is to develop the training game for enhancing dual task performance by using Microsoft Kinect [3]. In this game, the persons control a character on the screen through the Kinect in order to count numbers and alphabets in turns. Standing in front of the screen and controlling the character are effective for physical training. Counting numbers and alphabets are for enhancing cognitive performance. The difficulty of the games is beginner, intermediate and advance levels. Undergraduate students try the training games in order to estimate the target time of the task accomplish for elderly persons.

**DUAL TASK TRAINING GAME**

**Dual Task Performance**

Dual task performance is defined as a person’s performance doing two tasks simultaneously. Woollacott and his college [4] point out that the person of low dual-task performance has troubles on the processing ability of the tasks. Silsupadol and his college [5] report that elderly persons’ body balance control is related to their cognitive performance and therefore, training program for dual task performance is more effective for elderly persons than that for single task.

Generally, training programs for physical and cognitive performances are taken as dual tasks. Cognitive ability is composed of perceptual function, attention function, storage function, and so on. In this study, we will focus on the attention function.

Trail Making Test (TMT) is well-known test program for the attention function. In TMT, persons are requested to find numbers or alphabets in turns. Therefore, they have to do dual task of number and character recognition and hand movement.

In this study, TMT is designed as a simple video game using Microsoft Kinect on the Windows PC.

**Kinect**

Kinect is a motion sensing input device by Microsoft for video game console and Windows PCs. Users can control and interact with game and PCs without the need to
touch a game controller, through a natural user interface using gestures and spoken commands. Microsoft released Kinect software development kit for Windows 7 in 2011. This SDK was meant to allow developers to write Kinect apps in C++/CLI, C#, or Visual Basic .NET.

Figure 1: Game screen

Figure 2: Selection of game level (in Japanese)

Figure 3: A character touching number card
Game Design

A character exists in the screen and a user can control the character’s hands through the Kinect (Fig.1). A user can select the games for beginner, intermediate and advanced levels (Fig.2). The game for beginner is just introduction for explaining the game story for the user. The games on intermediate and advance levels are training games for dual task performance. Number and alphabet cards also exist in the screen and then, the user has to touch the cards in turns (Fig.3). The cards touched by the character vanish.

This game is designed for a user to do TMT on the video screen. It is considered that the game is effective for training the physical and cognitive ability.

<table>
<thead>
<tr>
<th></th>
<th>User A</th>
<th>User B</th>
<th>User C</th>
<th>User D</th>
<th>User E</th>
<th>Average</th>
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</thead>
<tbody>
<tr>
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<td>8.0</td>
<td>7.0</td>
<td>7.0</td>
<td>16.0</td>
<td>16.0</td>
<td>8.8</td>
</tr>
<tr>
<td>Intermediate</td>
<td>57.0</td>
<td>65.0</td>
<td>54.0</td>
<td>61.0</td>
<td>61.0</td>
<td>54.6</td>
</tr>
<tr>
<td>Advance</td>
<td>54.0</td>
<td>55.0</td>
<td>62.0</td>
<td>80.0</td>
<td>80.0</td>
<td>65.6</td>
</tr>
</tbody>
</table>

USER TEST

The game is tested by five undergraduate students. The time to accomplish the game is estimated. The distances between a user and Kinect and screen are 2m and 4m, respectively. The accomplish time is summarized in Table 1. The times to accomplish the games of intermediate and advance levels are 54.6 seconds and 65.6 seconds, respectively. According to the reference [6], the accomplishment times for elderly persons are estimated as 158.8- seconds for intermediate level game and 202.4 seconds for advance level game, respectively.

CONCLUSIONS

For avoiding the elderly persons’ overturn in the daily life, their daily training program is very important. The main internal reasons of the overturn are the reduction of athletic and cognitive performances. In order to enhance both performances, the dual task training program is very effective.

In this study, the training game for enhancing dual task performance by using Microsoft Kinect was presented. Undergraduate students tried the training games. The average times for the dual task performance were 8.8 seconds for beginner level, 54.6 seconds for intermediate level, and 65.6 seconds for advanced level. Therefore, the target times of the task performance for elderly persons were estimated as 158.8 seconds for intermediate level, and 202.4 seconds for advanced level.
REFERENCES