

Use of Immersive Technology and Virtual Reality to Improve Mental Health Access



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Treatment

Cognitive Behavioral Treatment:

HELPING TO CONFRONT

Treating Anxiety Disorders with Virtual Reality Exposure



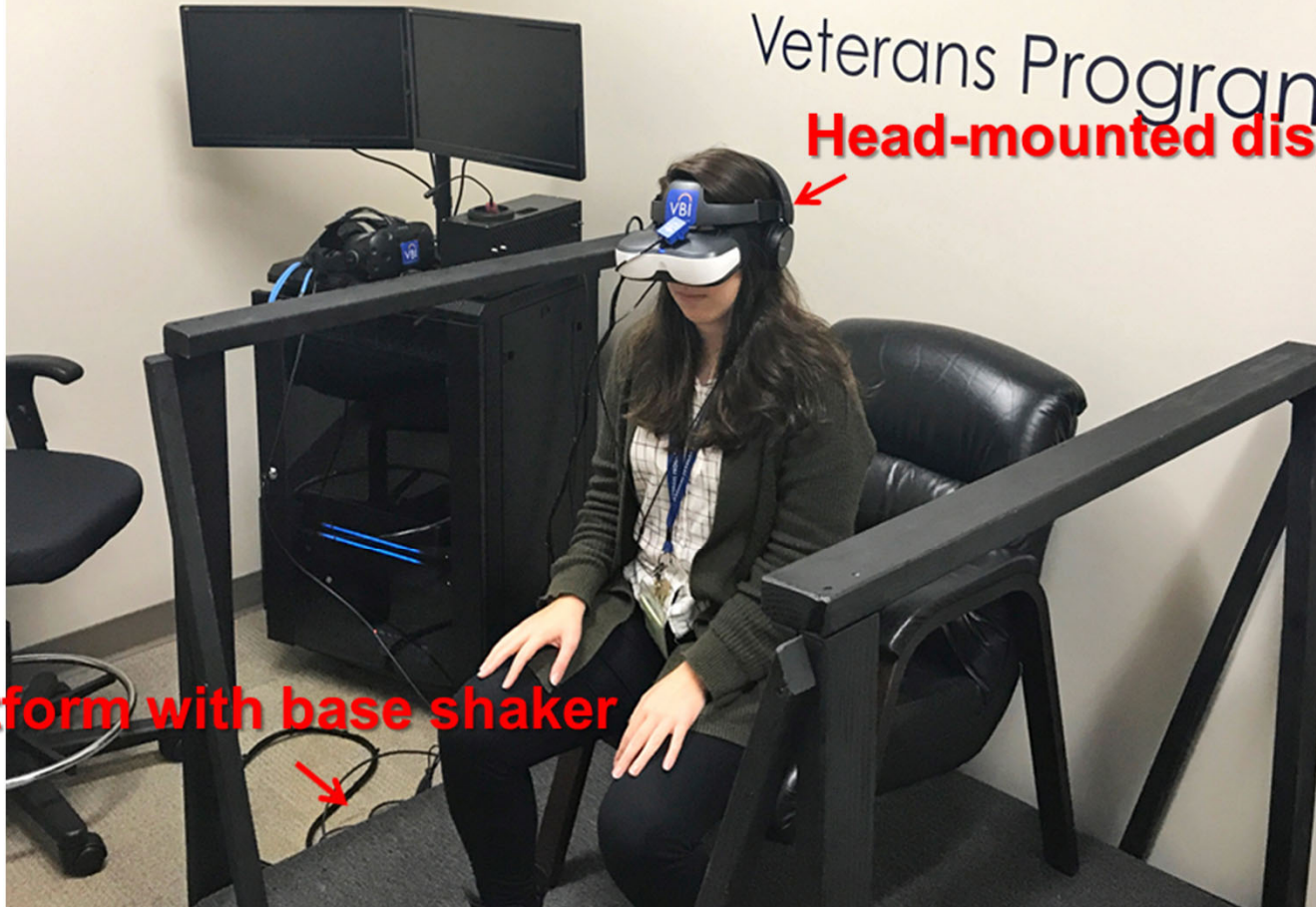
Virtual Reality Hardware

EMORY
HEALTHCARE

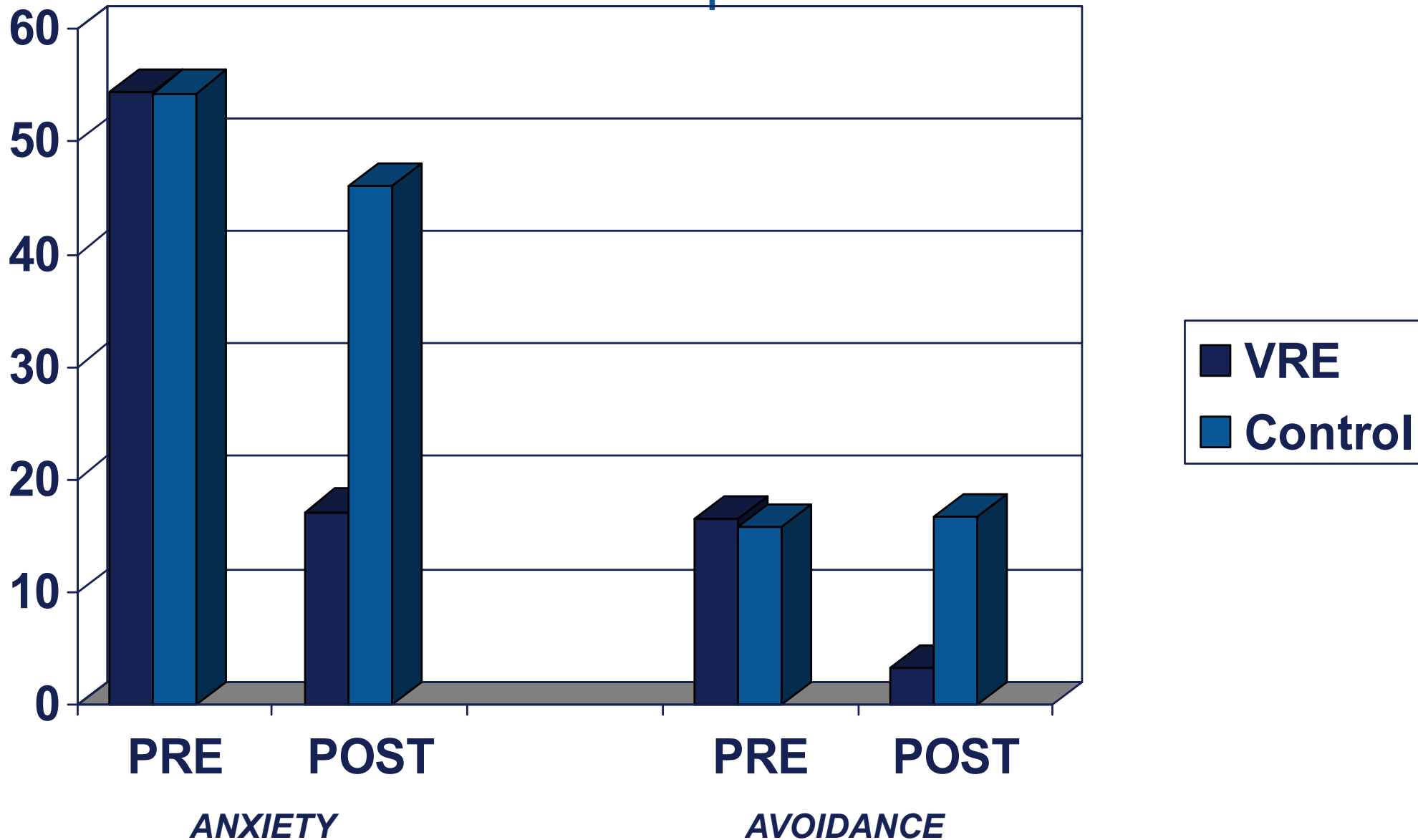
Veterans Program

Head-mounted display

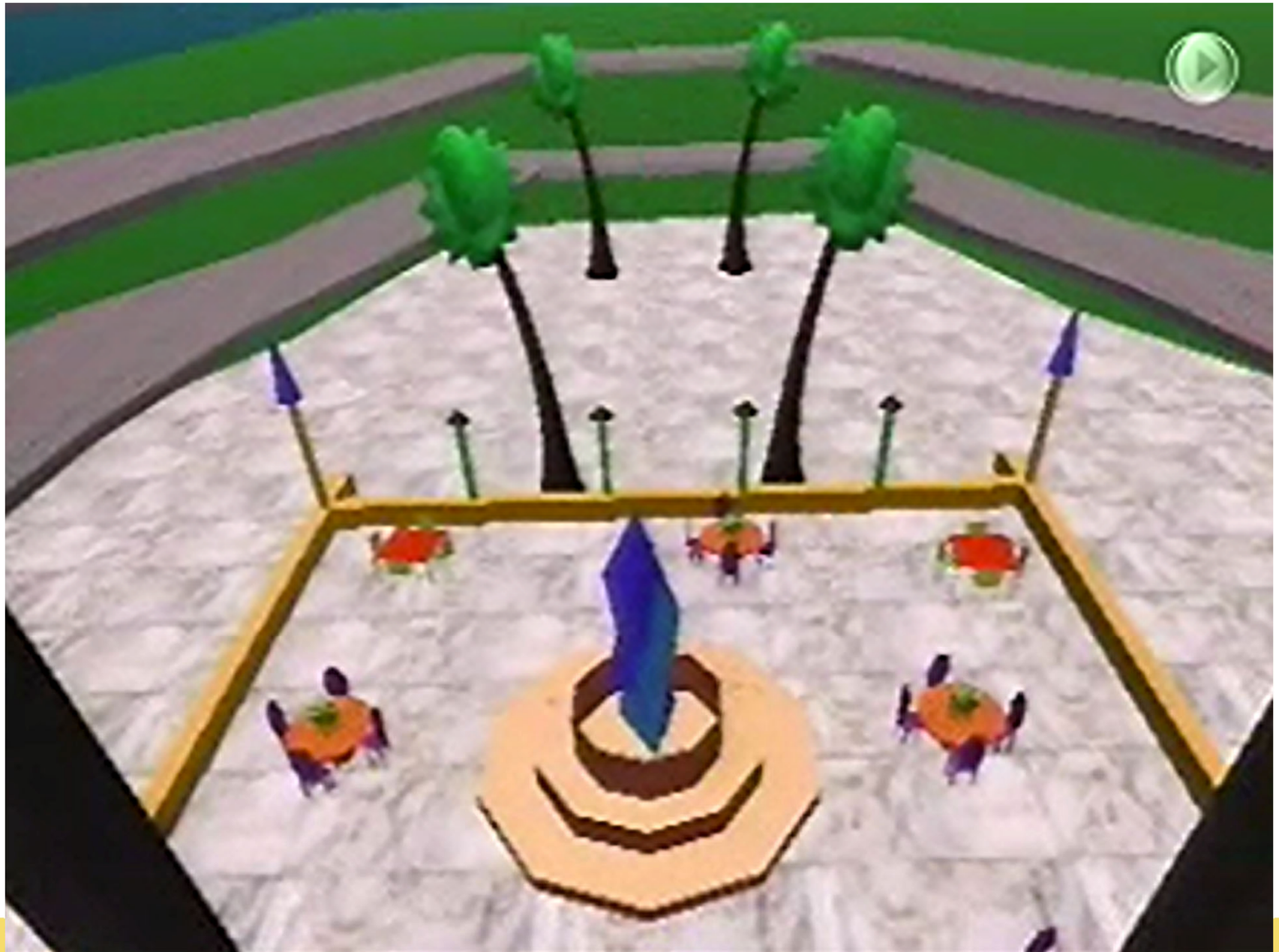
