

Application of Virtual Reality in Assessment and Enhancement of Cognitive Abilities of Military Personnel

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Abstract: Virtual Reality has been adopted by military for training soldiers for combat situations or other dangerous settings where they have to learn how to react in appropriate manner. Simulated environments such as battlefield scenarios are created which are similar to those faced by the military personnel in real warfare. The subjects are immersed in these situations which have visual and auditory experiences to see their real actions and to demonstrate what their subconscious tactical decisions might be when confronted in a similar manner. As rewinding and repeating are not possible in real environments, through simulations we can re-enact a particular scenario which is safe and less costly.

To help the soldiers when in real war the cognitive abilities which will be assessed and enhanced are: attention, working memory, stress and focus through the various shooting tasks under various situations performed in VR environment. The neurocognitive tests performed will be: Virtual environment tests and psychological tests. The virtual environment tests are the tasks performed in VR Environment. The psychological tests are D2 attention for focus, BVMT for working memory, TOVA for attention and ECG for stress. They will be judged in cognitive abilities on results of tasks performed. Recorded result will be analyzed through SPSS software. It will give the correlation between various tests based on parameter i.e. Response Time. Thus through the repeated immersion of subject in VR Environment we can enhance the cognitive abilities of military personnel in war situations without actual damage to life.

1. VIRTUAL REALITY

Virtual reality is a computer-simulated environment that makes physical presence in places that are prototype of real world. The environment makes us feel as if we are in a real world. For these environments to be immersive, highly visual and 3D equipments used are head mounted displays, data gloves, VR glasses etc.

1.1 VR in military

- Flight simulation

- Battlefield simulation
- Medic training
- Vehicle simulation
- Virtual boot camp

Using VR we can create an environment through which training can be provided without damage to life. Soldiers are trained in a controlled environment where they perform various tasks similar to those faced by them in the battlefield. Repeated training by performing the tasks can also be done in VR environment in a shorter time. Training through these tasks will help them to perform better when they face the real war.

2. PURPOSE OF THIS REVIEW

This review will focus on various psychological tests and VR environment tests that could be performed to assess and enhance the cognitive abilities of military personnel. The VR environment test will include various shooting task under different conditions and psychological tests include ECG, BVMT, TOVA, and D2 attention. Finally SPSS software will be used to find correlation between various tests based on response time.

3. RECENT FINDINGS

Currently VR is being used for training military personnel for combat situations. Creating simulators for various military operations.

4. VIRTUAL REALITY AND COGNITION

VR is now being used to create environments focused on cognitive processes like: attention, working memory, stress, and focus. Through VR we can create environments which are dynamic, immersive, and three dimensional in which all cognitive abilities are assessed and enhanced. Virtual reality can be defined as a computer controlled multisensory multi

sensor based communication technologies that allow better interactions with data and involve human senses in new ways. This technology enables the people to deal with information more easily. VR provides a different way to see and experience information, one that is dynamic and immediate. The virtual world is interactive; it responds to the user's action. Thus the virtual environments can help a lot in dealing with the actual situations faced by soldiers when in real war.

5. DEVELOPMENT OF VIRTUAL ENVIRONMENT

The VR environment can be developed using various game engines like unity, cry engine, unreal etc. Game engine is a software framework designed for the development of video games. The functionality provided by game engine includes 2D or 3D graphics, collision detection, sound, scripting, animation, artificial intelligence, networking etc. Game engines can be written in any programming languages like C, C++, and java though each language is structurally different and may provide different levels of access to specific functions.

6. VR ENVIRONMENT TESTS

This will include some tasks similar to those faced by soldiers when in a battlefield. Some of the tasks are shooting enemies, keeping track of changing position of enemy and your peers, your prevention, keeping yourself focused and stress free.

7. PSYCHOLOGICAL TESTS

7.1 Paper and pencil tests

Questionnaires which include statements which have to be answered in yes or no. They are easy to take.

7.1.1 D2 Attention test

This test is done to measure the focus of subject. It asks participants to cross out any letter 'd' with two marks above it or below it in any order. The surrounding distractors are usually similar to the target stimulus, for example a 'p' with two marks or a 'd' with one or three marks. Thus it measures processing speed, rule compliance, and quality of performance, allowing an estimation of individual attention and concentration performance.

7.1.2 Brief visuospatial memory test (BVMT)

This test is done to measure working memory of subject. Six geometric figures are printed in a 2 x 3 array on separate pages.

Test structure

The subject performs three trials in which he views the stimulus page for 10 seconds and is asked to draw as many of

the figures as possible in their correct location on a page in the response booklet. A delayed recall trial is administered after a 25-minute delay. Last, a recognition trial, in which the respondent is asked to identify which of 12 figures were included among the original geometric figures, is administered.

8. COMPUTERIZED TEST

8.1 Test of variables of attention (T.O.V.A.)

The test is used to measure a number of variables involving the test takers response to either a visual or auditory stimulus. For individuals between the ages of 4-5, the T.O.V.A test is 10.9 minutes long, while for older individuals the test lasts 21.6 minutes. During the first section of the test, the objective is to measure attention during a boring task. For adults, this section is 10.8 minutes long and the non-target is presented 3.5 times for every 1 time a target is presented. The second section of the test is a measure of attention where target is presented frequently. This section is also 10.8 minutes long and the target is presented 3.5 times for every 1 time a non-target is presented. The T.O.V.A. measures a set of different variables to determine whether or not response times and attention is at the normal range for the sex and age of the test take.

9. CONCLUSION

The Virtual reality technology is widely used in clinical research, battlefield training and many other fields. The objective is to measure the cognitive functions through virtual reality and to validate with psychological tests, as well as provide it as a training and assessment module. If we compare the VR environment with computerized test battery and paper pencil test then we will get the better results. Virtual Environment should be highly immersive because it will increase the possibility of better feel of environment and score. This could be the limitation of experiment. The age factor, environment parameters becomes limitation to get better results. Environment gives better results as comparison to psychological test at a certain level.

10. FUTURE SCOPE

After the experiment though there is an improvement in cognitive functions of subjects but only few results are significant. As the frontal lobe of our brain is mainly responsible for the attention related tasks and occipital lobe is also i.e. related to vision do not shows significant improvement for all the channels. We can also consider other parameters while considering the SPSS software to find the correlations. Other psychological tests could also be used to give better results. We can also try to make the VR environment more immersive.

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