

# *Virtual Iraq*: Initial Results from a VR Exposure Therapy Application for Combat-Related PTSD

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**Abstract.** Post Traumatic Stress Disorder (PTSD) is reported to be caused by traumatic events that are outside the range of usual human experience including (but not limited to) military combat, violent personal assault, being kidnapped or taken hostage and terrorist attacks. Initial data suggests that at least 1 out of 6 Iraq War veterans are exhibiting symptoms of depression, anxiety and PTSD. Virtual Reality (VR) delivered exposure therapy for PTSD has been used with reports of positive outcomes. The aim of the current paper is to present the rationale and brief description of a *Virtual Iraq* PTSD VR therapy application and present initial findings from its use with PTSD patients. Thus far, *Virtual Iraq* consists of a series of customizable virtual scenarios designed to represent relevant Middle Eastern VR contexts for exposure therapy, including a city and desert road convoy environment. User-centered design feedback needed to iteratively evolve the system was gathered from returning Iraq War veterans in the USA and from a system deployed in Iraq and tested by an Army Combat Stress Control Team. Clinical trials are currently underway at Ft. Lewis, Camp Pendleton, Emory University, Weill Cornell Medical College, Walter Reed Army Medical Center, San Diego Naval Medical Center and 12 other sites.

**Keywords.** PTSD, Virtual Reality, Exposure Therapy

## Introduction

War is perhaps one of the most challenging situations that a human being can experience. The physical, emotional, cognitive and psychological demands of a combat environment place enormous stress on even the best-prepared military personnel. Such

stressful experiences that commonly occur in warfighting environments have a considerable likelihood for producing significant numbers of returning soldiers at risk for developing PTSD. The initial data coming from both survey studies and anecdotal observations indicate that a large number of returning military personnel from the Iraq/Afghanistan conflicts are reporting symptoms that are congruent with the diagnosis of PTSD. In the first systematic study of mental health problems due to the Iraq/Afghanistan conflicts revealed that "...The percentage of study subjects whose responses met the screening criteria for major depression, generalized anxiety, or PTSD was significantly higher after duty in Iraq (15.6 to 17.1 percent) than after duty in Afghanistan (11.2 percent) or before deployment to Iraq (9.3 percent)" [1]. These estimates were made before the violence escalated even further in the last 2 years and other reports since the original Hoge et al., (2004) publication, have indicated equivalent or higher numbers of returning military personnel reporting positive for PTSD and symptoms of other forms of mental disorders [2].

Among the many approaches that have been used to treat PTSD, graduated exposure therapy appears to have the best-documented therapeutic efficacy [3-6]. Such treatment typically involves the graded and repeated *imaginal* reliving of the traumatic event within the therapeutic setting. This approach is believed to provide a low-threat context where the patient can begin to therapeutically process the emotions that are relevant to the traumatic event as well as de-condition the learning cycle of the disorder via a habituation/extinction process. While the efficacy of imaginal exposure has been established in multiple studies with diverse trauma populations [3-7], many patients are unwilling or unable to effectively visualize the traumatic event. In fact, avoidance of reminders of the trauma is inherent in PTSD and is one of the cardinal symptoms of the disorder. To address this problem, researchers have recently turned to the use of Virtual Reality (VR) to deliver exposure therapy by immersing clients in simulations of trauma-relevant environments that allow for precise control of stimulus conditions. This idea has been supported by three studies in which patients with PTSD were unresponsive to previous *imaginal* exposure treatments, but went on to respond successfully to VR exposure therapy [5,8,9]. The enthusiasm that is common among proponents of VR for this treatment is based on the view that VR has the capacity to deliver specific, consistent and controllable stimulus environments that don't rely on the hidden world of the patient's imagination.

