Improving Interaction with Non-Player Characters Through Physiological Data

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INTRODUCTION

As the sophistication of video games increases, flaws in certain aspects of games, such as communicating with non-player characters (NPCs), become more apparent. NPCs have limited information about the players, but they should ideally react to the players' emotional state. We propose an experiment to test the feasibility of using physiological data as an estimate of emotional states to improve this aspect of interaction between players and NPCs. Leveraging advances in biofeedback applications, the proposed setup uses galvanic skin response and electromyography for emotion estimation in an action role-playing game built in Unity. Players navigate through a post-apocalyptic setting as their physiological data is recorded during significant, in-game, events. We present the within-subjects experimental design in which this data will be utilized to influence the dialogue behaviors of NPCs in the game and the resulting effect on rapport with the characters will be tested.

While previous research in AI advances towards more convincing agents in terms of behavior (Gratch et al. 2007) or use natural language interaction as a means of creating more believable exchanges as seen in Façade (Mateas and Stern 2004), this project attempts to grant non-player characters more useful information about the player. Natural language interaction can result in more meaningful conversations with NPCs, however, that approach omits a key aspect of human interaction, emotion recognition (Kim et al. 2004). When engaged in conversation, we are able to identify one's emotional state based on information such as speech patterns and gestures. Non-player characters do not conventionally have access to this information and cannot take the user's emotional state into account. Humans use multiple methods to estimate the mood and current emotional state of an interaction partner. This study proposes to use a channel that is not available to humans: physiological data collected through an Arduino device. Using a mapping to arousal and valence axes, we can estimate emotional states during gameplay and make this information available to NPCs as the player engages in conversation with them. This paper describes the work-in-progress regarding the impact on the design of character behavior as well as the plans for an experimental evaluation of the impact of the design.

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EXPERIMENTAL SETUP

We developed a game prototype created in Unity connected to an Arduino device using the eHealth toolkit. Players will take control of the resident of a post-apocalyptic environment as they navigate through a short narrative-focused experience involving the ritual sacrifice of infants, food thievery, and decisions about survival and retribution. After a narrative setup, and initial calm phases that are used to establish baselines for physiological measures, the first interaction choices of players regarding peaceful or aggressive resolution of a conflict are used as input for NPC behavior. For instance, if the player chooses to kill a thief, an NPC will react negatively unless the player was not happy about their choice as indicated by physiological data. This system of detecting the user's emotion during key events will continue throughout the game to provide a unique experience for each player. In order to estimate emotions, the player will be connected to both Electromyography (EMG) and Galvanic Skin Response (GSR) sensors. The data collected from these sensors can be placed on arousal-valence axes, with GSR as an estimate for arousal and EMG for valence. The arousal-valence axes, also known as the Russell Plane, aims to capture human emotions on a two-dimensional graph (Bustamante et al. 2015). NPCs will be given 4 separate dialogue options along with representative gestures based on the determined location on the graph. In order to analyze the effectiveness of this system, a between subjects design and a questionnaire evaluation of rapport will be employed. One part of the game will utilize their physiological data and influence NPCs as described above. The control part will still track their data, but it will not be used in the game, rather the dialogue will be based solely on previous choices. The questionnaire instrument draws from previous work on measuring rapport with virtual agents (Gratch et al. 2007).

FURTHER STEPS

This study is intended to demonstrate both the feasibility of using a rapport measure as a proxy of effective NPC interaction as well as the effectiveness of physiological data for estimating emotional states during dialogue. Further work is needed to establish in what way granting NPCs access to physiological data can change and improve the design of NPC interaction.

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