Raised platform with base shaker



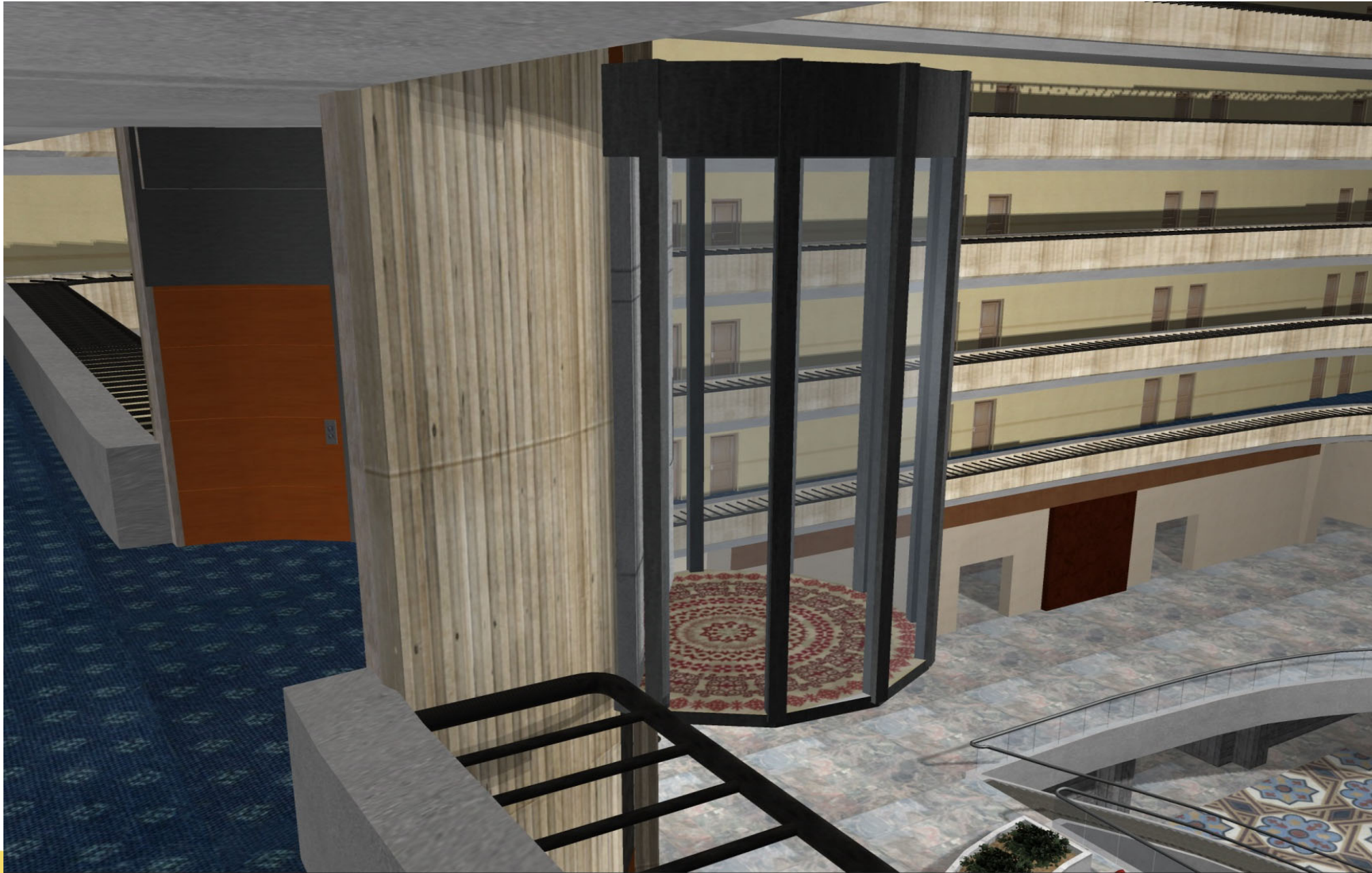
First Published Study of VRE for Psychiatric Disorder: VRE for Acrophobia

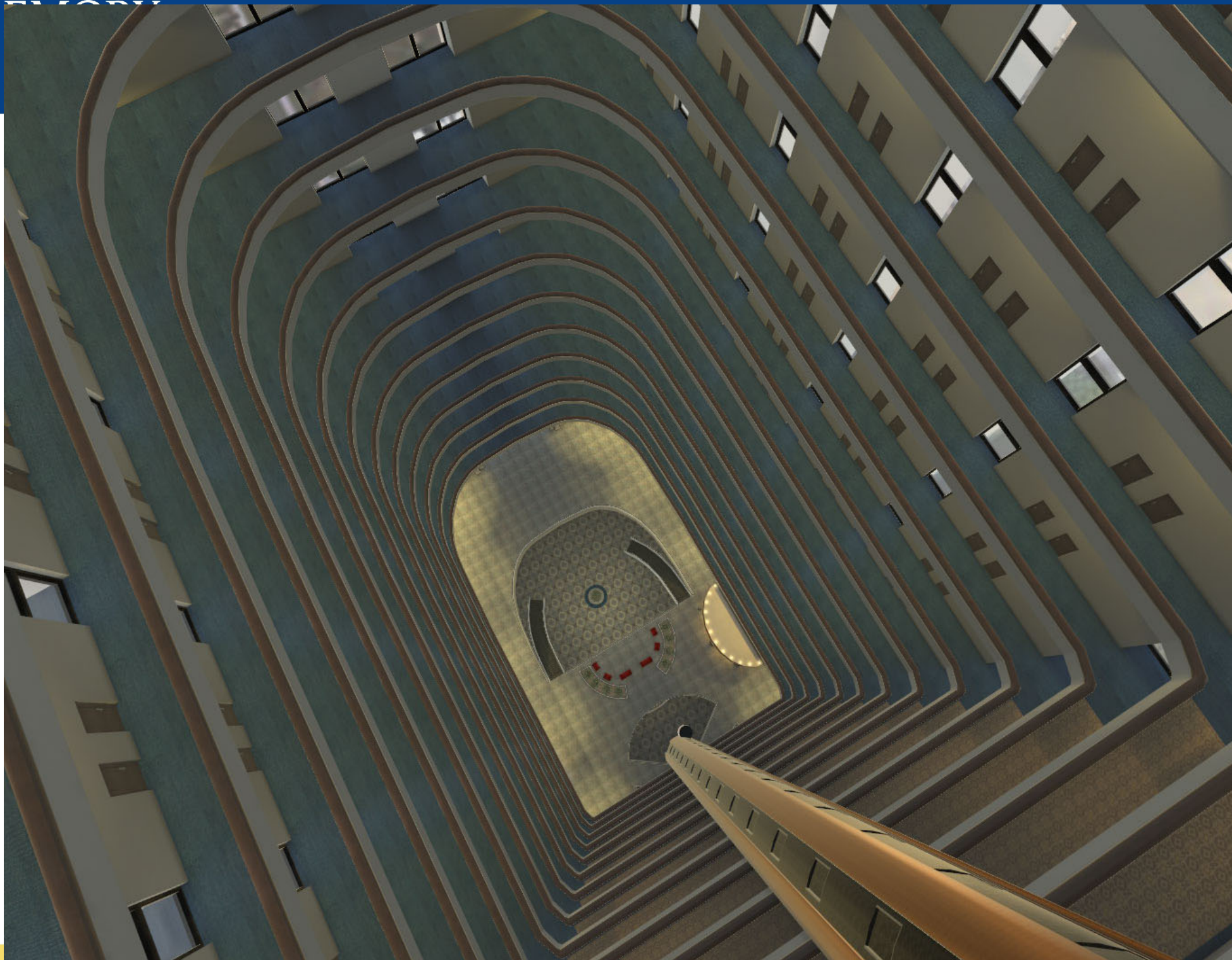


Old Virtual Elevator

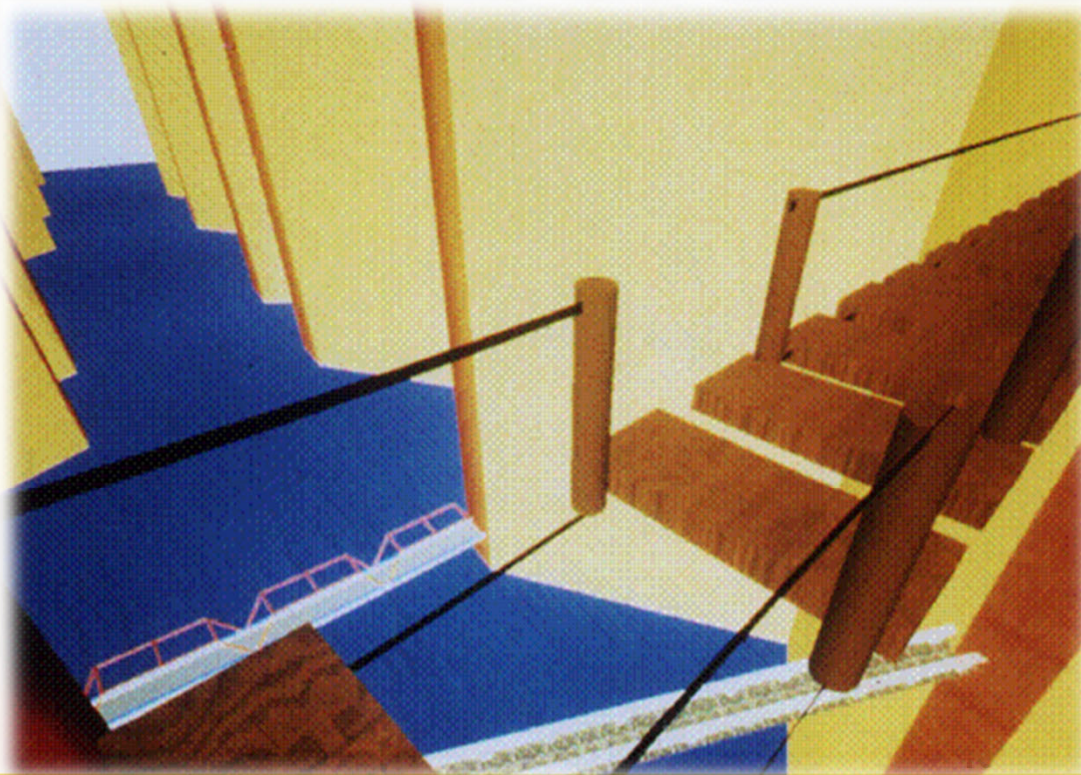


New Virtual Elevator

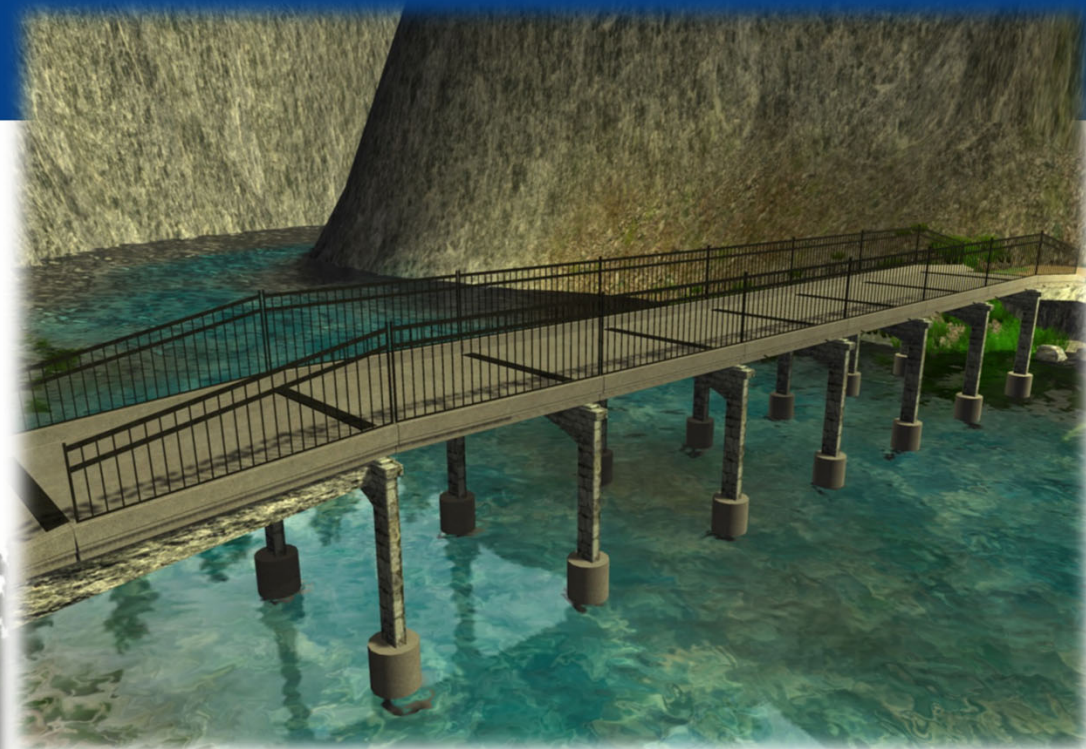




Old Bridges

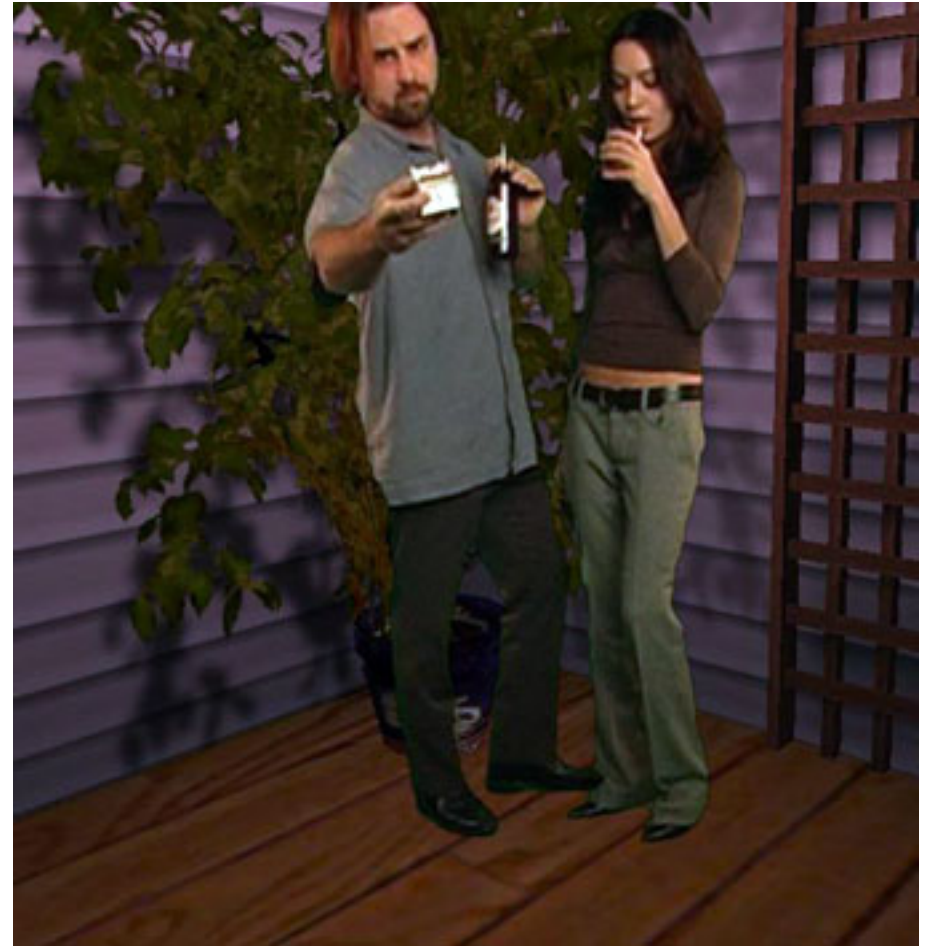


New Bridges



VR for Addictions

- Nicotine
- Alcohol



Indicate your greatest craving to smoke *at this time*.