In 1997, researchers at Georgia Tech released the first version of the Virtual Vietnam VR scenario for use as a graduated exposure therapy treatment for Post Traumatic Stress Disorder (PTSD) with Vietnam veterans. The first use of Virtual Vietnam with a veteran with PTSD was reported in a case study of a 50-year-old, Caucasian male veteran meeting DSM-IV criteria for PTSD [10]. Results indicated post-treatment improvement on all measures of PTSD and maintenance of these gains at a 6-month follow-up. This case study was followed by an open clinical trial of VR for Vietnam veterans [5]. In this study, 16 male PTSD patients were exposed to two HMD-delivered virtual environments, a virtual clearing surrounded by jungle scenery and a virtual Huey helicopter, in which the therapist controlled various visual and auditory effects (e.g. rockets, explosions, day/night, yelling). After an average of 13 exposure therapy sessions over 5-7 weeks, there was a significant reduction in PTSD and related symptoms. Similar positive results have also recently been reported for VR applied to PTSD resulting from the attack on the World Trade Center [8] in a case study using VR to provide re-exposure to the trauma with a patient who had failed to improve with traditional exposure therapy. Positive treatment outcomes from a wait-

list controlled VR study with patients who were not successful in previous imaginal therapy have now been reported by this group [9]. Such early results suggest that VR may be a valuable technology to apply for the treatment of PTSD and that it may be a promising component of a comprehensive treatment approach for persons with combat-related PTSD.

### 1. Brief *Virtual Iraq* System Description

With this history in mind, the USC Institute for Creative Technologies (ICT) has created an immersive virtual reality system for exposure therapy with combat-related PTSD. The treatment environment is based on a creative approach to recycling virtual assets that were initially built for the commercially successful X-Box game and tactical training simulation scenario, *Full Spectrum Warrior*. As well, other existing and newly created assets available to ICT have been integrated into this rapidly evolving application. The *Virtual Iraq* application consists of a series of virtual scenarios designed to represent relevant contexts for VR exposure therapy, including middle-eastern themed city and desert road environments (See Figures 1-6). In addition to the visual stimuli presented in the VR HMD, directional 3D audio, vibrotactile and olfactory stimuli of relevance can be delivered. The presentation of additive, combat-relevant stimuli in the VR scenarios can be controlled by a clinician via a separate “wizard of oz” interface (Figure 7), while the clinician is in full audio contact with the patient. The clinical interface is a key feature in that it provides a clinician with the capacity to customize the therapy experience to the individual needs of the patient. The clinician can place the patient in VR scenario locations that resemble the setting in which the traumatic events initially occurred and can gradually introduce and control real time “trigger” stimuli (visual, auditory, olfactory and tactile) as is required to foster the anxiety modulation needed for therapeutic habituation.



**Figures 1-3.** Virtual Iraq City and Desert Road Scenes



**Figures 4-6.** Turret View in Desert Road Scenario and IED Attacks

User-centered design feedback needed to iteratively evolve the system was gathered from returning Iraq War veterans in the USA and from a system deployed in Iraq and

tested by an Army Combat Stress Control Team (Figure 8). Clinical trials are currently underway at Ft. Lewis, Camp Pendleton, Emory University, Weill Cornell Medical College, Walter Reed Army Medical Center, San Diego Naval Medical Center and 12 other sites. The standard clinical protocol being tested involves 10 treatment sessions conducted on a twice weekly basis. A full description of the application and treatment protocol can be found in [7].

