INCORPORATING AFFECTIVE STATE OF PLAYERS IN VIDEO GAMES

ABSTRACT

In this project, I used the non-intentional gesture inputs of the player to measure the affective state of the player in order to dynamically adopt the game environments' specifications based on the player's affective state. To measure the affective state of the player, I used the two dimensional continues activation/evaluation space. In particular, to measure the affective state of the player, I analyze the inputs from the player and the manner of his playing. I analyzed the involuntary movements and key hold times. This information allows understanding affective states as important indications for player experience [2, 3]. For dynamic adoption of game levels, I have created a special game engine. This game engine considered the measured involuntary feedback and adopted the scene. I used DX10 to implement the graphics engine and used property scripting for the definition of game levels and adoption rules. As major benefit of my approach, the game level better fits user's gameplay skills, and, thus increases the fun level. Another benefit of my approach is that it is unobtrusive and no additional sensors such as neuro-biological measurement devices are required. A third benefit is that using off-the-shelf input devices and involuntary feedback to analyze affective states is performed at no additional cost, because no additional hardware and measurement setup are required.

As a proof-of-concept implementation and based on my own engine I have prototyped a 3D Game that was similar to the famous "Sabotage" game. In this game, the player must shoot at some falling bombs before they fall on his base. Players are requested to shoot the nearest bomb with minimum handshake, as soon as he can. My game considers these parameters to determine the ground's gravity of game environment. The scientific contribution of my thesis was design, implementation and evaluation of a game. Compared to [4, 5, 6], it needs no additional input device for playing and could target almost every computer or gaming device.

Index Terms— affective computing, affective gaming, input devices, emotion sensing

1. INTRODUCTION

Video Games are very popular, these days. They are used not only for entertainment but also for learning, medical rehabilitation, and etc. Affective computing [9] is described as "Computing that relates to, arises from, or deliberately influences emotions," and affective gaming is to use the player's emotional state to adapt the game environment and context. Although affective gaming results in a magical game experience [6], the current commercial games fail to consider affective states of the players into games. As a result, games often act inappropriately for some players: inappropriate game contents, feedbacks, viewport and timings. So, a specific genre of commercial games may be interesting for some players and distracting for others. By using the affective state of the player we could remove inappropriate game contents and feedbacks, add interesting one, and modify viewport and timing appropriately for each individual player based on his specific affective states. General approach to measure the affective state of the player is to use sensors and visual processing that track body movement devices, voice intonation analysis, facial expression analysis, specialized input devices, physiological sensors attached to the skin, and thermal imaging of the face [2, 8]. They required additional experimental setup such as capturing and processing [7] or vital data sensing [2] in order to measure affective states. These equipments are expensive and require additional setup effort prior to gaming [8]. In addition, most of them need to be carried on player's body, which introduces some problems with the ergonomics and user acceptance [2, 6, and 9]. The problem is to design a low cost system for real time measurement of affective states that do not require additional hardware setup.

In our approach, we will use non-intentional gesture input to measure affective state of player. Our game uses regular mouse or dual shock gamepad as input device. Our contribution is twofold: a) the design, implementation, and test of a system for capturing non-intentional gesture input, and b) an algorithm to measure affective states based on the analysis of non-intentional gestural user input. To measure affective state of player, we are going to analyze inputs from the player to calculate player's handshake and manner of playing. We will use variance analysis of raw sensor data to obtain player's affective state. Player's affective state will be used to change the difficulty of the game by changing the environment specifications, music playing rhythm, and vibration of gamepad. For example, if the player's affective states increases, these items will be modified in a manner which could provide a safe environment, more relaxed music and the gamepad will have fewer vibrations to provide a better gameplay for the player.

The rest of paper is organized as follows: In the next section we describe an example game scenario to better familiarize readers with the application domain and to describe their requirements. In section 3, we discuss the related works. Section 4 describes the approach and the system proposed in this paper. Finally, in section 5 we conclude the paper and present plans for future work.