None

More than ever





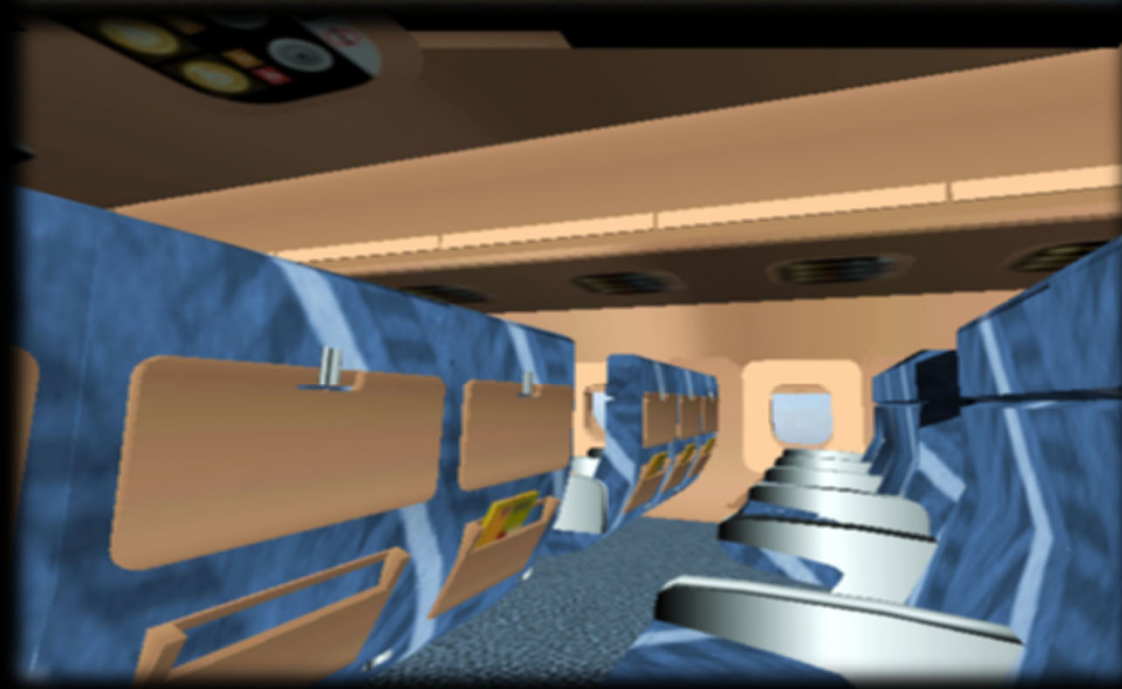




Social Anxiety Disorder

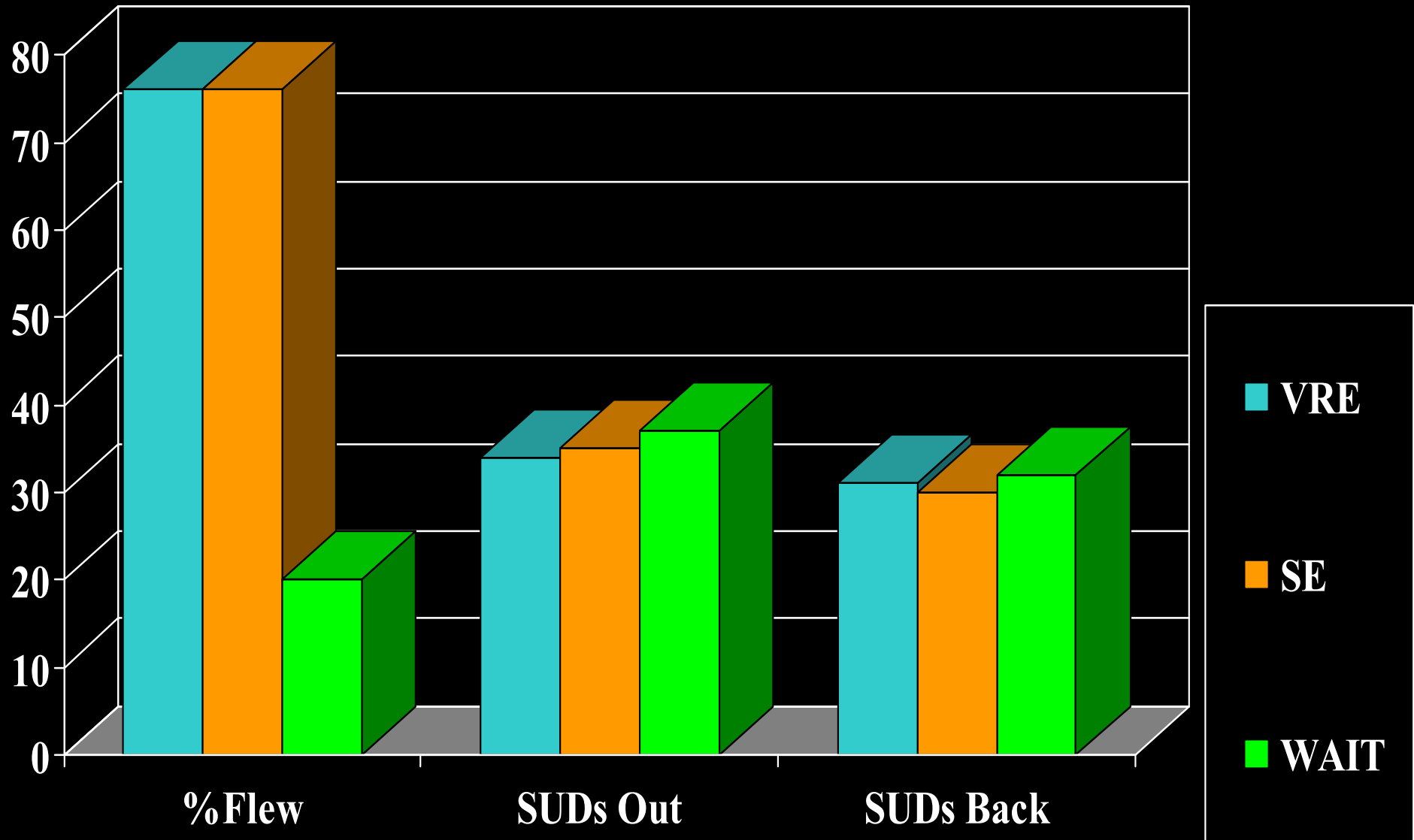
Old Audience Video Clip







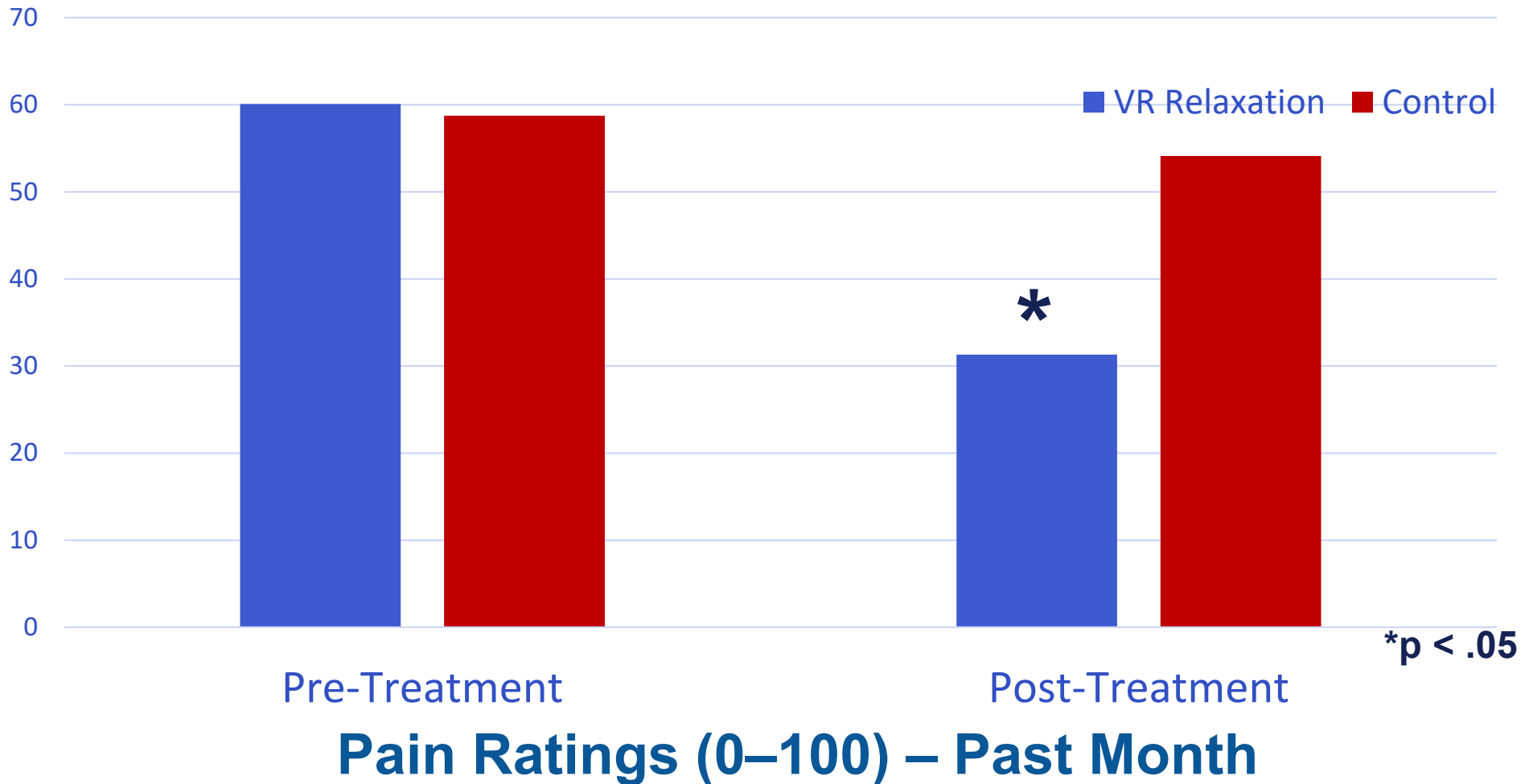
Actual Flight Data



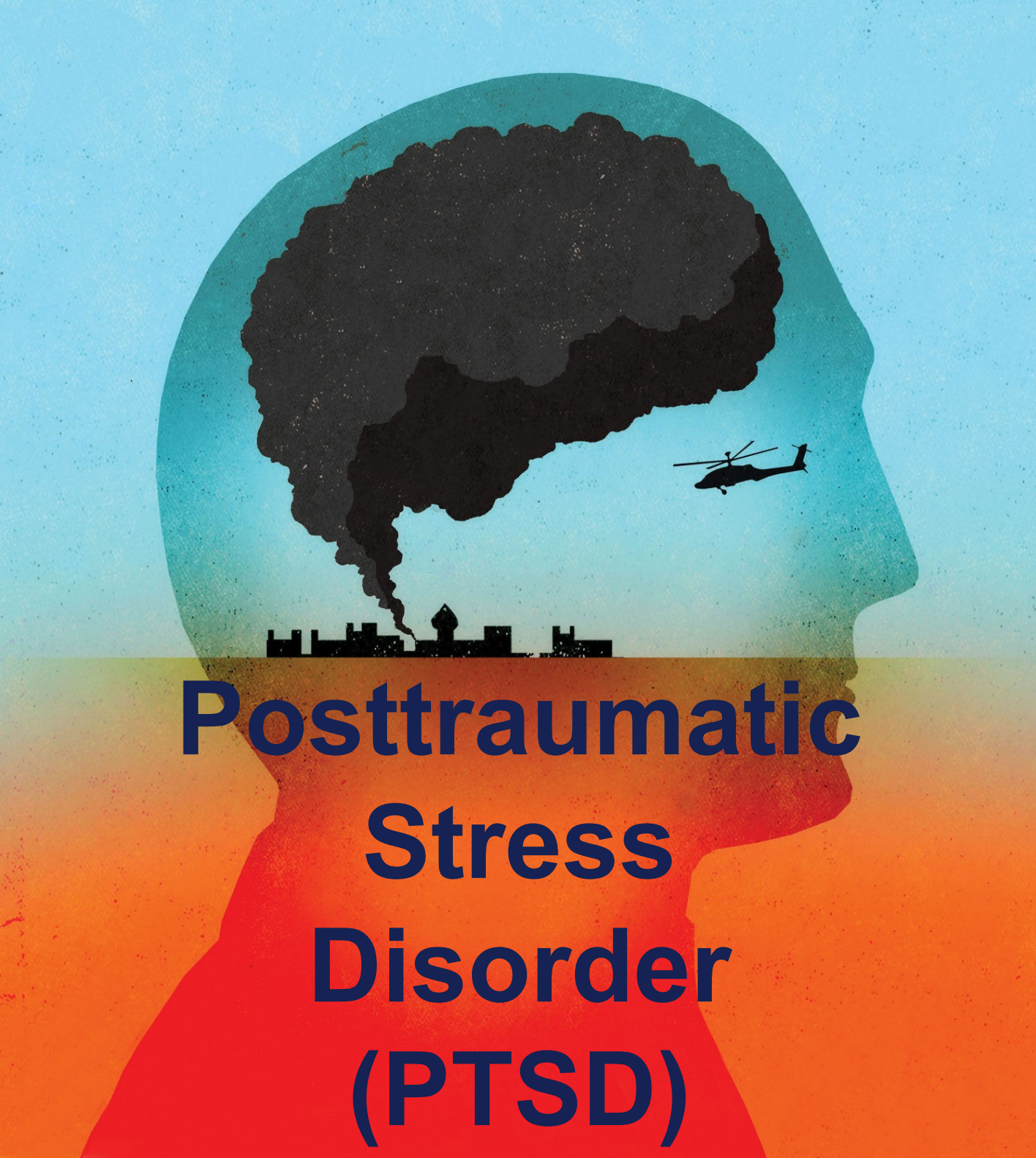
Rothbaum, et al (2000). Journal of Consulting and Clinical Psychology, 68, 1020-1026;
Rothbaum, et al (2006). Behavior Therapy, 37, 80-90.

Chronic Pain

VR Relaxation for Chronic Low Back Pain



Rothbaum, A, Tannenbaum, Zimand & Rothbaum, B. (2023). A pilot randomized controlled trial of virtual reality delivered relaxation for chronic low back pain. *Virtual Reality*. <https://doi-org.proxy.library.emory.edu/10.1007/s10055-023-00760-9>



Posttraumatic Stress Disorder (PTSD)

Virtual Reality Exposure Therapy for PTSD

- Imaginal exposure to most traumatic memories
- Recount it
 - out loud
 - in present tense
 - repeatedly
- Therapist matches in VR what patient describes



Potent Stimulus

Virtual Vietnam: First Trial using Virtual Reality to treat PTSD



Rothbaum et al. (2001). Virtual Reality Exposure Therapy for Vietnam Veterans with Posttraumatic Stress Disorder. *Journal of Clinical Psychiatry*.

