

The potential of stress induced with 3D videogames for teaching stress management skills to soldiers

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Abstract

Among the military population, data shows that exposure to combat or peacekeeping missions is associated with the risk of developing post-traumatic stress disorder (PTSD). To help soldiers cope with stress, and hopefully reduce the risks of developing PTSD, military personnel could greatly benefit from stress management training. Using virtual reality (VR) and 3D games to induce a manageable level of stress could prove to be an interesting option to practice stress management skills while providing an alternative to regular tools that are often viewed as “weak” when used by military personnel. This study set out to verify the capacity of commercial 3D video games 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 retro-projected stereoscopic images). To have a control and reference comparison of induced stress, participants were exposed to the well validated Trier Social Stress Test (TSST). An initial sample of 47 soldiers participated in the study. Results revealed significant increases in heart rate (HR) and respiration rate (Resp) while playing the 3D games as well as during the TSST. Implications of these results on further research is discussed.

Introduction

Stress management is viewed as a promising way to prevent mental health disorders in soldiers returning from war zones. Although preliminary data from the few available stress management programs are encouraging (e.g., Adler, Bliese, Hoge, McGurk & Castro, In preparation; Routhier, 2007), they also report significant adherence problems.

Adherence difficulties may be due to virility or an “Army strong” mentality that prevail in this population. VR may offer an alternative that fits with a popular activity among soldiers (i.e., playing video games) while allowing them to practice stress management techniques.

Objectives

- Evaluate the capacity of 3D videogames to induce stress in a population of soldiers (in order to later apply SMT).
- Compare two different games to assess the anxiety-inducing potential of each based on the quality of their graphics and differences in gameplay.
- Compare three immersive technologies in order to evaluate the degree of immersiveness necessary to achieve the goal.
- This study is part of a broader project that aims at using virtual reality to help military personnel practice stress management techniques in order to better prepare them for the stress associated to theater of operation and, hopefully, reduce the incidence of PTSD.

Method

Participants

The initial sample consisted of a total of 47 soldiers, all male, that were recruited at a military base in Québec, Canada. Subjects were divided into 5 conditions:

	22" stereoscopic screen	73" stereoscopic screen	CAVE
Left 4 Dead	Group 1 n = 8	Group 2 n = 11	Non-applicable
Killing Floor	Group 3 n = 10	Group 4 n = 5	Group 5 n = 9

Measures

Heart rate (HR)

HR is the most used objective measurement of stress. When an individual is confronted with a stressor, heart rate and the interval between beats increase. Heart rate is measured with an electrocardiogram (ECG), which measures electrical activity in the heart. This aspect has the advantage of being easy to measure. However, it is directly influenced by physical activity.

Respiratory rate (RESP)

Respiration is also measured with the Bioharness Strap. This measure is recorded because it influences heart rate and therefore can be used as a modulator to assess whether fluctuations are caused by physical movement or rather a symptom of stress.

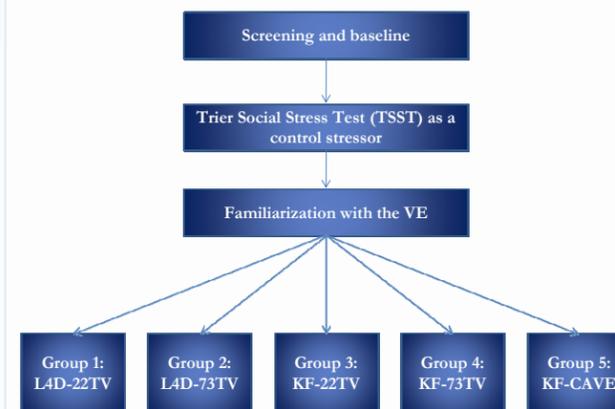
Procedure

Trier Social Stress Test

This procedure was used as a comparable measure of individual stress reactions. The TSST allows to induce stress in a controlled manner. Task consisted of: 1) simulation of a job interview in front of a panel of 3 persons with neutral reactions; 2) counting exercise where subjects had to count backwards from 2083 in increments of 13 as fast as possible.

Virtual Reality (VR)

Subjects were assigned randomly to one of the 5 conditions all containing a 30-minute VR immersion. The first 10 minutes were reserved for the familiarization phase (i.e. learning the game's control). During the following 20 minutes, subjects played the game, either Killing Floor or Left 4 Dead. This allowed a comparison of two videogames and the different types of immersion.



