

Embodied User Interface for Increasing Physical Activities in Games

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Abstract

The rate of obese has been increasing and obesity has emerged as a significant threat not only to the health but also in society. Obesity has adverse effects such as physical appearance, psychosocial consequences and metabolic disturbances. One of reasons causing these phenomena is most games have static and stationary user interfaces as input devices. These kinds of interfaces hold users at their computers and cause not only decreases of the strength of their health, but also blocks communications between family members. In this paper, we propose physical activity based interactive exercise called Punch Punch, which is played with virtual objects displaying on a large screen. The informal study revealed that the Punch Punch enhanced physical and social activities while playing games. The goal of this study is finding embodied user interfaces to increase physical and social activities.

1. Introduction

Obesity is defined as a condition where a pathological excess of body fat is present in an individual [6]. Recent scientific literature reveals a tremendous change in the health status of children and adolescents caused by malnutrition and changes in general life style [7]. As many studies show, TV viewing, an inactivity and food intake promoter can be one of the risk factors for obesity in childhood [3] and obesity in childhood is associated with several health hazards and functional disabilities [5]. Obese children and adolescents frequently suffer from not only disease, but also personal quality of life in terms of unhappiness with their own body. Besides, many obese children will become obese adults with possible societal implications. Therefore, medical and social pressures to lose weight seem to be substantial, and many methods to lose weight have been introduced for recent years with the result of studies suggesting that quality of life is improved among reduced obese. It is argued that physical activity is very important in the treatment of obesity [2]. Companies and researchers are trying to give better physical activities while playing games, but most games for pursuing

interactive are lacking inducement of full mobility of human body [4]. In this paper, we proposed an embodied user interface to increase physical activities in a game called Punch Punch. It is played with human body in a real environment rather than with a mouse in a monitor.

2. Motivation

The motivation that leads to this study is to implement an embodied user interface that can enhance physical and social activities between users especially for obese children. Children spend most of their time with computers to learn and play game [1]. Game is one of good ways of learning something and refreshing mental workload. However, as they are spending their time playing game, they are gradually losing chances to do physical exercises and social activities. This means a new interface is needed that makes children to do physical and social activities.

3. Design and Implementation

An embodied user interface for enhancing physical and social activities is suggested based on three concepts such as using real space, gesture based interactions and collaborations as illustrated in figure 1 below.

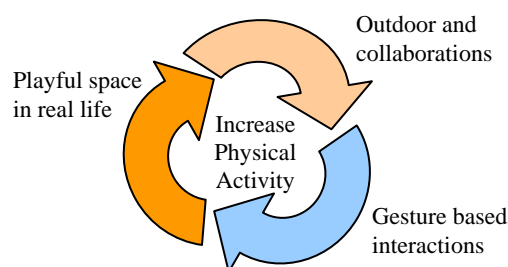


Figure 1: The concept of embodied interactive interface.

In the concepts, playful space in real life represents interaction space for a game playing in a real environment such as on a floor or on a wall. Outdoor and collaboration stands for a collaboration tasks acting together for participants goals in outdoor, not in inside of computers. Gesture based interactions is the concept of using human physical body when pointing or hitting virtual objects displaying on a real environment. This means game is

being played by participants' position, where they are located in a real playful space, providing input data with their movements, instead of using conventional devices such as a mouse or joystick.

The game that has an embodied user interface consists of three stages and each stage various types of virtual instant foods generated by a computer. In brief, game participants need to hit every virtual foods as they as can using their bodies, especially using their hands, to get enough score to go to next stage and to make physical activities. Such this way participants can meet a successful ending and consequently become their weight lose. If players fail to clear each stage, then a failure-ending scene will be appeared. In the game, we used fast-food images such as hamburgers, cokes and french-fries to let game users learn an association between fast food and obesity. We also used dynamic animations of the characters while playing game in order to prevent playing the game from monotonous.

The concept of body pointing is applied to an embodied interface because most current conventional interfaces make a user stationary and inactive in front of their computers, and those input interfaces have few degrees of freedoms in controlling motions. To implement embodied interface, we used a computer vision system which is non-touchable and invisible interface as an input interface. A beam project is used to display virtual objects such as food to a real environment.

4. Evaluation

An embodied user interface hitting virtual objects using human body showed in practice to some users, although the exercise game was quite simple. We invited dozens of subjects, most were university students, to take part in the game, and they gave us valuable feedbacks for further research. While the subjects were playing the game, we observed them and analyzed their behaviors. From the observation, first, we discovered that the participants' physical behaviors were changed after they did the game. In the first stage, they just used their two arms to hit the virtual objects without using their upper or lower body. However, when they did the last part of the game, they used entire body depending on the changing trajectories of the virtual objects while balancing their bodies. The second thing that we found is that most subjects talked or shouted while they were playing the game. For example, when they were missed the objects, they said aha, oh, god or wu. We guessed that they were enjoying the game and having fun. The last thing that we observed was sweat. After finishing the three stages of the game, some subjects got sweat on their forehead and some subjects began to gasp. From this finding, we realized that the game provided more physical activities than compared to games using conventional user interfaces. However, there were some problems with the user interfaces such as occlusions between a camera and

participants and the evaluation methods of social activity under the game.

5. Conclusion

In this paper, an embodied user interface for increasing physical and social activity is implemented and tested with a basic game called Punch Punch, which is a large screen based interactive exercise in order to provide more degree of freedom in mobility. Concerning overall interactivity of the embodied user interface, the interface provided a lot more physical activities than with electrical artifacts and more chances to make social activities such as talking, asking and laughing. The interface in Punch Punch enabled users to collaborate each other. According to informal study described in above section, the embodied user interface played an important role in providing more mobility than effects of current games and programs. The reason is Punch Punch was used specific virtual targets for actions such as punching, and interaction space is not restricted than other computer vision based activities relatively.

We hope that the embodied user interface especially in a game will enable users to lead healthier lives and be an appropriate solution especially for obese children who desperately need efficient and fun exercise while playing games. We will strive to increase social activities and conduct a systematic formal study in order to find and evaluate children's mental model under embodied user interfaces. In a technical sense, we are going to improve the accuracy of gesture based inputting interfaces to give better affordance and fidelity of use.

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