Motivating Elderly People to Exercise Using a Social Collaborative Exergame with Adaptive Difficulty

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BACKGROUND

The problem regarding the ageing of Europe is a growing concern considering the rapid increase in the over 65 age group. Many elderly people do not participate in sufficient exercise to prevent physical decline which may result in accidents such as falling.

A solution to this problem is being developed as part of Join-in, a project of the Ambient Assisted Living (AAL) Joint Programme is an online social collaborative exercise game which implements an adaptive difficulty system. The aim of this game is to motivate elderly people to exercise frequently as well as exercising with others to prevent social isolation.

Prior to the development phase a series of user testing sessions were scheduled to gather requirements for the game design (Figure 1).

THE GAME

A collaborative walking game was developed for the Join-in project. The game was developed using JavaScript so that it could be accessed from a HTML5 compatible browser. The Microsoft Kinect was selected as the input device which tracks each user’s joint data and sends them to the game server.

The primary objective of the game is to walk a set number of steps which is adjusted to suit each user. The challenge of the game is to step in rhythm to the in-game beat represented by white bars while avoiding obstacles such as potholes (Figure 2). Each player attempts to walk at the same pace as the other players in the game; although players of a higher skill level will be presented with additional obstacles.

ADAPTIVE DIFFICULTY

Adaptive difficulty is a method of altering the difficulty level of a game based on the skill level of the player. This game’s Dynamic Difficulty Adjustment (DDA) system attempts to assess a user’s skill level and assign appropriate goals and challenges.

The goal of implementing an adaptive system is that it links into one of the key conditions of Flow, matching challenges with a user’s perceived skills. If a user is kept in a state of Flow they should remain motivated to play the game longer.

During a game session the system alters the difficulty in real time to prevent the user getting bored if the challenge is too easy or frustrated if the challenge is too hard. The system can employ one of the several possible adjustments implemented in the Join-in game to try and improve the game’s balance. The adjustment could be simply reducing the precision required for the user to avoid an obstacle to be less strict or implementing a rubber band AI system to ensure that all players remain in close proximity.

SOCIAL COLLABORATIVE

The Join-in game is designed to be played primarily as a multiplayer game, where users work together cooperatively. The game is accessed through a social platform where users can create a group with friends of family.

The goal of creating a collaborative multiplayer game is to address the issue of social decline of elderly people. The addition of a multiplayer mode encourages users to make new friends and also facilitates intergenerational gameplay with their children and grandchildren. Social interaction with family and peers helps motivate elderly to exercise.

STUDY

The goal of the study is to investigate the effect that adaptive difficulty has on the game’s motivational impact. The game’s usability and the effect the game has on the user’s physical condition and social connectedness are also evaluated. The instruments used include:

- Motivation - Intrinsic Motivation Inventory (IMI)
- Usability - Software Usability Measurement Inventory (SUMI)
- Social Connectedness - Social Network Index (SNI)

Each participant is issued a set-top box across the partner countries with the game and a Microsoft Kinect (Figure 3). Some of the participants are issued a version of the software with the adaptive difficulty system and the others are presented with a game with three static difficulty options to compare which version is more effective.

CONCLUSIONS

Initial user testing sessions revealed that nearly a third of the group do not currently participate in any exercise. The members of the user group played a series of exergames such as Wii Fit, Wii Sports, Kinect Sports and Body and Brain Training. The group preferred playing games using the Microsoft Kinect and enjoyed playing together. The results of these initial testing sessions influenced the design of the software for the Join-in project. The Join-in game is currently being tested by the user group. The goals of this testing phase are to evaluate the motivational impact of the game as well as assessing the usability, the social and physical effects of the game. The results of the testing may help improve the adaptive difficulty system by increasing its ability to assess the user’s skill level, provide additional methods of adjustment and improve the chances of the system selecting the best method. If the adaptive system is more precise it may have a greater effect on the motivation to keep playing.

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