

6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the
Affiliated Conferences, AHFE 2015

Developing a digital game for stroke patients' upper extremity rehabilitation – design, usability and effectiveness assessment

Mei-Hsiang Chen^{a,*}, Lan-Ling Huang^b, Chao-Hua Wang^c

^a*School of Occupational Therapy, Chung Shan Medical University and Occupational therapy Room, No.110, Sec.1, Jianguo N. Rd., Taichung City 40201, Taiwan*

^b*Department of Art and Design, Tan Kah Kee College, Xiamen University, 363105, Zhangzhou Development Zone, P.R. China.*

^c*Department of Multimedia Design, National Taichung University of Science and Technology, No.129, Sec.3, Sanmin Rd, North Dist., Taichung City 404, Taiwan*

Abstract

The purpose of this study was to develop a digital game system for rehabilitation and to assess their feasibility, usability and effectiveness. A questionnaire was designed to evaluate the usability and feasibility associated with using this game. The results of this study can be summarized as follows: 1) the upper extremity rehabilitation gardening game (UERG game) is special designed for domestic stroke patients. 2) This UERG game uses Kinect's skeletal tracking features and motion sensor to interaction with patients. 3) design features are as following: game contents include three difficult levels according to different upper limb motor function recovery stages; to record user's motor performance; to provide feedback information (for example: to record the completed the task time and to detect whether the user has compensatory action, etc.). 4) A total of 10 patients to assess this set of games. The results showed that 90% of patients reported that using UERG game in treatment increased their treatment motivation.; 70% of them reported that this games is very interactive; 80% patients considered this game is conducive to recovery their upper extremity functions; 80% patients considered the feedback information provided help them to understand their performance in each session after training; 60% patients indicated the game interfaces were easy to operate and learning; 90% of patients reported that this game is enjoyment and satisfied with this game for rehabilitation. Overall, the UERG game is feasibility to use in rehabilitation.

© 2015 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of AHFE Conference

Keywords: Upper extremity rehabilitation; Stroke; Digital gaming design; Usability assessment

* Corresponding author. Tel.: +886-935-306-173
E-mail address: cmh@csmu.edu.tw

1. Introduction

Many daily living tasks are performed with the upper limbs. Upper limb motor deficit is one of the main symptoms of stroke patients, and up to 85% of stroke patients experience hemiparesis immediately after stroke [1]. Therefore, rehabilitation treatment of the upper limbs is very important for stroke patients.

Upper extremity rehabilitation equipment (UERE) is usually used for training the proximal upper extremity movement functions [2]. They are essential tools in the occupational therapy (OT) practice. Most existing clinical UERP provides no feedback to the patients in Taiwan. Patients may find that repeating the same activity can be boring and monotonous and thus develop a negative attitude toward the therapy process. In order to increase the mental satisfaction and physical vitality of rehabilitation therapy, some therapists have using off-the-shelf video game systems in rehabilitation. Digital games have been proven effective in upper extremity rehabilitation for stroke patients in addition to arousing higher motivation and feelings of pleasure. However, only a few OT departments in Taiwan's hospitals have tried to adopt digital games in their OT programs. The main reasons may be summarized as following: a) the devices are expensive; b) the gaming interfaces are not in Chinese, hence easily causing operation errors and inconveniences; c) the gaming interfaces are complicated for patients to independently operate the games without help from the therapists; d) the games contents are design for normal person to leisure, not for Stroke patient. Their individual strengths and weaknesses may affect treatment effectiveness and safety for the patient. Therefore, digital games for stroke patient must be designed with users in mind. Such products that truly fit the users can increase user acceptance [3].

It is desirable to domestically develop digital upper extremity rehabilitation games for the local hospitals as well as individual users. The purpose of this study was to develop a digital game system for rehabilitation and to assess their feasibility, usability and effectiveness. It is hoped that the results of this study could be used to improve existing UERE to meet the practical needs of practitioners providing treatment and quality care.

2. Methods

This study included four parts: 1) to conduct literature review and expert interviews to identify types of daily living activities that meet treatment purposes and then determine the priority of each task for patients' resumption to independent living; 2) to design a digital game for upper extremity rehabilitation, based on the selected daily living activities and the results of our previous research on improvement of game design; 3) a questionnaire was designed to evaluate the usability and feasibility associated with using this game. 4) to assess the effectiveness of UERG game. These parts were showed as follows.

2.1. Expert interviews to identify the game contents for rehabilitation

This part includes two items to identify the game contents for rehabilitation: 1) to interview the clinical occupational therapists, and 2) to reference previous research results.

Three clinical occupational therapists were interviewed. They proposed two most important suggestions for the system design: 1) Reaching-to-Grasp is one of the most important daily living activities. Also, note that, when patients do Reaching-to-Grasp activity, the compensatory movements easy occurred. Therefore, therapists suggested that an attention function of the Compensatory Movements design is needed in the digital gaming design for rehabilitation. 2) Rehabilitation-based game contents (such as usage situation and tasks) should conform to the actual task in life. It would make patients more familiar with the task of daily life.

Our previous study was to survey the therapeutic effectiveness, usage problems and needs of the commercial digital videogames (Wii and XaviX) applied in rehabilitation, then summarize a guideline for improvement design of the digital UERP. Design guidelines can be synthesized as follows, where items a to d are about software design, and items e to i about hardware (Chen et al., 2014): (a) To increase the response time of the games. (b) To increase difficulty levels of the games in order to better suit the various patients with different abilities of upper extremity functions. (c) To expand the sensor's sensing scope. (d) To be able to record movement data, such as: reaction time, operating time. (e) To improve the ways to fix the controller on the user's hand. (f) To fit the controllers size for different hand dimensions of the patients. (g) To provide better correspondence between the game and real-life

Download English Version:

<https://daneshyari.com/en/article/1143760>

Download Persian Version:

<https://daneshyari.com/article/1143760>

[Daneshyari.com](https://daneshyari.com)