

Virtual reality: a tool capable of generating emotions

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Abstract:

The creation of virtual environments that allow interacting with simulated phenomena arises as one of the most powerful tools in the field of clinical psychology. Virtual Reality is able to elicit a feeling of presence and emotional states that can be useful for therapy in various psychological disorders. The aim of this paper is to check the ability of artificial environments to elicit emotions in a healthy population within the scientific paradigm of startle reflex modulation.

We assessed the subjective and physiological responses of 54 students (27 women and 27 men) while they visualized 9 virtual environments (3 pleasant, 3 neutral and 3 unpleasant). The physiological test was composed by a 5-minute adaptation period followed by 18 startle trials. The virtual stimuli were displayed during 20 seconds in a 180 degrees immersive screen.

The results demonstrate the ability of virtual environments to modulate emotional responses within the defensive reflexes modulation paradigm.

Keywords: virtual reality, startle reflex, emotion.

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INTRODUCTION

Virtual reality has proved effective for the treatment of different disorders (Quero et al., 2012), facilitating the patient's exposure to stimuli and situations that are difficult to reproduce in real contexts (Botella et al., 2004). However, little research has been done to gauge how effectively virtual environments can generate emotional states in a healthy population (Jang, Ku, Shin, Choi and Kim, 2000). The synthetic appearance that characterizes these environments, the difficulty of isolating them from their surrounding environments and their level of realism all cast doubt on their abilities to generate emotions. Determining the efficacy of artificial environments is critical since the feeling of immersion depends on the participant experiencing the sensations and emotions produced by the virtual environment in the realest way possible (Marks, 1987).

One of the most solid paradigms for the study of emotions is that of startle reflex modulation, which is measured through the contraction of the orbicularis oculi muscle (Lang, Bradley and Cuthbert, 1990; Vrana, Spence and Lang, 1988). The logic is simple: blinking intensity before an unexpected and highly intense stimulus can be modulated after an unpleasant or pleasant emotion is induced. During pleasant emotional states, the blink magnitude is diminished in comparison with the blink magnitude in unpleasant situations, thus indicating the participant's emotional state.

Objectives The objective of this study was to gauge the capacity of artificial environments to generate emotions in a healthy population through the study of startle reflex modulation. Thus we expect that the visualization of an aversive artificial environment increases the startle reflex magnitude while the viewing of a positive artificial environmental decreases the blink magnitude.

METHOD

A total of 54 students between the ages of 18 and 38 participated in the study ($M=21.85$; $SD=4.12$). The distribution by gender was 27 women (age $M=21.19$, $SD=3.87$) and 27 men (age $M=22.19$, $SD=4.4$). Their reward for participating consisted in extra credit at the Department of Personality and Psychological Evaluation and Treatment. The experimental protocol was approved by the Ethics Committee for Human Research at the Universidad de Granada.

Nine virtual environments were created. Three were unpleasant (showing traffic accidents, dead bodies and threatening situations); three were pleasant (showing social situations, parties and gift giving); and three were neutral (showing objects or buildings). To ensure similar stimuli for all participants, 20-second clips were shown in order to keep participants from interacting with the virtual objects. The participants viewed the environments on a 180-degree immersive screen. (Vision Station, Elumens®). The physiological test consisted of a 5-minute adaptation period followed by 18 startle tests. The startle-eliciting stimulus was binaural white noise with an intensity of 105dB, lasting 50ms and instantaneous rise time. The reaction of the subjects was measured with an integrated electromyogram (EMG) that tracked the orbicularis oculi muscle of the eye.

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RESULTS

Variance analysis revealed significant effects ($F[2,106]=9.426$; $p<.001$) based on the emotional category of the virtual environment (pleasant, unpleasant or neutral). The post-hoc analysis showed that the EMG range of the orbicularis oculi muscle was significantly lower while visualizing pleasant environments than when viewing neutral ones; it was also higher for unpleasant environments (all $p<.05$ with Bonferroni correction; see Figure 1)

DISCUSSION AND CONCLUSIONS

Just as we had expected, the range of the startle response was reduced when participants found themselves in pleasant virtual environments (parties, social gatherings) and higher for unpleasant situations (accidents or threats). Thus artificial environments could be an excellent tool for inducing emotional states not only in a clinical population but in a healthy one as well. In our study, in spite of the virtual element and the limited possibility for interacting with the objects, the virtual environments were capable of activating physiological responses similar to those usually observed when other visual stimuli are employed.

Our results show that virtual reality is an effective tool for inducing emotional states in experimental contexts, allowing the intensity of the emotional impact to be adjusted through realism or the level of interaction.

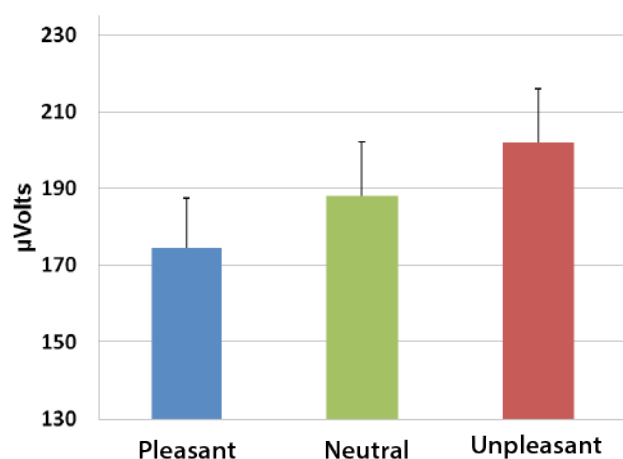


Figure 1. EMG startle range based on the emotional category of the virtual environment viewed (* $p<.05$; ** $p<.01$).

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