Affective Gaming

Measuring emotion through the gamepad

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ABSTRACT
In search of suitable methods for measuring the affective state of video-game players, this study investigates the hypothesis that the player's state of arousal will correspond with the pressure used to depress buttons on a gamepad. A video game was created that would detect the force of each button press during play. It was found that as the difficulty level of the game increased, players would hit the gamepad buttons significantly harder.

Keywords
Affect, emotion, video game, gamepad, biofeedback

INTRODUCTION
Although the study of affective computing has increased considerably during the last five years, few have applied their research to video game technology. This is surprising considering the importance of the emotional component of HCI in video games. Game players frequently turn to the console in their search for an emotional experience [4], something clearly identified by Sony when they christened the Playstation 2 CPU the 'Emotion Engine'.

At Glasgow Caledonian University we are investigating ways of assessing the affective state of video game players. There are numerous benefits such technology could bring to the video game experience, including:

- **The ability to generate game content dynamically with respect to the affective state of the player.**

  Knowledge of the player's affective state allows the game to deliver content at the most appropriate moment. For example, in 'horror' based games, the optimum effect of a loud noise will only occur if produced when the player is incredibly tense.

- **The ability to communicate the affective state of the game player to third parties.**

  With the advent of on-line gaming it is more frequently the case that the player's opponent is not physically present. However, it is often the emotional involvement of other players that shapes our enjoyment of a game. Affective Gaming technology can address this issue by having the on-screen persona reflect the player's emotional state.

- **The adoption of new game mechanics based on the affective state of the player.**

  An example of affective game mechanics can be found in Zen Warriors [5], a fighting game where, to perform their finishing move, the player has to switch from fast paced aggression, to a Zen-like state of inner calm.

Previous work into affective gaming has adopted traditional methods to assess the affective state of the player. Using galvanic skin response (GSR) measurements to determine state of arousal, Bersak et al. [1] developed 'Relax-to-Win', a therapeutic game where the player's level of relaxation controlled the speed of a racing dragon. During the game, the rate of change in player arousal is used to determine the speed of the dragon. An increase in player arousal results in a decrease in the dragon's pace. The player who relaxes more quickly has the faster dragon, and therefore wins the race.

Although GSR measurements are suitable for states of relaxation and stillness, they are inappropriate tools for measuring affect when playing traditional, fast-paced video games. GSR equipment works by testing the conductivity of the skin. The higher the player's state of arousal, the more they sweat and the greater the skin conduction. Unfortunately the electrical resistance of the skin will also change if the player tightens a muscle, or perspires heavily [3]. This is not a problem when the game is designed to induce states of relaxation, but totally inappropriate for fast paced arcade style games requiring quick fingered dexterity.

If research into affective gaming is to be conducted using the current generation of video-games it is essential that

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the technology be suitable to the gaming environment. From a marketing perspective, it is also preferable if the current video game technology is used to measure affect, rather than introducing new paraphernalia to the gaming experience. Specialist peripheral hardware is rarely adopted in large numbers, which in turn limits the financial investment to produce games that utilise such equipment.

Modern game consoles have analogue buttons which indicate the pressure used when playing a game. Work by Clynes [2] suggests that a person's emotion can be detected through finger pressure, making the analogue buttons on the gamepad a possible resource for collecting data. This is a record of our initial investigation to determine whether data from the gamepad correlates with a player's level of arousal during game play.

METHOD

Using a within subjects design, players were asked to play three levels of a video game. Each level differs in difficulty, and was presented in a random order. The pressure used by the player when controlling their on-screen persona was recorded and compared across each difficulty level.

Participants

Ten students, from different academic disciplines, were recruited for this study.

Materials

The game, a remake of the classic arcade game 'Space Invaders', was written on the Sony Playstation 2 which had been adapted to run the Linux operating system. The object of the game is to shoot alien spacecraft as they march down the screen toward the player's craft. It is possible for the player to avoid offensive attack by moving their spacecraft either left or right. The player can also return fire by pressing a button on the gamepad.

Three levels of difficulty were incorporated to alter the player's level of arousal: easy, medium and hard. For the easy level, the alien spacecraft would move very slowly towards the bottom of the screen, and the player could hide behind one of three shields. For the medium level the alien craft would march twice as fast, and the player would have the benefit of only two barriers. In the hard level the tempo of the alien craft was increased by a further factor of two, and the barriers were removed completely.

Game levels were presented to the player in a random order, and the game recorded the amount of pressure exerted by the player on each button press.

RESULTS

Graph 1 shows the mean pressure of button presses across the three levels of difficulty. It is clear that as the levels increase in difficulty, so does the pressure used to press buttons on the gamepad. Paired-sample t-tests showed that buttons on the gamepad were pressed significantly harder in the hard condition than in either the easy condition ($p=0.002$) or the medium condition ($p=0.014$). No significant difference was found between the easy and the medium conditions.

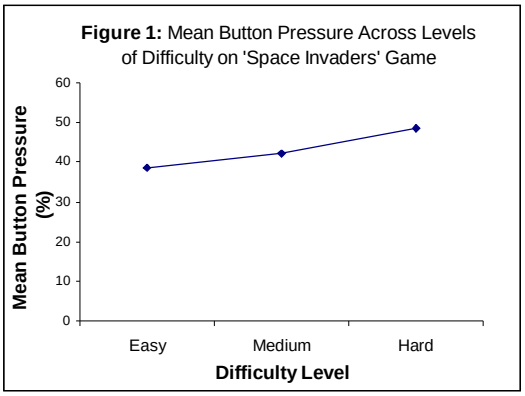

Figure 1: Mean Button Pressure Across Levels of Difficulty on 'Space Invaders' Game

DISCUSSION

The results of this study indicate that it is possible to determine the level of a game player's arousal by the pressure they use when controlling the gamepad. However, some players might enjoy stressful games, where others might find such levels of arousal unpleasant. Without a measure of valence it is difficult to determine whether the arousal state is positive or negative. Therefore, the next step is to determine whether it is possible to detect valence through the player's use of the gamepad.

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