Results

Physiological measures revealed significant increases when comparing the TSST to baseline as well as when comparing stress during the immersion to the baseline (see Table 1).

Table 1. Heart rate (HR; N = 36) and respiration rate (Resp; N = 42) - means and standard deviations for each condition.

	Baseline Mean (SD)	TSST Mean (SD)	Immersion Mean (SD)
L4D – 22 inch HR (n = 4) Resp (n = 7)	85.31 (13.26) 2.32 (5.92)	108.96 (25.68) 15.37 (3.46)	98.56 (27.58) 20.12 (3.62)
L4D – 73 inch HR (n = 10) Resp (n = 10)	88.28 (8.41) 8.45 (16.55)	93.35 (13.96) 12.93 (3.49)	94.97 (23.10) 17.29 (7.16)
KF – 22 inch HR (n = 7) Resp (n = 8)	85.09 (15.55) 5.58 (7.76)	94.69 (22.57) 15.69 (2.72)	93.60 (31.58) 16.96 (3.70)
KF – 73 inch HR (n = 8) Resp (n = 9)	83.44 (10.17) 10.43 (13.22)	89.07 (14.25) 14.50 (3.51)	87.78 (18.73) 18.67 (4.46)
KF – CAVE HR (n = 7) Resp (n = 8)	80.09 (16.40) 5.68 (7.20)	97.06 (9.80) 12.76 (4.46)	103.18 (21.32) 18.14 (2.86)

Repeated measures ANOVA was significant for the main effect of Time and contrasts revealed that increases were significant when comparing the TSST to baseline as well as when comparing the virtual immersion to the baseline.

No significant differences between the five conditions were found, either on the Condition main effect or on the Interaction effect (see Table 2).

Table 2. Heart rate and respiratory rate - ANOVAs for comparisons between all five conditions, monitor sizes and games.

	Time F	Condition F	Interaction F	Time contrasts	
				Baseline vs TSST	Baseline vs Immersion
Comparison between all conditions					
HR (n = 36)	4.53*	0.73	0.48	15.95***	5.21*
Resp (n = 42)	25.88***	0.40	0.73	15.7***	34.15***
Comparison between monitor sizes					
HR (n = 29)	2.24	0.78	0.44	7.87**	2.19
Resp (n = 34)	18.53***	0.24	1.56	12.55***	23.67***
Comparison between games (CAVE excluded)					
HR (n = 29)	1.92	1.52	0.05	6.27*	2.02
Resp (n = 34)	16.84***	0.38	0.26	10.46**	22.17***

Note. *p < .05; **p < .01; ***p < 0.001

Discussion

Results suggests that 3D videogames are stress-inducing, both physiological measures confirming the hypothesis. The VR immersion were not found to be more stressful than the TSST that was used as a standardized stressor.

Results showing that the TSST was found to be equally stress-inducing than the videogames might be explained, in part, by the fact that in the TSST soldiers had to perform a task potentially frustrating and “away from their comfort zone” whereas the gameplay was quite similar to what they are regularly trained to do (i.e., house cleaning). Therefore, in further study, it might prove interesting to train soldiers in stress management while performing stressful tasks that stand out more from their regular duties, such as helping a critically wounded person for example.

Although participants in the CAVE reported the highest heart rate and the second highest respiration, results showed no significant differences when comparing the immersive technologies. This proved quite surprising considering the stronger immersive properties of the CAVE.

No significant differences were found between the games used in this study. This finding is encouraging as it allows flexibility in the choice of stressor used.

Difficulties with the physiological data led to the exclusion of an important number of participants for the measure of heart rate. No data were lost for breathing, yielding a larger sample size and clearer results.

Self-report measures, such as the STAI-Y1, were administered to participants. However, the data cannot be trusted. For example, average scores at baseline were comparable to those obtained after deep-muscle relaxation. The scores following the stress-inducing procedures revealed a significant increase after the TSST but only reached normative levels of non-stressed civilians. The discrepancy with physiological measures lead us to discard the information provided by the self-reports.

*The opinions expressed in the presentation reflect the opinion of the authors and do not necessarily represent the opinion of the Canadian Forces or the Department of National Defence