BusWorld: Designing a Virtual Environment for Post-Traumatic Stress Disorder in Israel—A Protocol

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ABSTRACT
A number of carefully controlled studies have documented the effectiveness of traditional imaginal exposure for the treatment of post-traumatic stress disorder (PTSD). Virtual reality (VR) exposure therapy is based on a similar logic but rather than self-generating imagery, patients wear a VR helmet and go into a three-dimensional (3-D) computer generated virtual world to help them gain access to their memory of the traumatic event. Recent preliminary research has shown that some patients who fail to respond to traditional therapy benefit from virtual reality exposure therapy, presumably because VR helps the patient become emotionally engaged while recollecting/recounting/re-interpreting/emotionally processing what happened during the traumatic event. The present paper presents a brief overview of a new VR World we developed to provide virtual reality therapy for terrorist bus bombing victims in Israel, and a brief description of our research protocol and measures (for details, see www.vrpain.com).

INTRODUCTION

SINCE THE BEGINNING of the Palestinian “Intifada” (or the uprising in September 2000), about 1,000 Israelis and 2,500 Palestinians have been killed. Approximately 7,000 Israeli civilians have been treated for physical trauma resulting from deadly terrorist suicide bombing attacks directed at Israelis. It is estimated that a substantially larger number of people have developed post-traumatic stress disorder (PTSD).1-4

The present project explores whether immersive virtual reality could help Israeli survivors of terrorist suicide bombings who have developed PTSD. Virtual reality (VR) exposure therapy for PTSD was introduced by Rothbaum et al.5,6 They proposed that the illusion of going inside the computer generated world would help emotional processing of memories associated with the traumatic event. And they showed in two pilot studies that exposure therapy can reduce symptoms of chronic PTSD in Vietnam Veterans. The U.S. Office of Naval Research has recently funded three teams of researchers to explore the use of VR exposure therapy for treating PTSD in active duty U.S. servicemen returning from Iraq and Afghanistan with combat-related PTSD (<www.onr.navy.mil/media/article.asp?ID=86>).

In a recent study, Difede and colleagues have successfully treated nine WTC PTSD patients with

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virtual reality exposure. These patients were New York City Fire Fighters, civilians and disaster workers, all directly exposed to the WTC attacks on September 11th, 2001. Five of the nine patients had failed to respond to traditional imaginal therapy prior to trying VR but all showed improvements after VR exposure therapy in a VR simulation of September 11th. As a group, the amount of PTSD reduction post-test after VR exposure dropped significantly compared to a group of eight matched control PTSD patients waiting to begin therapy. In light of these encouraging preliminary results, additional research exploring the potential utility of VR therapy is justified. Below we describe the new VR therapy software we have developed, and our methodology for quantifying the effectiveness of VR therapy for treating PTSD in civilian survivors of Israeli terrorist bus bombing attacks.

PROTOCOL

VR world: Bus World

During VR exposure therapy, patients wear a head-mounted display (HMD), part of an immersive VR system designed to give them the illusion of standing on a virtual sidewalk in Israel, near a café, across the street from a bus stop. Several increasingly realistic versions of the virtual simulation of the terrorist bus bombing attack allow graded exposure. The therapist controls what the patients see in VR by pressing buttons on the keyboard. For the initial scenario, level 1, the patient looks around the Israeli city block in VR. When the patients look across the virtual street, they just see a bus stop, no bus appears (Fig. 1A). When the patients habituate and can look at this with mild to moderate anxiety, they can advance to the next level. For the next button, a bus drives around the corner and pulls up to the bus stop but there is no explosion (Fig. 1B). When the patients have habituated to the point where they can look at this with mild to moderate anxiety, with their permission, they can advance to the next level. Additional levels add explosion sound effects, visual special effects of an explosion (Fig. 1C) and the bus on fire (Fig. 1D), sounds of people screaming and crying in Hebrew, police sirens and flashing lights pulling up. Each sequence is repeated a number of times until habituation occurs before proceeding to the next scenario. Gradually, the patients habituate to each scenario and are then able to approach more advanced VR simulations. Initially each new level elicits high but tolerable anxiety (scenarios that would have been too much for the patients if they had not already habituated to the lower levels of exposure). The therapist helps train the patients how to cope with their anxiety and helps the patients adopt a more healthy interpretation of what

FIG. 1. Images (A–D) from <www.imprintit.com>, used with permission.
happened (e.g., a lot of patients have “survivor guilt” which is irrational in the current situation where they were just lucky to survive). The therapists who will be treating these patients are previously trained in the application of the traditional PE program (<www.med.upenn.edu/ctsa/>) and also in the use of VR exposure. VR exposure therapy is a powerful tool, so it is especially important that therapists be well trained and experienced in treating PTSD before using it.

BusWorld was designed by our team with help from Ari Hollander (<www.imprintit.com>). Ari also programmed the world. We incorporated sound effects generously provided by DaneTracks (<www.danetracks.com>), and sound effects custom created for BusWorld by sound engineer Cmd. Russ Shilling (www.shilling.us). BusWorld uses texture maps from digitized photos of an actual Israeli bus stop, and photographs from real terrorist bus bomb scenes gathered from photographs taken from numerous previous attack crime scenes in Israel.

Clinical treatment

The program includes 10 sessions that last 90–120 min each conducted weekly. The components of the treatment program are the following: education about the common reactions to trauma (sessions 1 and 2), breathing retraining (sessions 1 and 2), in vivo exposure to situations related to the traumatic event (sessions 2–10), and VR exposure to the traumatic event (sessions 3–10). To practice VR exposure between sessions (at home) the patients will view a DVD recording of the VR exposure session conducted with the therapist during their most recent session. They will also have in vivo exposure homework. To test the efficacy of our treatment program we use an assessment protocol that includes PTSD symptom measures, as well as general psychopathology measures, administered at pre-treatment, post-treatment and follow-ups.

The instruments included in our assessment protocol are the following (all questionnaires are standardized with Hebrew translations): (1) Clinician Administered PTSD Scale (CAPS),7 a diagnostic interview to determine if the patient meets DSM-IV criteria for PTSD; (2) Post Traumatic Diagnostic Scale (PDS),8 a standardized self-report questionnaire to measure PTSD symptoms; (3) Beck Depression Inventory (BDI),7 a standardized questionnaire measuring symptoms of depression; (4) Brief Symptom Inventory (BSI),10 a standardized questionnaire measuring general psychopathology symptoms; (5) Presence Questionnaire (PQ),11 a standardized questionnaire to investigate perceptions and feelings of presence in the VR world; and (6) Activity Card Sort (ACS), a standardized measure of human occupation.12

CONCLUSION

We have just completed an analog usability study of 30 non-symptomatic subjects who were exposed to the various levels of BusWorld. As a preliminary test of the efficacy of our program, we are about to treat five clinical PTSD patients who have developed PTSD as a result of their exposure to suicide bus bombing.

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REFERENCES


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