MILITARY SEXUAL TRAUMA



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Journal of Anxiety Disorders

journal homepage: www.elsevier.com/locate/janxdis



You can do that?!: Feasibility of virtual reality exposure therapy in the treatment of PTSD due to military sexual trauma

Laura Loucks^a, Carly Yasinski^a, Seth D. Norrholm^a, Jessica Maples-Keller^a, Loren Post^a, Liza Zwiebach^a, Devika Fiorillo^a, Megan Goodlin^a, Tanja Jovanovic^a, Albert A. Rizzo^b, Barbara O. Rothbaum^{a,*}



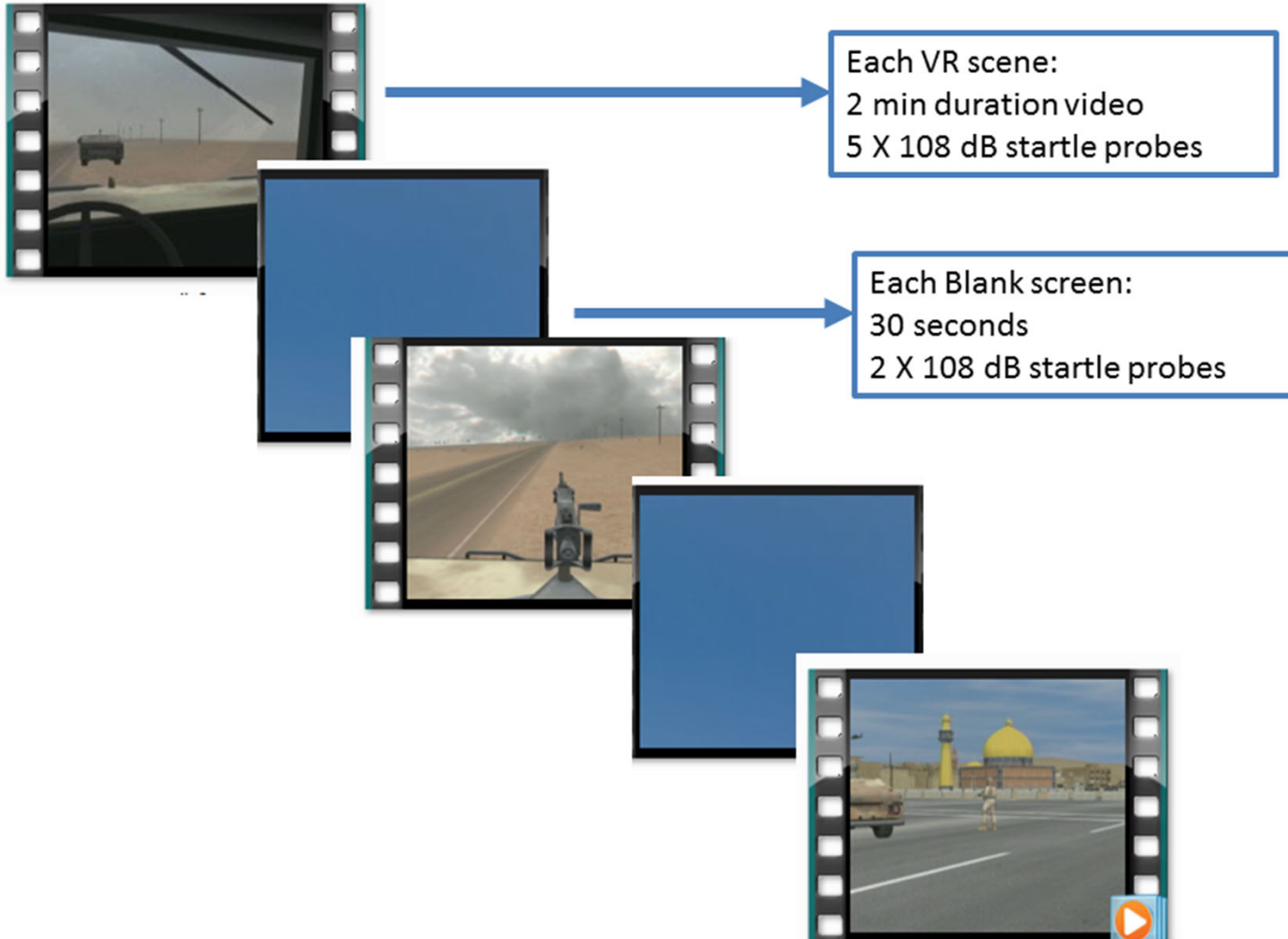






Assessment

Assessment Session Diagram



Virtual Reality Assessment Session:



- 3 VR SCENES: HUMVEE 1, HUMVEE 2, FOOT PATROL
- 2 BLOCKS, TOTAL SESSION: 15 MINUTES

Acoustic Startle Response

- Symptom of PTSD
- Translational tool:
observed in all mammals
- Non-invasive measurement
- Simple 3 neuron
subcortical circuit
- Modulated by emotion via

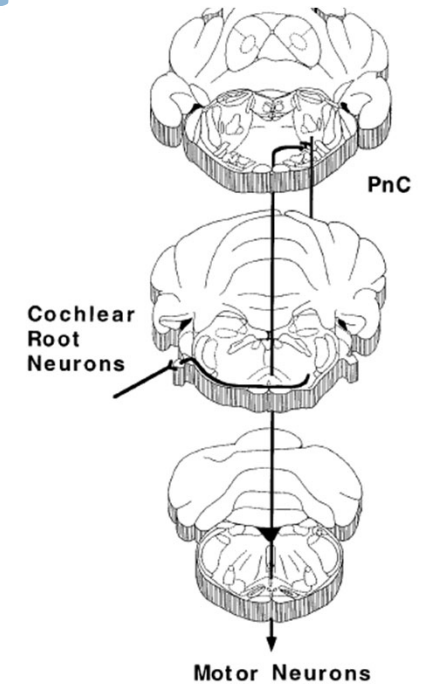
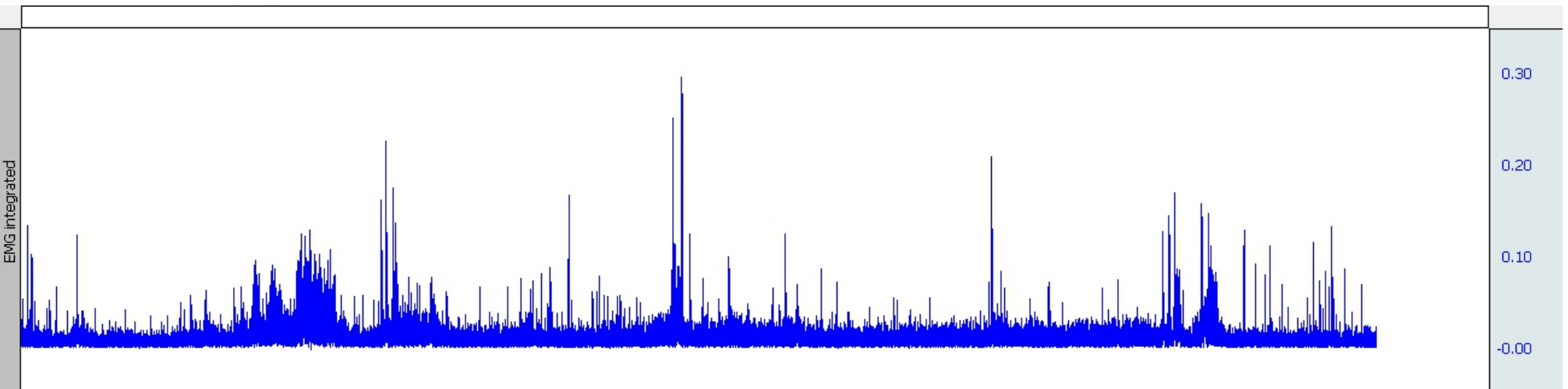
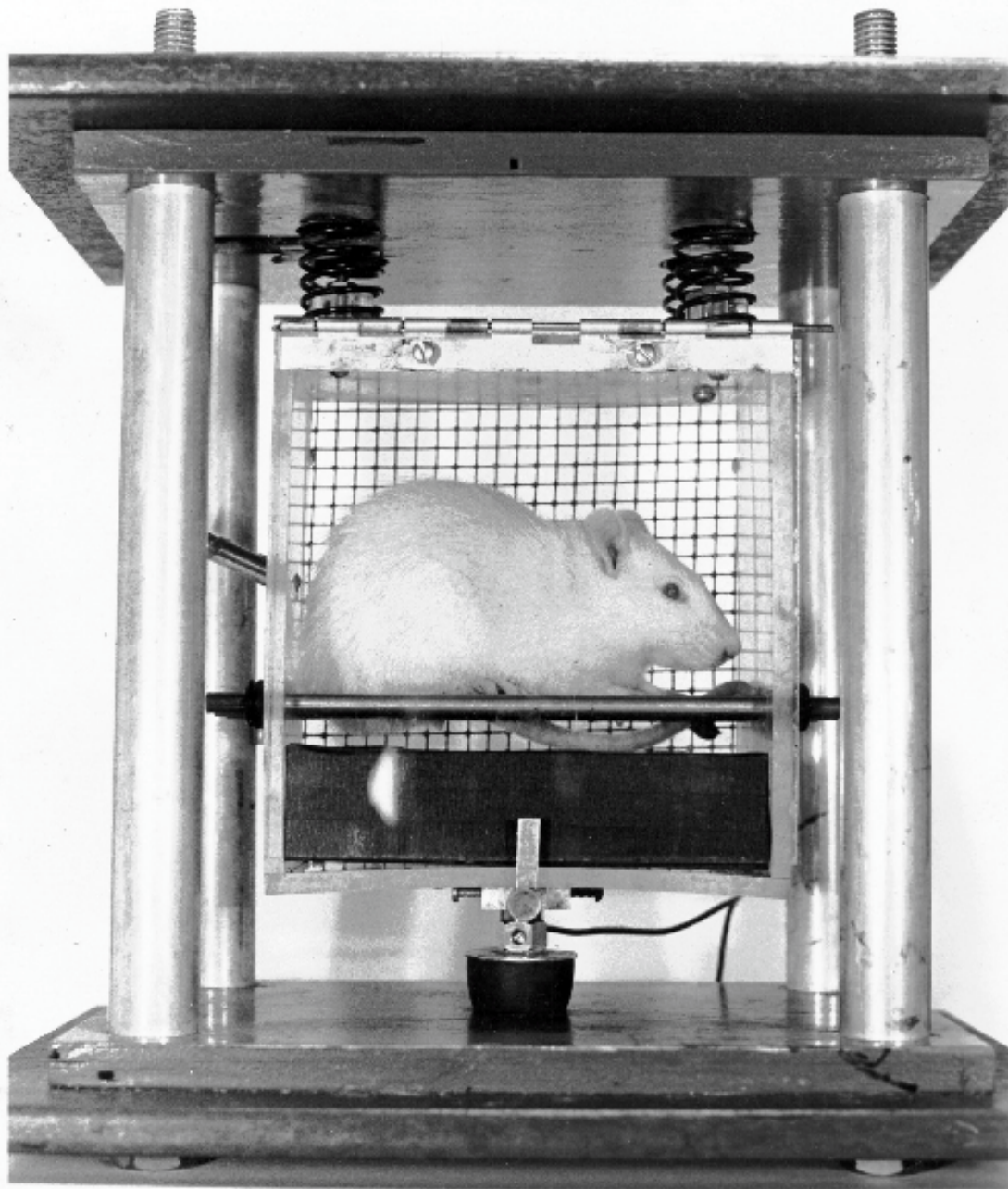


Figure 12. Diagram illustrating a primary acoustic startle circuit consisting of the CRNs, the ventrolateral part of the PnC, and axons projecting to motoneurons in the spinal cord.





