Searching for an Adequate Stressor to Practice Stress Management Skill Prior to Deployment: The Potential of Immersion in Stressful 3-D Games

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Abstract. This study tested the efficacy of two commercial 3-D video games to elicit a significant level of stress and compared three immersive stereoscopic technologies–a 22-inch monitor, a 73-inch monitor and a CAVE™. Fifty-six soldiers returning from Afghanistan were recruited and randomly assigned to one of five conditions in which they played either the 3-D games "Killing Floor" or "Left 4 Dead" while immersed using the different technologies. As a control and reference comparison of induced stress, participants were exposed to a standardized stressful procedure. Subjective data were collected using the State Anxiety scale for all participants but extremely slow scores cast doubt on the validity of the results on this variable. Repeated measures ANOVAs revealed statistically significant increase in heart rate and respiration rate while playing the 3-D games and during the TSST. No significant group or interactions effects were found. Increases in physiological arousal were significant when comparing the baseline to the immersion and to the TSST, but not when comparing both stressors. Immersion in 3-D games is proposed as a practical and cost-effective option to practice SMT.

Keywords. Stress Management Training, PTSD, 3-D Game, Heart Rate.

Introduction

Among the military population, data shows that exposure to combat or peacekeeping missions are associated with the risk of developing posttraumatic stress disorder (PTSD). To help soldiers to cope with stress, and hopefully reduce the risks of developing PTSD, soldiers could benefit from stress management training. Although preliminary data from the few available programs are somewhat encouraging, they are confronted with significant adherence problems. Practicing stress management skills is a challenge for people involved in a culture where virility and an "Army Strong" mentality prevail. In addition, it requires the trainers to stress the soldiers so they can practice their coping skills. Using Virtual Reality (VR) and 3-D games to induce a manageable level of stress could be an interesting option to practice stress management skill with this population. However, instead of trying to create a virtual environment

without knowing if it will be significantly stressful, researcher can use off-the-shelf 3-D games. Several 3-D games companies are investing millions of dollars each year to analyze, design, and build games that are highly stressful, such as “Left 4 Dead” and “Killing Floor.”

1. Method

This study set out to verify the capacity of two commercial 3D video games (“Left 4 Dead” and “Killing Floor,” see Figures 1 and 2) to elicit a significant level of stress in soldiers, and also to compare three immersive technologies - a 22-inch stereoscopic monitor, a 73-inch stereoscopic monitor and a CAVE™ (a room with four 9 feet by 9 feet walls with retroprojected stereoscopic images). The games were selected after considering 38 criteria, such as elements of surprise, forewarning, human corpses and casualties, blood, cries and spooky sounds, etc. “Left 4 Dead” was more attractive as a stressful stimulus because of superior graphics quality compared to “Killing Floor,” but only “Killing Floor” could be modified to be used in the CAVE. It was therefore decided to use both games, as it would allow comparing two levels of graphics quality.

Figure 1. Screenshot from "Leaf 4 Dead"

Figure 2. Screenshot from "Killing Floor"

An initial sample of 56 solder participated in the study. Subjective data were collected on all participants using the State anxiety scale of the State Trait Anxiety Inventory but extremely slow scores (e.g., baseline mean score of 29.7, sd = 7.1) cast very serious doubt on the validity of the results on this variable. Therefore, only psychophysiological parameters will be reported. Due to technical problems, only 36 participants could be used for the analysis of heart rate data and 42 for the breathing data.

Participants were randomly assigned to one of five conditions in which they played either the 3-D game “Killing Floor” or “Left 4 Dead” using the small monitor (22-inch), the large monitor (73-inch) or the room-size CAVE (only used with Killing Floor). To have a control and reference comparison of induced stress, participants were exposed to the well-validated Trier Social Stress Test (TSST; Kirschbaum, Pirke & Hellhammer, 1993) after the collection of baseline physiological data and before the experimental manipulation with 3D games. Participants’ heart rate and respiration rate were measured continuously using the Bioharness from Biopack.

2. Results

Repeated measures ANOVAs (3 Times X 5 Conditions) revealed significant increases in heart rate (HR) and res- piration rate (RESP) while playing the 3D games (HR: $F = 5.21$, $p < .05$; RESP: $F = 33.51$, $p < .05$) as well as during the TSST (HR: $F = 15.94$, $p < .05$; RESP: $F = 15.76$, $p < .05$). However, no significant interactions between conditions were found (see Figure below). Repeated-measures contrasts confirmed that increases in heart rate and respiration rate were significant when comparing the baseline to the 3-D games and to the TSST, but not when comparing the TSST to the 3-D games. The discussion will address implications of these findings for the development of reliable stressors allowing practicing stress management skills with solders.

3. Conclusion

There is a growing interest in the military about resilience and the development of emotion regulation skills. However, it is doubtful that limiting the training of military personnel to teaching SMT in a classroom would be sufficient to result in significant mastery of the techniques. Practice is essential; yet it may be insufficient unless there is objective information about the level of arousal and the immediate impact of the technique. The immersion in a stressful game, coupled with biofeedback, has the advantages of inducing enough stress to practice SMT and enough feedback to allow soldiers to master the technique and increase their perceived self-efficacy. Therefore, the most significant advantage of the immersion probably rests on the fact that playing videogames has a strong “buy-in” value: it is more likely to be accepted by soldiers than simply practicing techniques that may be considered “too feminine for a real man” [5].