Immersive Virtual Reality and Affective Computing for Gaming, Fear and Anxiety Management

Mehdi Karamnejad, School of Interactive Arts & Technology, Simon Fraser University
Amber Choo, School of Interactive Arts & Technology, Simon Fraser University
Diane Gromala, School of Interactive Arts & Technology, Simon Fraser University
Chris Shaw, School of Interactive Arts & Technology, Simon Fraser University
Jeremy Mamisao, School of Interactive Arts & Technology, Simon Fraser University

abstract

This paper describes a game we are developing that utilizes players' fear, measured by biofeedback, to affect the game's dynamics. Additionally, it uses 3D stereoscopic technology along with a head-mounted display to provide an immersive gaming experience. The game uses Galvanic Skin Response (GSR) technology to measure the emotional arousal of the player. This GSR data, an abstraction of real-time emotional feedback is then programmed to dynamically affect gameplay as the user's emotional states fluctuate among fear, anxiety and calmness during gameplay. Taking advantage of players' emotions while they are experiencing the game has the potential to reflect players' inner (interoceptive) senses into the flow of gameplay and render it as a more engaging and pleasurable experience. A player's progress is continuously monitored using biofeedback technology and they win the game if they manage to keep their state calm and relaxed.

Additionally, we have outlined user studies to determine if this game could be utilized to assist patients who have common phobias, such as a fear of heights. If successful, players who could benefit from our game would be exposed to the environment for four sessions, where they would be encouraged to progressively face their fears during gameplay, according to standard exposure therapy protocol [1].

related work

- Using biometric information to enhance gameplay [2]
- A first-person shooter game developed to use implicit and explicit biofeedback for driving gameplay [3]
- An approach to improve game interaction using direct and indirect biofeedback [4]

our approach

1 Expose a player to an increasingly frightening 3D stereoscopic VR environment.

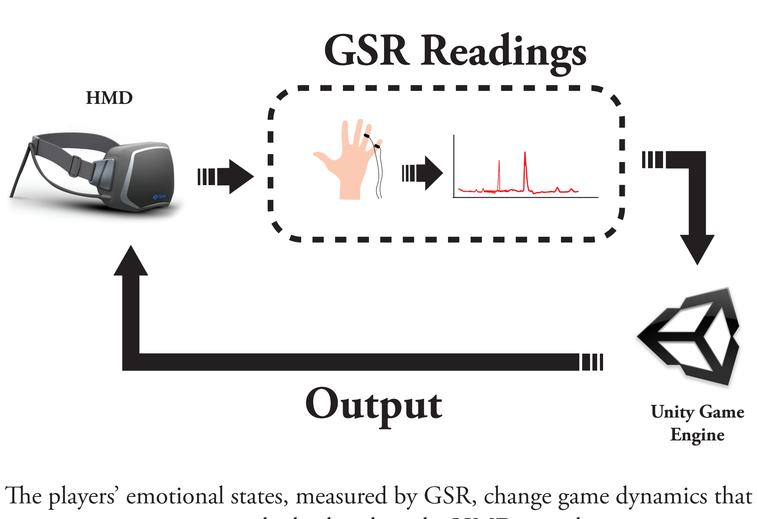
2 Observe a baseline of player's current emotional state using GSR technology.

3 Constantly monitor the player's changing emotional arousal during gameplay; special effects in the game such as ambient sounds and animations help to trigger fear in the player.

4 Check for the player's progress at certain checkpoints. If the player is unable to maintain an adequately calm state, s/he loses the game.

5 The player wins the game when all check points are passed.

6 By playing the game several times to achieve a 'win' state, patients begin to train themselves to lower their perceived fear and anxiety, which is a skill that can re-purposed in real life settings (exposure therapy).



The players' emotional states, measured by GSR, change game dynamics that are consequently displayed on the HMD in real-time.

Screenshot of the game — the player explores the world as frightening visual and auditory events unfold.

A head-mounted display from *Sensics* enhances a sense of immersion for the player.

GSR equipment from *Thought Technologies* measures the player's changing emotional arousal in real-time.

challenges

- Dealing with artifacts in GSR readings
- Recognizing fear as the proximate cause of emotional arousal
- Balancing gameplay so that it is customized to each player's initial GSR baseline, and adaptive to increasing gameplay difficulty
- Define collaborations with clinical practitioners

future work

We are planning to extend the game map, spatialized ambient sounds, and ambient 3D animations to boost the quality of the game. To increase the accuracy of the fear detection, we are also evaluating the use of EEG signals in combination with GSR technology.

references

[1] L. F. Hodges, B. O. Rothbaum, R. Kooper, D. Opdyke, T. Meyer, J. J. de Graaff, J. S. Williford, and M. M. North, Virtual environments for treating the fear of heights. Computer 28, 1995, pp.27–34
[2] A. Dekker and E. Champion, "Please biofeed the zombies: enhancing the gameplay and display of a horror game using biofeedback," Proceedings of DiGRA, 2007.
[3] K. Kuikkaniemi, T. Laitinen, M. Turpeinen, T. Saari, I. Kosunen, and N. Ravaja, "The influence of implicit and explicit biofeedback in first-person shooter games," in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, New York, NY, USA, 2010, pp. 859–868.
[4] L. E. Nacke, M. Kalyn, C. Lough, and R. L. Mandryk, "Biofeedback game design: using direct and indirect physiological control to enhance game interaction," in Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems, 2011, pp. 103–112.

SCHOOL OF INTERACTIVE ARTS + TECHNOLOGY

Graphisme, animation et nouveaux médias
Graphics, Animation and New Media