TRAINING

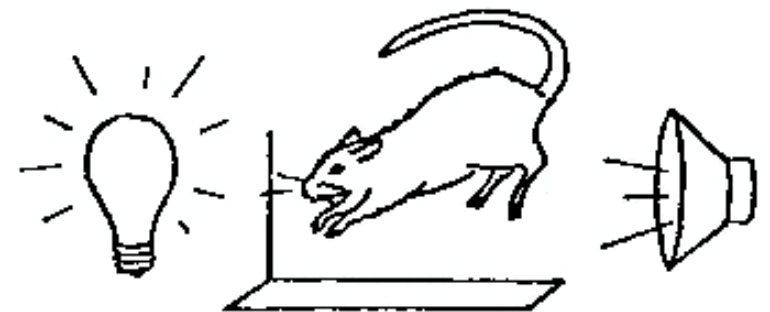


Light (CS) is Paired with Shock (US)

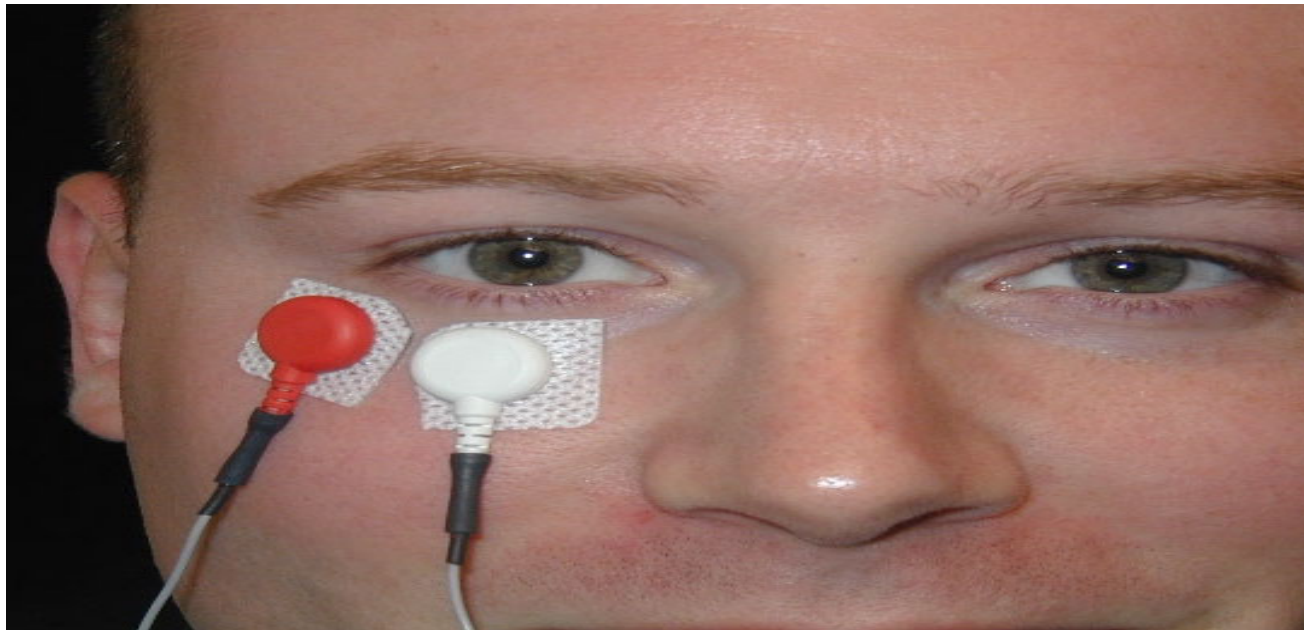
TESTING

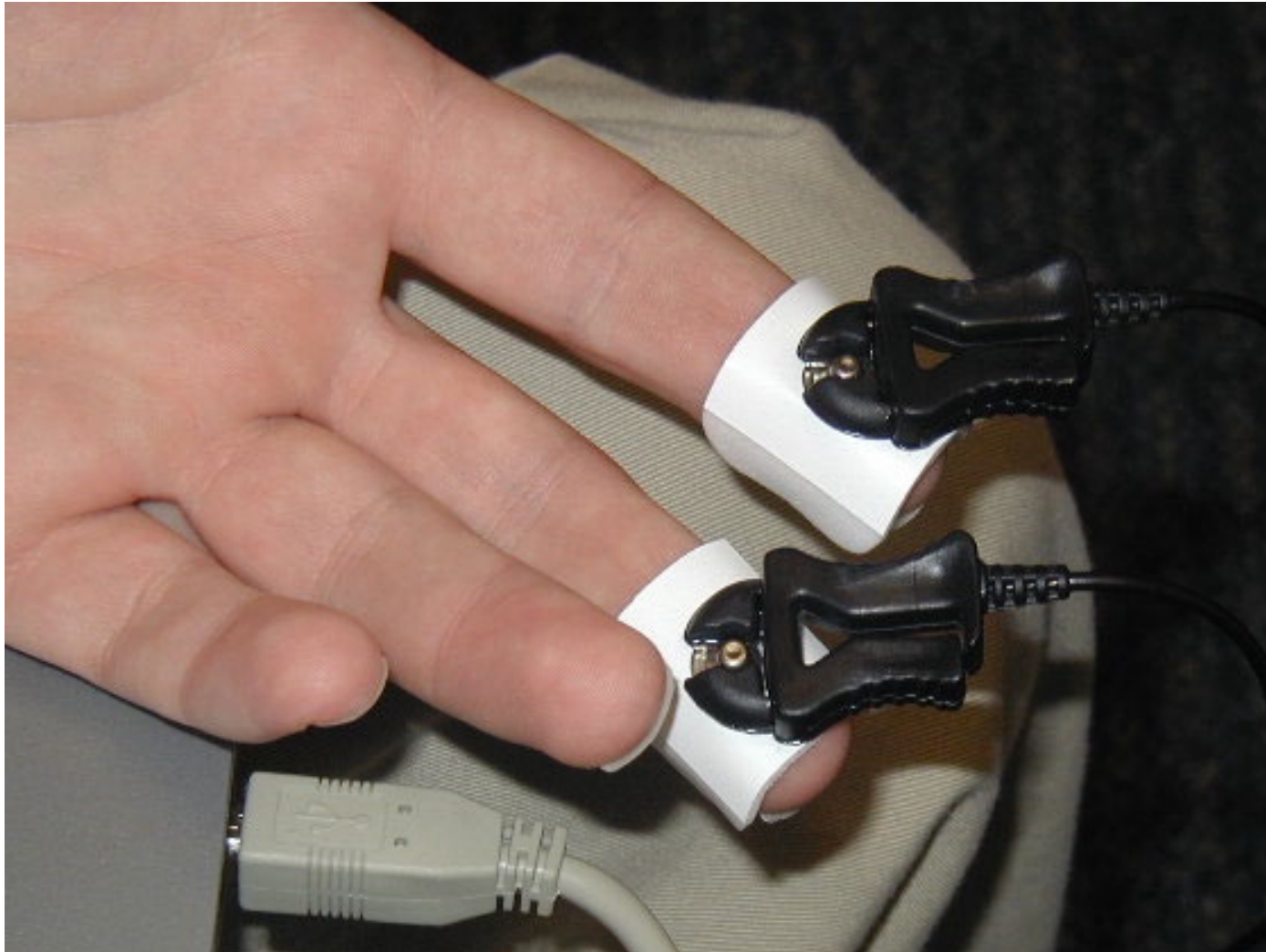


Startle is Measured in the Dark

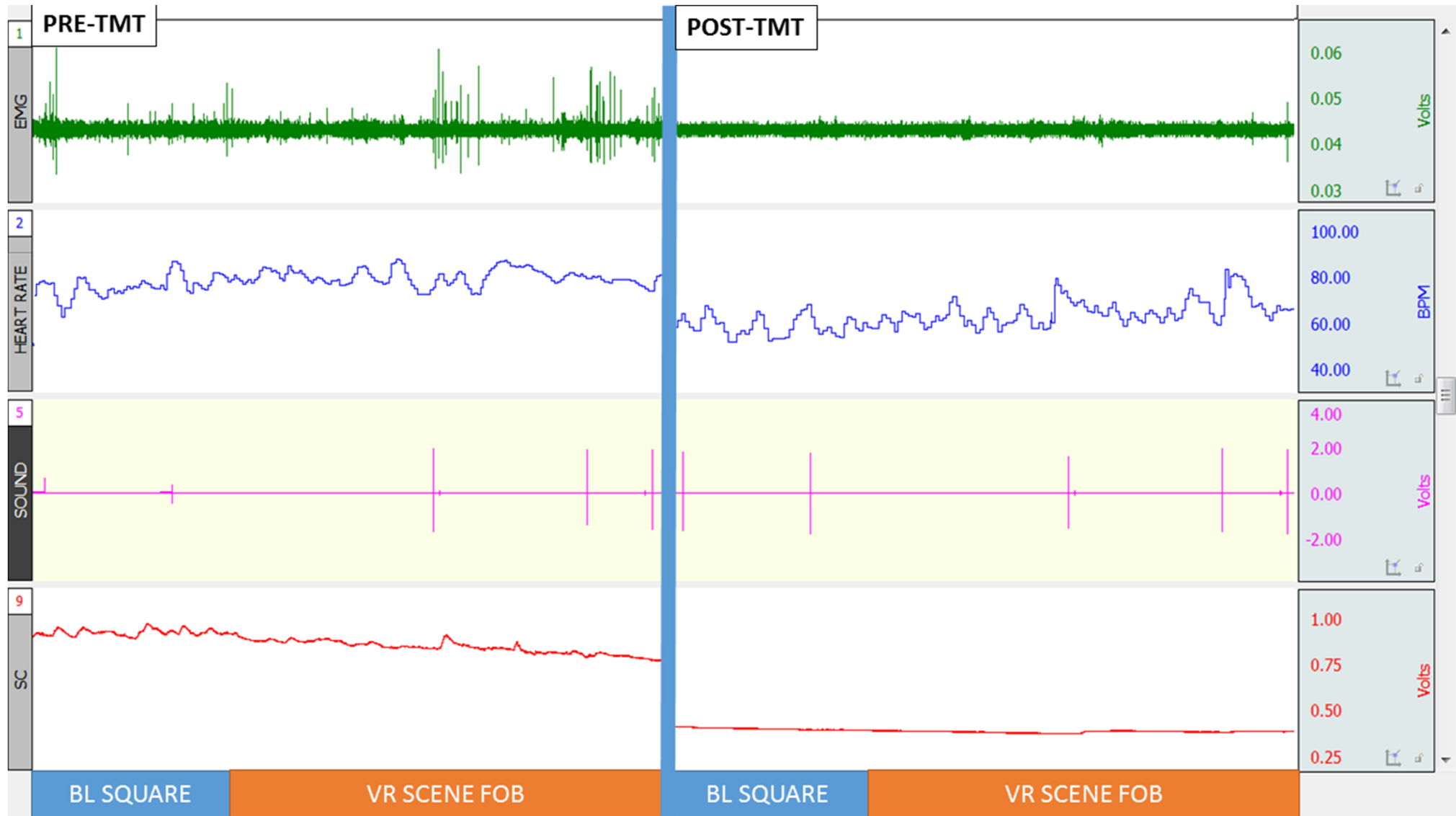


And in the Presence of the Light CS





Case Example: Psychophysiological Data



Virtual Iraq



A Randomized, Double-Blind Evaluation of D-Cycloserine or Alprazolam Combined With Virtual Reality Exposure Therapy for Posttraumatic Stress Disorder in Iraq and Afghanistan War Veterans

Barbara Olasov Rothbaum, Ph.D.

Matthew Price, Ph.D.

Tanja Jovanovic, Ph.D.

Seth D. Norrholm, Ph.D.

Maryrose Gerardi, Ph.D.

Boadie Dunlop, M.D.

Michael Davis, Ph.D.

Bekh Bradley, Ph.D.

Erica J. Duncan, M.D.

Albert Rizzo, Ph.D.