2. EXAMPLE GAME SCENARIO

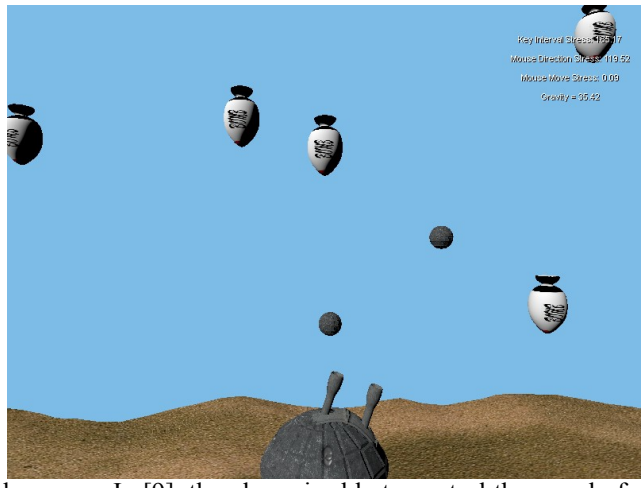
Our game is designed similar to famous Sabotage game [3] which was designed and implemented on Apple II platform on 1981 but our game has a different interaction method.
The famous Sabotage game was playable with keyboard, paddle control or a single axis of a joystick [3]. Our game is playable with a mouse or a dual shock gamepad. The game environment is a desert environment which our base is positioned in it and a canon which is positioned in the middle our base which is responsible to defend our base. The enemy's airplanes start to fall bombs on our base. We must control the canon to stop the bombs from falling on our base. The player is able to adjust the canon's shoot angle and driving force of the bullet. By shooting the bombs, the player gains score and if the bomb falls on the base, the base health will decrease. If the health of the base decreases to 0, the base will be destructed and the player will lose. The difficulty of the game increases with time by falling more bombs on the ground. No victory point has been defined for this game but the top scores will be recorded in the game's initial menu. In order to not only use the inputs from the player, we will use the affective state of player which is achieved by analyzing the inputs of the player.
The player is able to move the head of the canon by moving the mouse or analog stick of gamepad and he can specify the power of the shoots by holding down a mouse button or gamepad button. The power of the shoots and the angle of shooting which are determined by player fingers pressure is a good factor to detect the player's emotion [5]. As well, we could detect the handshake of the player by analyzing the player's inputs to rotate the head of the canon. Every change in these factors are considered as changing in the affective state of the player, so by measuring the current affective state of the player, we are able to modify the game features based on the changes of game factors.

3. RELATED WORKS

Although affective gaming is a young research area [6], many researches have been done in this field. We will review the related works in 2 distinct parts. First, we will discuss the affective games' related projects and in second part, we are going to discuss different methods to measure the affective state of the player.

3.1 Designing and Implementation of affective Games

A preliminary example of affective games was given in S.M.A.R.T Braingames [6]. It uses real Playstation2's video games integerated with NASA technology. The system which were using in this project, determines whether the user is in desired brain state, during the game. If he is in desired brain state, he has a full control on the game controller, otherwise the speed and steering control



decreases. In [9], the player is able to control the speed of a racing dragon via his affective state. [14] is an alternation of Quake game, a commercial first-person shooter game, which involve the player's affective state into the game. In this game, when the player is startled, the player's avatar startled, too and jumps back. As well, the size of the player's avatar will be related to the player's arousal. [2] presents a first person shooter game, which adapts four player's avatar attributes based on the biofeedbacks of the player.

3.2 Measuring Affective State of Player

To measure the affective state of the players, there are two methods: a) using special types of equipments b) analyzing the input devices.
There are many special types of equipment to measure the affective state of the players. [11] describes different methods to measure the affective state of the player using audio, visual or spontaneous expressions of the user. As well some approaches use features such as facial expression, gesture, vocal intonation, and language to detect affective state of player [13]. [7] Described that the affective state of the player can be detected using thermal cameras. [2, 6] mentioned that biosensing systems including electroencephalogram (EEG), electromyography (EMG), electrocardiogram (ECG), electrodermal activity measurement (EDA) and measurement of respiration change (RESP) could be used to capture the affective state of the player. [12] introduces a device which could detect Blood Volume Pulse (BVP), Temprature (T), and Galvanic Skin Response (GSR).
Additionally, some aspects detect affective state of the player by analyzing the inputs from the user which is using non-intensive devices like keyboard, mouse or gamepad. [10] measures the emotion of the player by analyzing the pressure which is used by the player during playing. [8] identifies the emotional state of the user by analyzing the rhythm of his typing pattern on a standard keyboard.

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