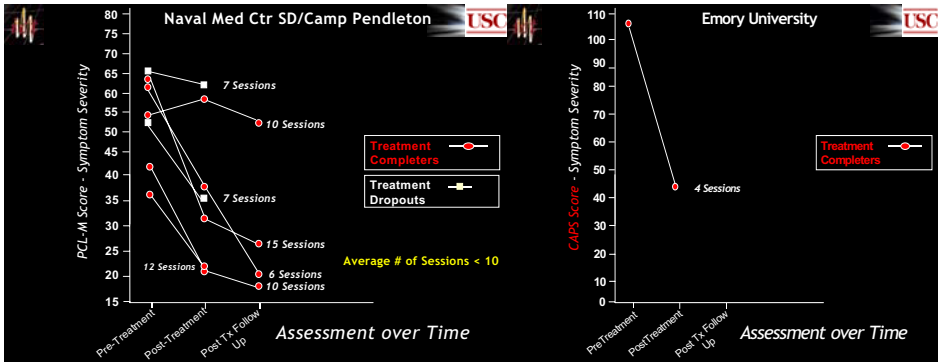


**Figures 7-8.** “Wizard of Oz” Clinical Interface and User feedback from Iraq

## 2. Results

User-Centered tests with the application were conducted at the Naval Medical Center–San Diego and within an Army Combat Stress Control Team in Iraq. This feedback provided by non-diagnosed Iraq-experienced military personnel provided information on the content and usability of the prototype system application that fed an iterative design process. A clinical trial version of the application built from this process is currently being tested with PTSD-diagnosed personnel at a variety of sites. The primary test sites are conducting an open clinical trial to evaluate the system’s efficacy for PTSD exposure therapy with active duty military personnel recently redeployed from Iraq. The system is also being used to compare the efficacy of Cognitive Behavioral Therapy, VR and pharmacotherapy (Sertraline) alone and in combination, with placebo controls and blinded outcome measures at the Uniformed Services University of the Health Sciences. A randomized controlled trial comparing VR alone and VR+D-cycloserine is in progress at Emory University and a clinical trial comparing VR exposure with standard of care treatment is ongoing with returning soldiers at Ft. Lewis, Washington. Twelve other sites are also preparing to commence clinical treatment and testing with this system addressing a variety of research questions ranging from PTSD assessment to predicting future risk of developing PTSD using psychophysiological measures.

At the time of this writing, we have successfully treated five of seven active duty patients at NMCS (See Figure 9) and one National Guard veteran was successfully treated as part of the Emory University study (See Figure 10). However, it should be noted that two other participants have recently chose to discontinue treatment before completion (both seven sessions each-one with clinical gains and one without) and another patient recently completed treatment with no observed therapeutic benefits. Results from such initial case reports are difficult to generalize from and we are cautious not to make excessive claims based on these early results. At the current time we are encouraged by these early successes and we continue to gather feedback from the patients regarding the therapy and the Virtual Iraq environment in order to continue our iterative system development process.



**Figures 9-10.** Results from NMCSD and Camp Pendleton as of 10/2007 and results from first patient in Emory University Study

### 3. Conclusions

One of the more foreboding findings in the Hoge et al., [1] report, was the observation that among Iraq/Afghanistan War veterans, "...those whose responses were positive for a mental disorder, only 23 to 40 percent sought mental health care. Those whose responses were positive for a mental disorder were twice as likely as those whose responses were negative to report concern about possible stigmatization and other barriers to seeking mental health care." (p. 13). While military training methodology has better prepared soldiers for combat in recent years, such hesitancy to seek treatment for difficulties that emerge upon return from combat, especially by those who may need it most, suggests an area of military mental healthcare that is in need of attention. To address this concern, a VR system for PTSD treatment could serve as a component within a reconceptualized approach to how treatment is accessed by veterans returning from combat. Perhaps VR exposure could be embedded within the context of "post-combat reintegration training" whereby the perceived stigma of seeking treatment could be lessened as the soldier would be simply involved in this "training" in similar fashion to other designated duties upon redeployment. VR PTSD therapy may also offer an additional attraction and promote treatment seeking by certain demographic groups in need of care. The current generation of young military personnel, having grown up with digital gaming technology, may actually be more attracted to and comfortable with participation in a VR application approach as an alternative to what is viewed as traditional "talk therapy" (even though such talk therapy would obviously occur in the course of a recommended multi-component approach for this disorder).

The positive clinical outcomes observed from our initial eight patients are encouraging, although we are cautious not to make excessive claims based on these early results. At the current time we are continuing to gather data and feedback from patients regarding the therapy and the *Virtual Iraq* environment in order to continue our iterative system development process. And in fact, we recently released an updated version of the system in October 2007 with added functionality that has its design "roots" from feedback acquired from these initial patients and the therapists who have used the system thus far. It should also be noted that this project is currently in an open clinical trial phase. As such, we intend to use such initial results to develop, explore and test hypotheses as to how we can improve assessment, treatment, and most

importantly, determine what patient characteristics may predict who will benefit from VR exposure therapy and who may be best served by other approaches.

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