Kerry J. Ressler, M.D., Ph.D.

Objective: The authors examined the effectiveness of virtual reality exposure augmented with D-cycloserine or alprazolam, compared with placebo, in reducing posttraumatic stress disorder (PTSD) due to military trauma.

Method: After an introductory session, five sessions of virtual reality exposure were augmented with D-cycloserine (50 mg) or alprazolam (0.25 mg) in a double-blind, placebo-controlled randomized clinical trial for 156 Iraq and Afghanistan war veterans with PTSD.

Results: PTSD symptoms significantly improved from pre- to posttreatment across all conditions and were maintained at 3, 6, and 12 months. There were no overall differences in symptoms between D-cycloserine and placebo at any time. Alprazolam and placebo differed significantly on the Clinician-Administered PTSD Scale score at posttreatment and PTSD diagnosis at 3 months posttreatment; the alprazolam group showed a higher rate of PTSD

(82.8%) than the placebo group (47.8%). Between-session extinction learning was a treatment-specific enhancer of outcome for the D-cycloserine group only. At posttreatment, the D-cycloserine group had the lowest cortisol reactivity and smallest startle response during virtual reality scenes.

Conclusions: A six-session virtual reality treatment was associated with reduction in PTSD diagnoses and symptoms in Iraq and Afghanistan veterans, although there was no control condition for the virtual reality exposure. There was no advantage of D-cycloserine for PTSD symptoms in primary analyses. In secondary analyses, alprazolam impaired recovery and D-cycloserine enhanced virtual reality outcome in patients who demonstrated within-session learning. D-Cycloserine augmentation reduced cortisol and startle reactivity more than did alprazolam or placebo, findings that are consistent with those in the animal literature.





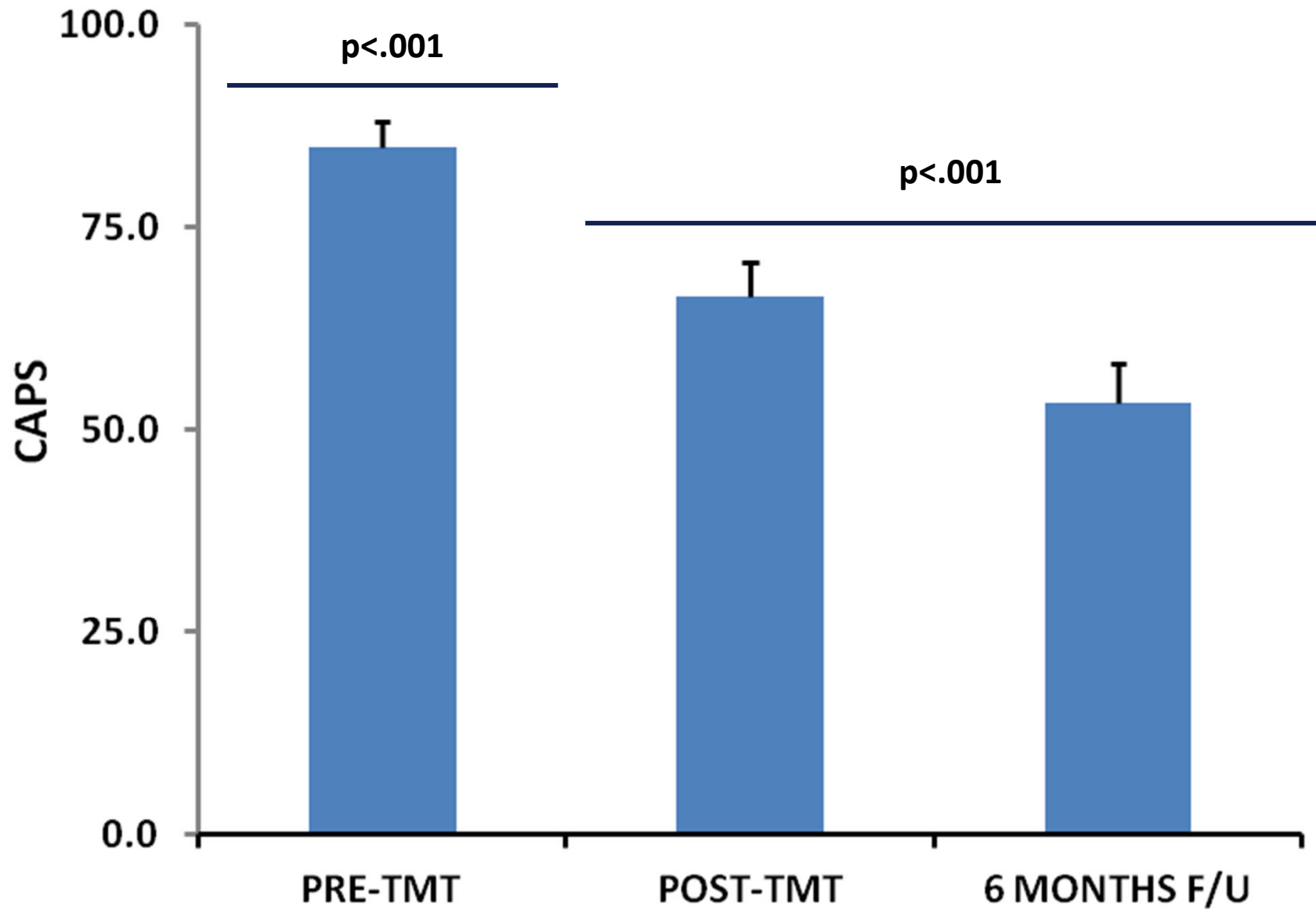




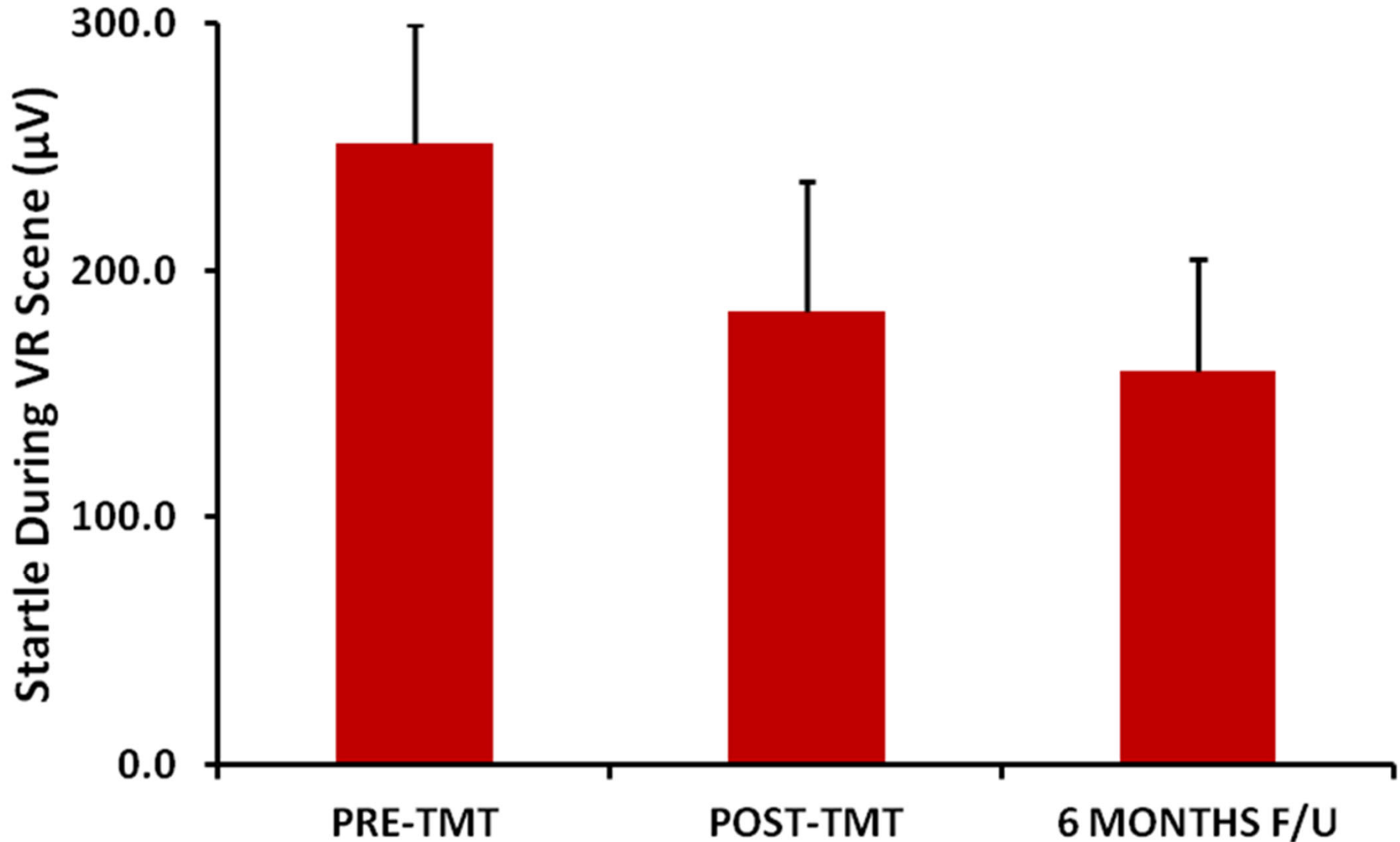


Assessment

CHANGE IN PTSD SYMPTOMS WITH TREATMENT

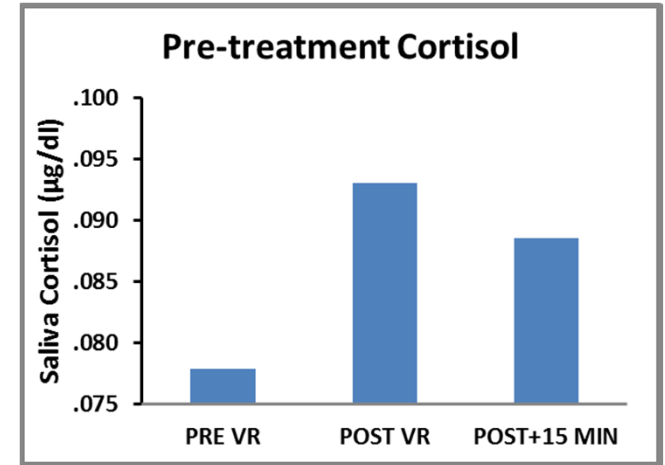


Startle response during VR scenes decreased with treatment



Cortisol sampling

VR SESSION: 15 MIN



PRE



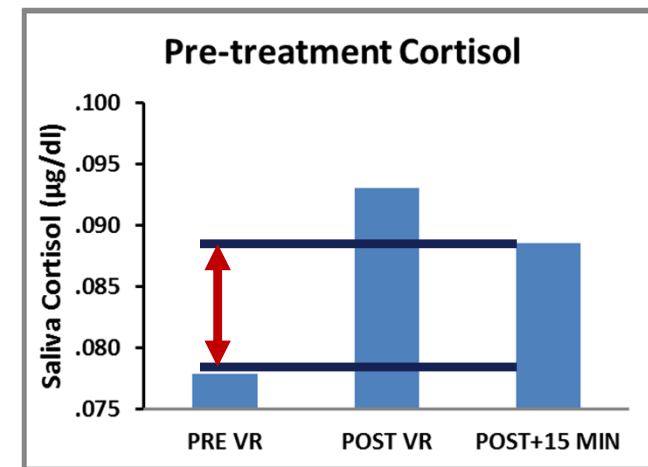
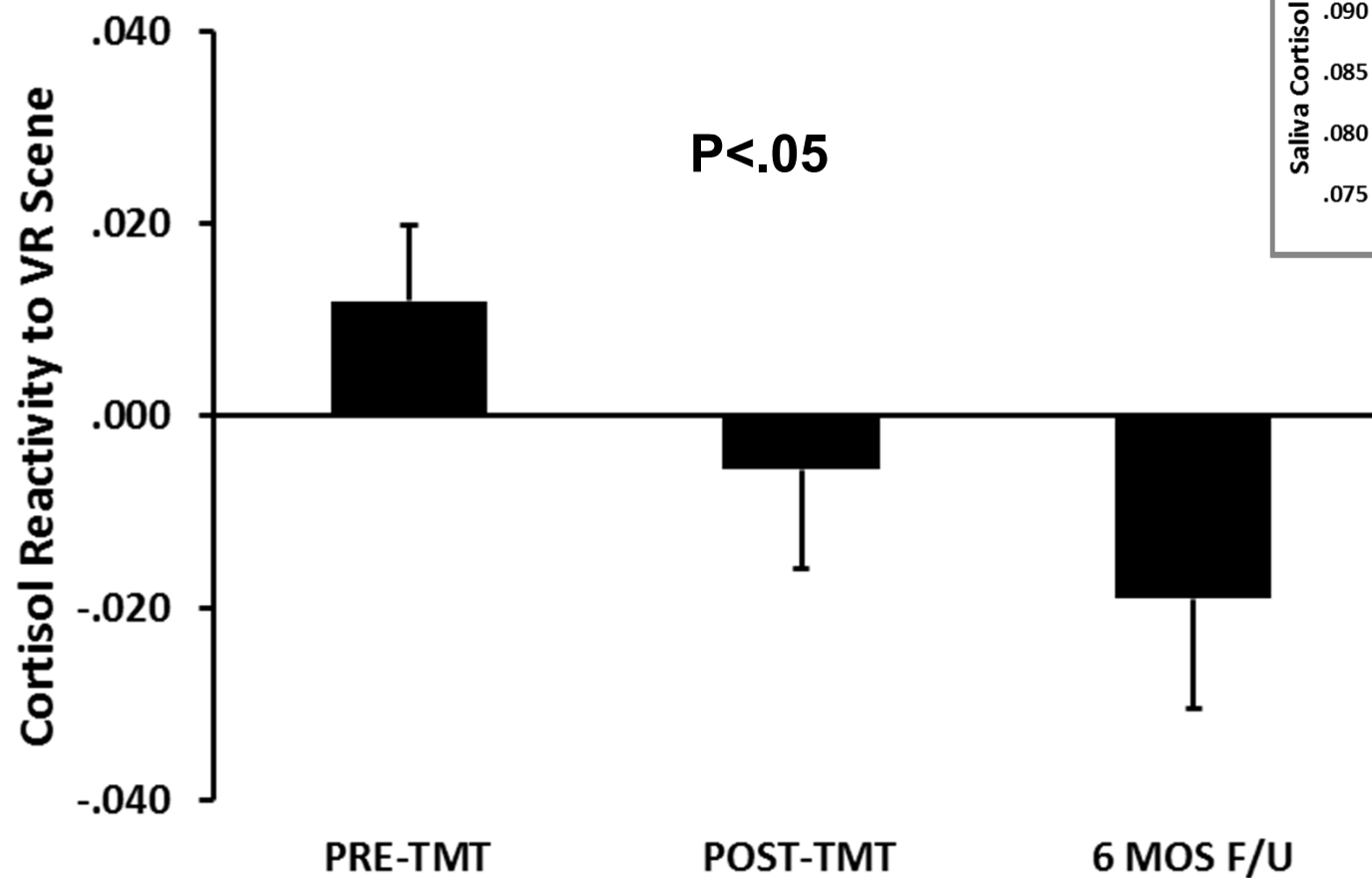
POST



