Lost in the Dark: Emotion Adaption

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ABSTRACT
Having environments that are able to adjust accordingly with the user has been sought in the last years particularly in the area of Human Computer Interfaces. Environments able to recognize the user emotions and react in consequence have been of interest on the area of Affective Computing. This work presents a project – an adaptable 3D video game, Lost in the Dark: Emotion Adaption, which uses user's emotions as input to alter and adjust the gaming environment. To achieve this, an interface that is capable of reading brain waves, facial expressions, and head motion was used, an Emotiv® EPOC headset. For our purposes we read emotions such as meditation, excitement, and engagement into the game, altering the lighting, music, gates, colors, and other elements that would appeal to the user emotional state. With this, we achieve closing the loop of using the emotions as inputs, adjusting a system accordingly as a result, and elicit emotions.

Author Keywords
Emotion recognition; affective states; EEG; 3D videogames

ACM Classification Keywords
H.5.2 [Information interfaces and presentation]: User Interfaces --- interaction styles, input devices and strategies.

General terms
Design, Human Factors

INTRODUCTION
In games, immersion has always been a long sought goal of the designing process. Feeling more connected with the game through interactivity, wealth of sensory information, or an environment that demands your full attention always makes it more enjoyable. An adaptive environment helps to enhance immersion. With our game's unique emotion controls, we hope to enhance it more to create a fun and helpful experience for players. Our game uses the Emotiv® EPOC headset to read brain waves that indicate user's current levels of excitement, engagement, and meditation. Using these as game variables, we have the game either adapt or adjust to match the player's current emotional state, or provide obstacles that require the player to take control of his emotions and use them to progress. Like recent developments in game design in which user movements are used to make him feel more part of the game, using a user's emotions can open up entirely new levels of gameplay and research, and increase games' ability to adapt to an input as complicated as human emotions.

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BACKGROUND
This section provides information about the technology behind the game including hardware and software.

Emotiv® EPOC Headset
Our research uses the Emotiv ® EPOC headset [2]. This device has non-invasive electrodes that are used to capture brain-wave signals. It measures voltage fluctuations resulting from ionic current flows within the neurons of the brain, which occur differentially in the presence of diverse emotions. This device uses pattern detection analysis to infer emotional states and reports affective states such as: excitement, engagement, meditation, calmness, boredom, and frustration.

Emotiv SDK
The Emotiv® EPOC headset comes with a Software Develop Kit (SDK). This SDK in conjunction and based on the ABE system [3] allows developers to get data from the device in real time, by introducing its functionality into game-developing environments.

XNA + Visual Studio
XNA Game Studio 4.0 [5] is a game-developing environment that allows the use of Visual Studio 2010 [4], an integrated development environment (IDE) from Microsoft used to develop console and graphical user interface (GUI) applications. It supports XNA's Framework 4.0, a set of libraries for game development.

THE GAME
The game offers a 3D maze enhanced with emotional components as inputs that are mapped with features in the game, allowing an adaptive maze in terms of light, sound, play time, and access to different sections and levels.

The 3D Maze
The maze takes place on the inside of a gigantic cylinder, gravity forces players downward from the center so that they can walk along the inside of it. The maze walls are generated to also stretch across the walls, providing the

player with a view of other parts of the maze that they can look up at to discern where to go next. The walls are colored (red, yellow, and green) indicating how far or near is the exit. The player starts at one end of the cylinder, must unlock and cross through diverse gates, and make his way to the other side where an elevator takes him into the next level. There are keyboards' controls (WASD keys) for movement, an Xbox 360 controller to control movements and the camera, and a mouse for looking around. The players are also provided with a mini-map for navigation.

The Components based on Emotion Inputs

We use three emotions from the ones the Emotiv® EPOC headset picks up: excitement, engagement, and meditation.

Excitement determines the color of the Light Bot, a floating sphere that projects all of the light within the maze (see Figure 1). Light Bot has colors that run along the sides, matching up to a certain level of excitement. Ranging from black to red to yellow to green to teal to blue to purple to white (from calmest to most excited), a bar to the left demonstrates the spectrum and user's current level, so that he knows how to reacts if he needs the Light Bot to change its color. There are also gates within the maze that range in the same color spectrum, and they will open and allow the player to continue if he can match the Light Bot's color to that of the gate. This forces players to take control of their excitement by calming or invigorating themselves.

Engagement controls music. When the player is relaxed and unconcerned, the music changes volume to a softer tone to reflect the player's relaxed state, but when the player becomes more interested or agitated, the music increases in volume to match the new manic state. This helps set the mood for the game according to the player's emotional status.

For meditation, we added in the ever-increasing danger of the player's sole light source giving out. As time passes in the game, the Light Bot will lose light, forcing the player to hurry to the exit before it goes out. However, by focusing on the meditation, players are able to expand their field of vision and keep the darkness at bay, and keeping this level of focus while playing makes the game easier (see Figure 1). This forces players to learn to play with a cool, concentrated head under stressful situations. As the meditation level increases, the current level of light increases, and as it decreases, so does the light.

Implementation

The game's mazes are generated by reading comma-separated-values (csv) text files that use characters to represent wall pieces, gates, or elevators. After reading the file, the game automatically generates the maze. Mazes could be created or edited with ease by altering the text file.

Graphics were made using the Maya 3D Animation Software [1]. We created the shapes for the wall pieces, gates, the cylinder, elevators, and the Light Bot.

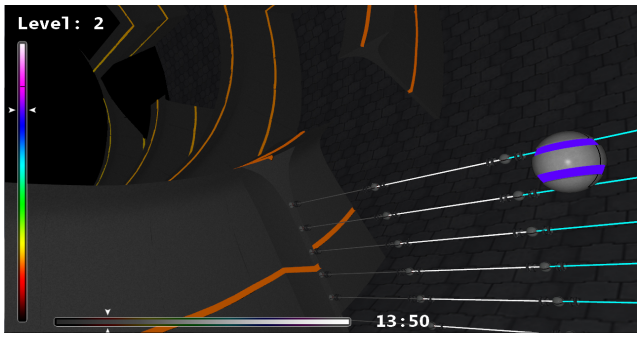

Figure 1. A screen shown from gameplay, as the light level is closing in due to a lack of meditation upon the part of the player, as the player is attempting to change his excitement level to match the colors of the gate and ball.

This environment was used to create textures that would fit over all of the game objects: the floor tiles, wall graphics, and the lights that make up the gates and Light Bot.

Music for the game was not specifically made, but is simply the song "Self Esteem Fund" from the popular game *Portal*, mainly to create the feeling of lonely suspense.

CONCLUSION AND FUTURE WORK

Adjusting an environment according to emotions is complex, and it's difficult to find mechanics for each emotion that feels natural to be connected to. However, we consider our game to have done a great job in creating a complete experience for players to use their emotions as a tool to play the game, and we consider it provides a world of opportunities in the future where emotions patterns can be used for much more integrated controls, and changing of an environment. Not only is it entertaining, but it could be transferred to education and learning areas, allowing people to practice controlling their emotions, and discerning what elements on an environment trigger what emotions.

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