Social and emotional presence of characters in virtual reality video games

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Abstract

The future of video games lies in Virtual Reality, and this new medium demands greater detail not only in the environments but also in the interactive characters that inhabit them. Our project consists of developing a software framework that aims to incorporate emotions to existing non-player characters to increase its social and emotional presence, improving the immersion achieved in video games. To do so, it provides a range of behaviors that the characters will adopt based mainly on an computational model of emotions. This emotional model modulates the character's behaviour according to the events that are continuously received by the character during execution. In turn, the emotional state at any given moment depends on the emotional tendency or personality that has been defined for the character. The framework, called VR NPC, is implemented as a extension of Behavior Designer and Unity. A preliminary experiment has been conducted on a demonstration scenario which seems to make it clear that players are able to perceive and appreciate such emotions in non-player characters.

Keywords

Video Game Development, Affective Computing, Immersion, Development Tool, Unity, Non-Player Character, Gestures

1. Introduction

Virtual Reality (VR) has become a field of study that encompasses many facets, whether it is the possibilities of communication between different people, leisure or virtual work. The ambitious Metaverse project promoted by Meta (formerly known as Facebook) is an example of the current boom. There are also companies with great weight in the field of video games such as Sony or Microsoft that are also investing in this technology.

The problem to be solved by this work is how to improve the different behaviors, mainly of Non-Player Characters (NPC) in VR, so that the player perceives them in a socially and emotionally appropriate way. Emotionless or lifeless characters produce feelings that are the opposite of what one seeks in a truly immersive environment.

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2. Related Work

There are not many works that study the figure of the non-player character (NPC) in videogames, with notable exceptions [1].

OZ Project [2, 3] was one of the first projects that sought to represent believable characters in VR, since they saw that a lot of researchers tend to give more importance to the physical aspect of the environment. The goal of this project was to create simulations of characters with a series of characteristics that could help artists create truly interactive and dramatic worlds. They use the OCC model of emotions, basically modeling one specific emotion and a cause that provoked it. One of their early examples was Lyotard, a simulation of an apartment in which we control its residents and can interact with a cat that responds to our actions.

Lit sens [4] is a system focused on sound immersion with the goal of improving the feeling of presence of VR players through ambient music. It mixes different pieces of melodies to form an abstract song according to the performance and the situation in the game, accompanying emotions that are tagged to the game event that is occurring.

Finally, we are building on earlier work [5] that aims to create a NPC guide for an escape room in VR with a strong social presence, giving the necessary indications to the player for solving the game. In the absence of an emotional model, we wanted to extend this work and create VR NPC, a more complete toolkit for building believable characters for VR games.

3. VR NPC Framework

To develop this project we used Scrum, the agile methodology, with sprints of 2 weeks, working over an academic year with 3 major milestones to assess progress.

The tools used in this project are Unity, Behavior Designer [6] (an extension for using behavior trees), and other plugins such as VRGestureRecognizer [7], MiVRy [8], Dotween [9], plus the example scenario VR Escape Room [10].

Behavioral systems usually have these elements in common, which are the ones that we have considered: Scenery or environment, Media (VR, in our case) and NPCs (see Figure 1).

For the VR NPC framework, an architecture with three important parts is used:

- **Emotional Selector**: It connects to the Emotional Controller and chooses the appropriate behavior according to the data received. A new type of Behavior designer sequence nodes have been implemented in order to select the branch of the tree to be executed.
- **Emotional Controller**: It manages the data of each emotion and makes the necessary changes when an Event occurs. It is implemented as a Singleton object, and six MonoBehavior classes model the emotions.
- **Events**: A series of scripts that are executed when certain conditions are met. They have been implemented by means of Behavior Designer conditional nodes and actions, plus some Unity scripts.

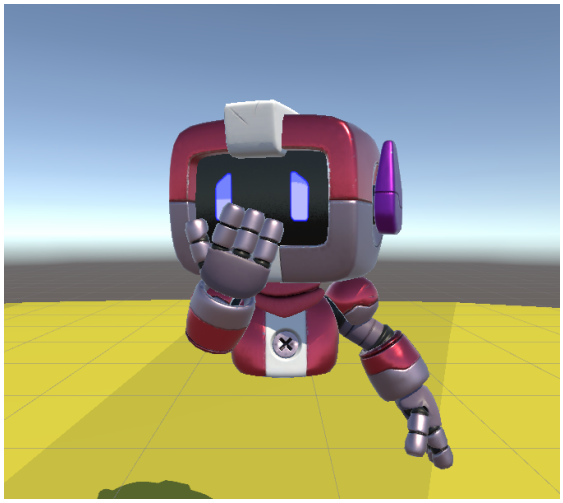

Figure 1: Our robotic NPC manifesting the emotion of sadness at a medium level of intensity.

4. Results and Discussion

To test the framework, it has been used to develop an example scenario in which players must solve an Escape Room with the only help of a robotic NPC whose personality (or emotional tendency) can be chosen at the start. The hypothesis is that the manifestation of emotions, according to the chosen model, will give greater credibility to the character and allow the player to establish stronger bonds with him/her, involving him more in the game (via the so-called social presence) and even achieving a better performance on his part.

An A/B test was carried out with 7 users, dividing the participants into 2 groups, conducting a slightly different experiment with each one.

- **Group A**: This control group had the emotional enhancements applied to the character DEACTIVATED, so it only shows emotions in specific situations, predefined in the game script. In the rest of the cases the character shows a neutral expression, both in his face and in his bodily expressiveness.
- **Group B**: This group had the character emotional enhancements ACTIVATED so when the character react to different events that occur in the environment, such as the player dropping an important object on the ground, it always shows relevant emotions.

The responses of both groups to the post-experiment questionnaire are summarised in Table 1.

5. Conclusions

From what we have been able to see in the results obtained from the test, and ignoring the fact that we do not yet have a large set of testers with which to generalise the results, we can appreciate a significant improvement in the emotional model compared to the unemotional one.

Given this situation, it can be said that the desired objective of increasing the emocional and social presence obtained in the performance of the test in the NPC is getting closer.

Question	A	B
Players enjoying the game.	2/3	4/4
Players escaping the room.	1/3	4/4
Players assisted by the NPC.	2/3	4/4
NPC's personalities chosen.	-	Joyful, Angry, 2x Sad
Players identifying NPC's emotions.	2/3	3/4
Emotions identified (of 7).	Fear, Joy, Surprise	Fear, Joy, Surprise, Anger, Sadness

Table 1
Summary of A/B test responses.

In general, it can be said that this framework has been successfully integrated with the previous work, since it has not caused problems in the actions performed by the NPC in the demo scenario and the whole system has worked normally.

We are able to offer the community a computational model of emotions for VR characters that players will be able to identify and enjoy.

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