POST+15 MIN



Cortisol reactivity attenuated with treatment



Translational Psychiatry

www.nature.com/tp

ARTICLE OPEN



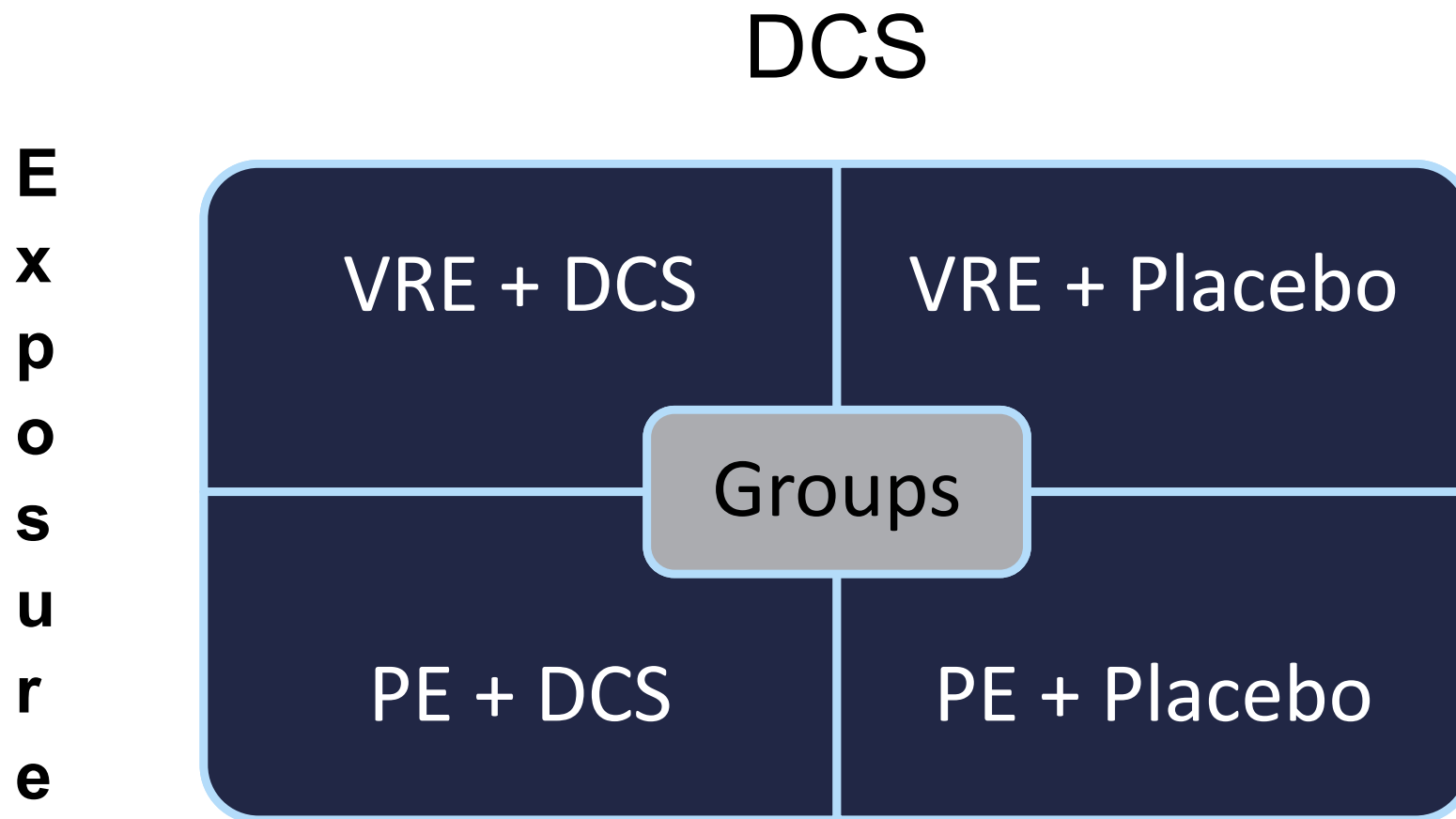
Enhancing exposure therapy for posttraumatic stress disorder (PTSD): a randomized clinical trial of virtual reality and imaginal exposure with a cognitive enhancer

JoAnn Difede ¹✉, Barbara O. Rothbaum ², Albert A. Rizzo ³, Katarzyna Wyka ¹, Lisa Spielman⁴, Christopher Reist ^{5,6,7}, Michael J. Roy ⁸, Tanja Jovanovic ⁹, Seth D. Norrholm ⁹, Judith Cukor¹, Megan Olden ¹, Charles E. Glatt¹ and Francis S. Lee ¹

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**The study was funded by the Department of Defense [W81XWH-10-1-1045].
This study was supported by an award from the National Center for Advancing
Translational Science.**

Difede, Rothbaum, Rizzo PE vs VRE, DCS vs Placebo 2 x 2



Top Line Results

- Virtual reality (VRE)–based exposure therapy is as effective as traditional exposure therapy (PE) for combat-related posttraumatic stress disorder (PTSD). ***Those with comorbid depression may particularly benefit most from its use.***

Advantages of VR

- Control over stimuli
- Can create the “perfect” exposure
- Increased feasibility (e.g., don’t go to airport and fly)
- In research, offers methodological rigor
- Each participant receives exactly the same stimuli at exactly the same dose
- No exposure outside of the experimental sessions
- Increased engagement
- Potent stimuli



EMORY'S VETERANS PROGRAM

Healing the invisible wounds of war

Two Formats

Accommodating to veterans' needs and location



- **Traditional outpatient care** for regional service members, veterans, and families (Sept 2015)
- **2-week intensive outpatient program** for service members, veterans, and families from across the United States (Jan 2016)

PSYCHOLOGICAL
AND PSYCHIATRIC
CARE



TRAUMATIC BRAIN
INJURY AND
NEUROLOGICAL
CARE



HOLISTIC
INTEGRATIVE
MEDICINE FOR
WELLNESS



Intensive Outpatient Program (IOP)

- Post-9/11 veterans and servicemembers
 - No cost to the veteran
 - Two-week structure
 - Prolonged exposure
 - Skills training in family/relationship management
 - Individual and group sessions
- Potential additional services:
 - Cognitive/neuropsych assessment & treatment
 - Sleep assessment & treatment

Treatment Focus Areas

- Posttraumatic Stress Disorder
- Mild Traumatic Brain Injury (mTBI)
- Military Sexual Trauma (MST)
- Major Depressive Disorder
- Anxiety
- TBI Track
- SUD Track

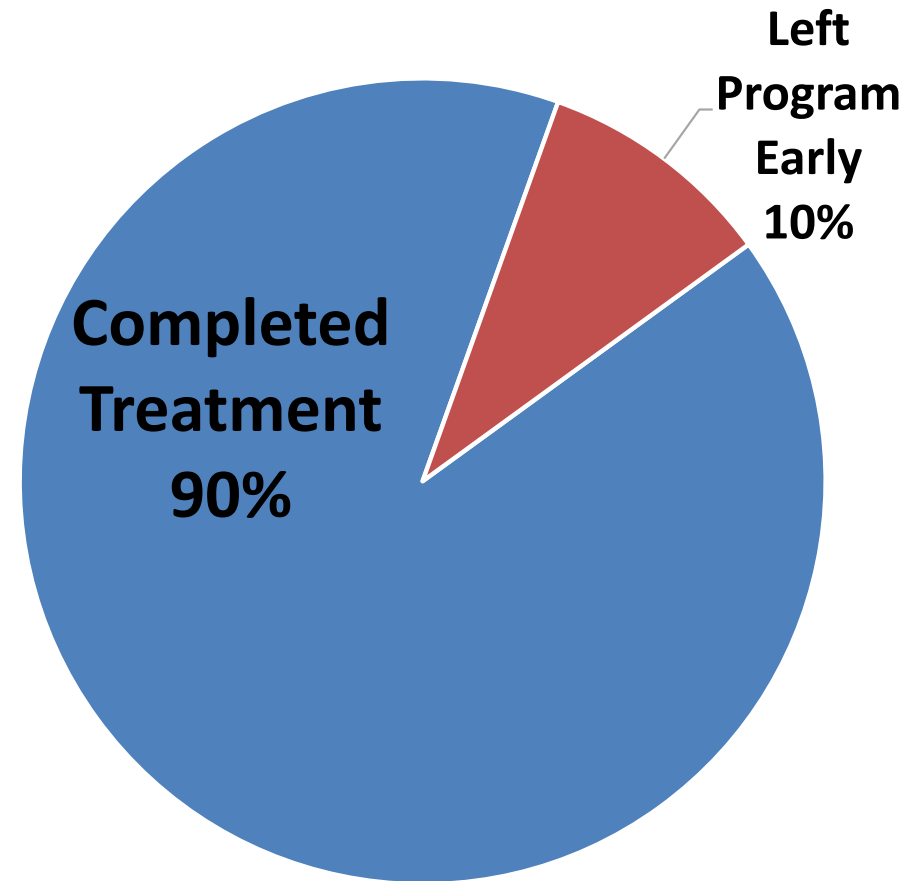
Services Provided

- Psychotherapy
- Pharmacotherapy
- Cognitive rehabilitation
- Stress management skills
- Sleep training/education, sleep studies
- Integrative medicine for wellness (e.g., acupuncture, yoga, and nutrition)
- Family groups
- Assistance navigating the VA system

Program Impact

- **1129 warriors treated in the IOP since 2015**
- **566 warriors treated in IOP since April 2020**
- **111 of those were treated through Tele-IOP**

IOP Retention



Utilization

Service Sessions

Patient Count **2,860**

Total Sessions **54,009**

Service Duration (in hours)

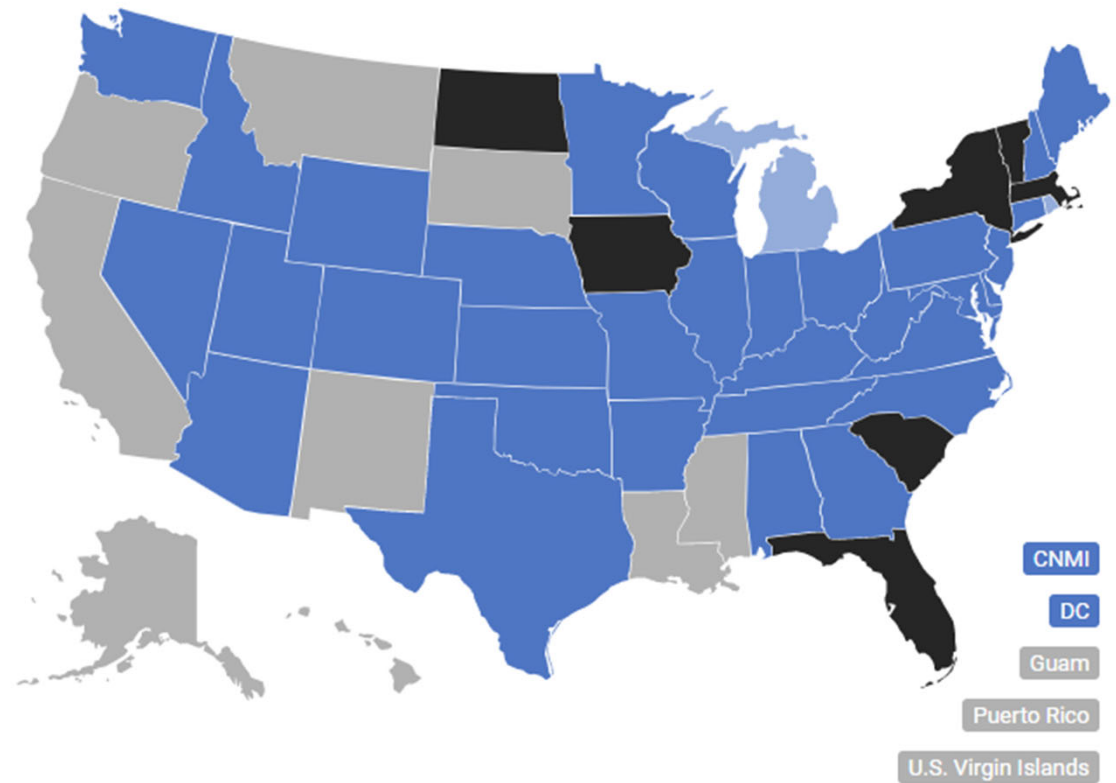
Patient Count **2,860**

Total Duration **62,717**



Tele-IOP Clinical Services

- PE
- In-Vivo Exposure
- Medication
- Family counseling
- Effective behaviors (anger management)
- mTBI Track
- Substance Use Disorder Track
- Individually-tailored care plan
- As effective as in-person IOP



Intensive Outpatient Program

- Effective treatment
- Large decreases in PTSD and depression at post-treatment
- Maintained improvement across 12-month follow-up

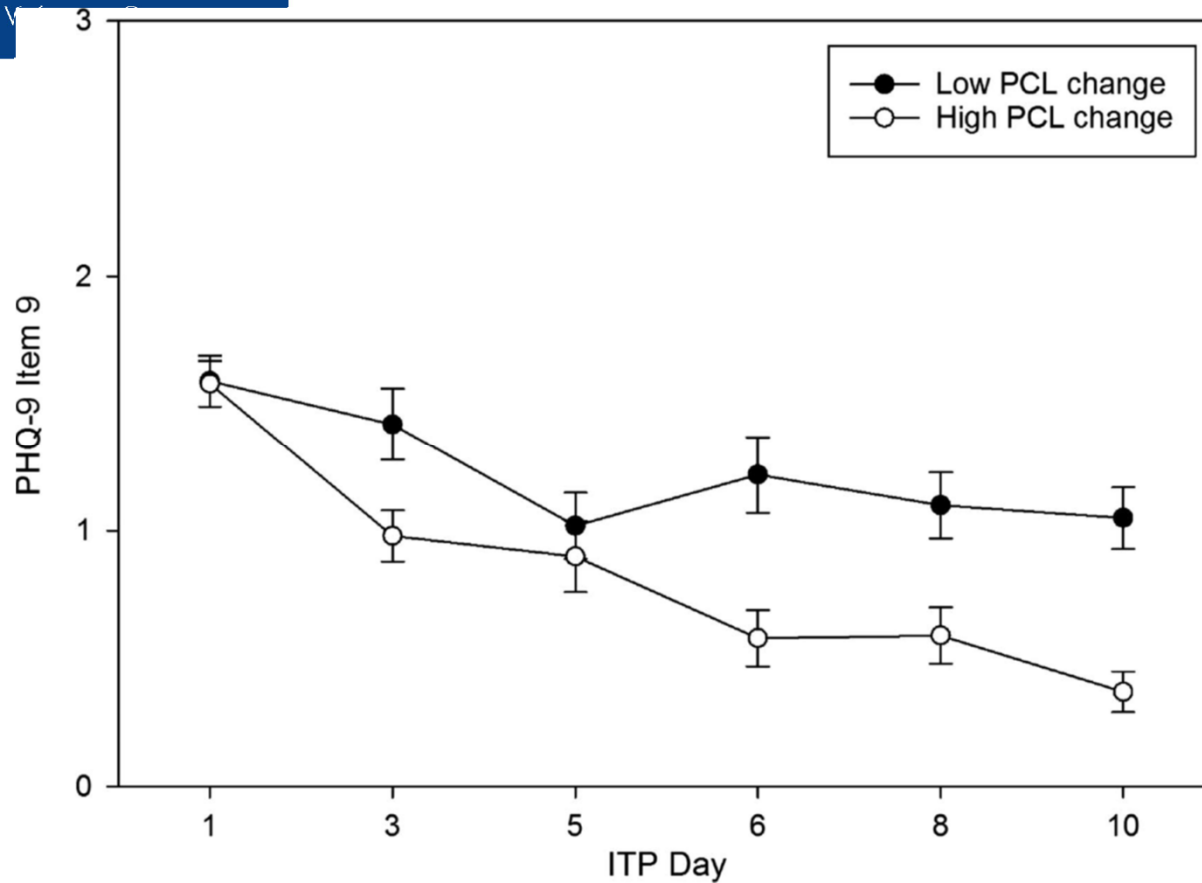
Impact of Intensive Treatment Programs for Posttraumatic Stress Disorder on Suicidal Ideation in Veterans and Service Members

Loren M. Post¹, Philip Held², Dale L. Smith², Kathryn Black¹,
Rebecca Van Horn², Mark H. Pollack², Barbara O. Rothbaum¹,
and Sheila A. M. Rauch^{1, 3}

¹ Department of Psychiatry and Behavioral Sciences, Emory University School of Medicine

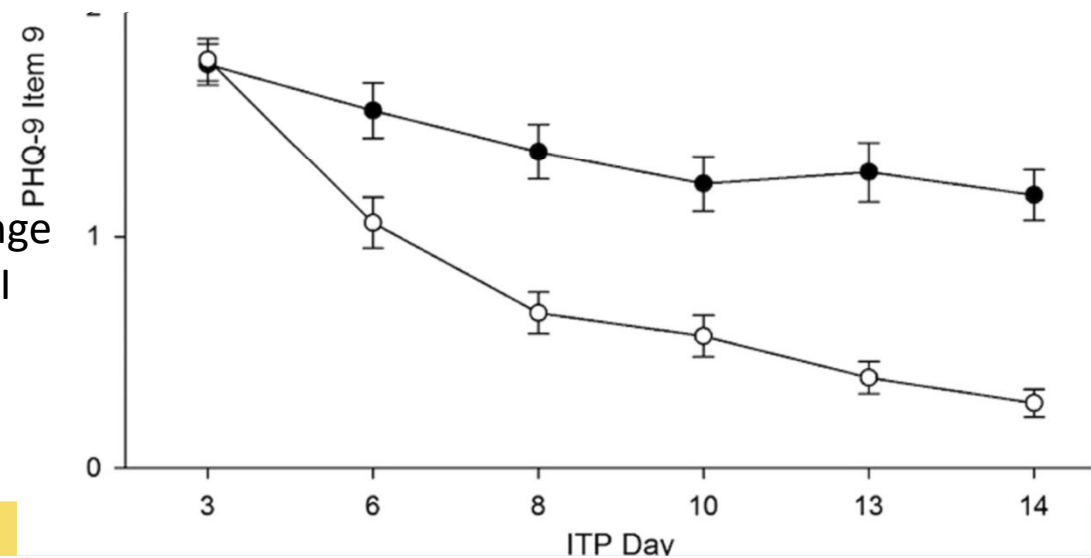
² Department of Psychiatry and Behavioral Sciences, Rush University Medical Center

³ Atlanta VA Healthcare System, Mental Health Service Line, Decatur, Georgia, United States



Associations Between PTSD Symptom and SI Change Across PE-ITP Among Individuals with Elevated SI

Associations Between PTSD Symptom and SI Change Across CPT-ITP Among Individuals with Elevated SI





EMORY
HEALTHCARE

Veterans Program

Substance Use Disorder Track for Intensive Outpatient Program

EHVP SUD Track Summary

- *Successfully treat PTSD and SUD concurrently*
- Number of days abstinent increases
- Number of days binge drank decreases
- PTSD improves
- Depression improves
- Maintain gains



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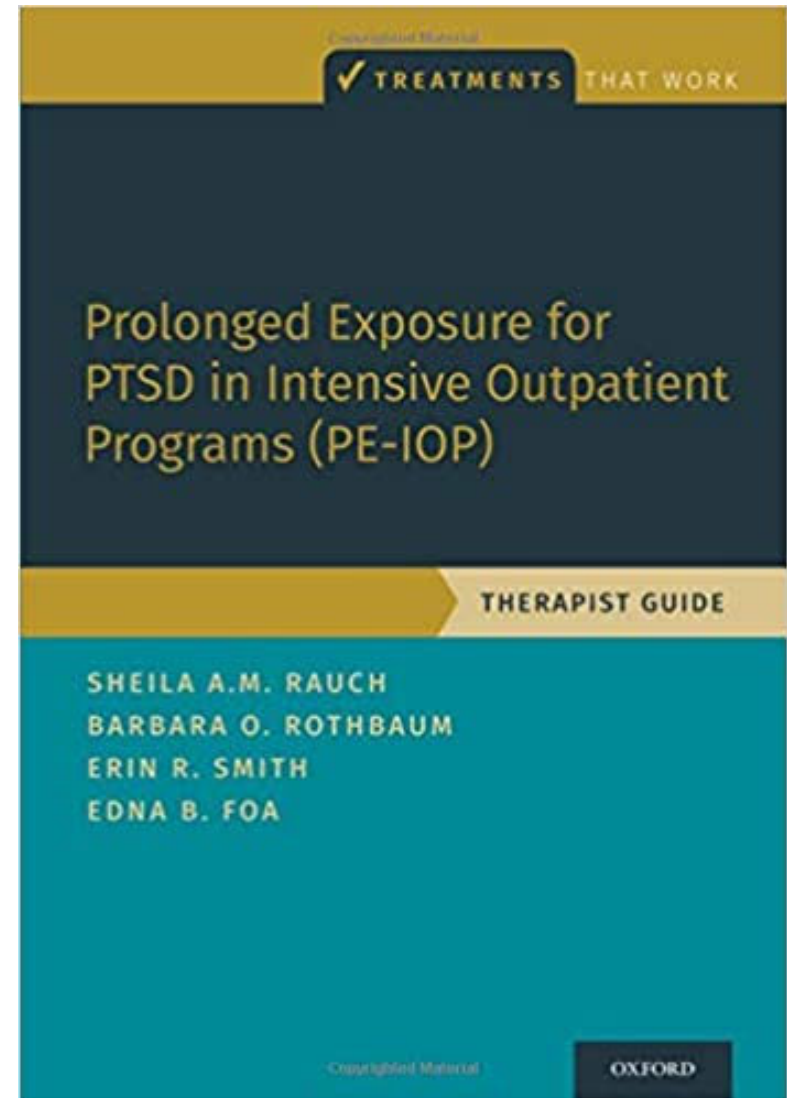
Veterans Program

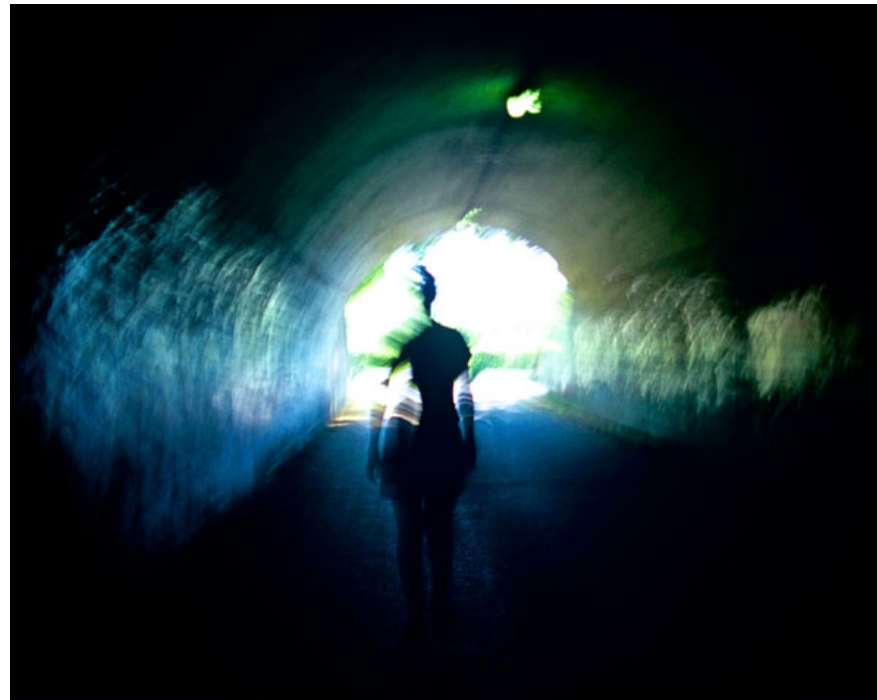
TBI IOP Track

EHVP TBI Track Summary

- *Successfully treat PTSD and TBI concurrently*
- TBI symptoms decrease
- PTSD improves
- Depression improves
- Maintain gains

Prolonged Exposure for PTSD in Intensive Outpatient Programs (PE-IOP): Therapist Guide (TREATMENTS THAT WORK)





PTSD

WHAT EVERYONE NEEDS TO KNOW®

BARBARA OLASOV ROTHBAUM
and SHEILA A.M. RAUCH

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