

# Integrative approach to PTSD and aggression

---

D. Kozarić-Kovačić, M. Grubišić-Ilić, I. Marinić

University Hospital Dubrava  
Department of Psychiatry  
Referral Centre for the Stress-related Disorders  
of the Ministry of Health and Social Welfare  
Regional Centre for Psychotrauma Zagreb



# Definitions

---

- aggression
  - not easily defined
  - refer to verbal aggression, physical aggression towards people or objects



# Definitions

---

- includes the intent to harm or otherwise injure another person
- different types of behaviors are aggressive even though they do not involve physical injury (verbal aggression, coercion, intimidation, social ostracism...)¹
- some authors include self directed aggression
- violence – physical aggression towards other person

---

¹Sadock BJ, Sadock VA. Kaplan and Sadock's synopsis of psychiatry : behavioral sciences, clinical psychiatry. Philadelphia, PA: Lippincott Williams & Wilkins; 2002

# Predictors of aggression

---

- aggressive acts – mostly against persons they know
  - probability of aggressive behavior increases when
    - person become psychologically decompensated, or
    - when the onset of a mental disorder is rapid
  - **any given set of conditions that are increasing aggressive impulses and decreasing self control can lead to aggressive acts**
-

# Predictors of aggression

---

- some predictors of dangerousness to others<sup>1</sup>
  - high degree of intent to harm
  - presence of a victim
  - frequent and open threats
  - concrete plan
  - access to instruments of violence
  - history of loss of control
  - chronic anger, hostility or resentment
  - enjoyment in watching or inflicting harm
  - lack of compassion



---

<sup>1</sup>Sadock BJ, Sadock VA. Kaplan and Sadock's synopsis of psychiatry : behavioral sciences, clinical psychiatry. Philadelphia, PA: Lippincott Williams & Wilkins; 2002

# Predictors of aggression

---

- some predictors of dangerousness to others (cont)
    - self view as a victim
    - resentful of authority
    - childhood brutality or deprivation
    - decreased warmth and affection in home
    - early loss of parent
    - fire setting, bed wetting and cruelty to animals
    - reckless driving
  - the best predictor is a history of violent behavior
-

# Predictors of aggression

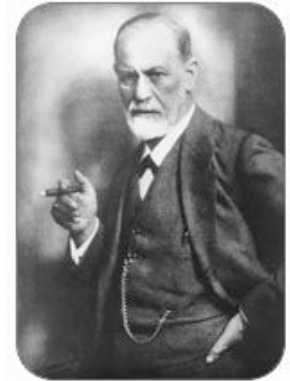
---

- also important
    - psychiatric disorders with delusions and hallucinations
    - alcohol or drug intoxication, abuse or dependence
    - lack of impulse control
    - antisocial personality traits
    - environmental factors – family or social environment
-

# Psychological factors

---

## *Instinctive behavior*



- S. Freud
    - different views
    - aggression – stems from the redirection of the self destructive death instinct away from the self and toward others
  - K. Lorenz
    - aggression – from a fighting instinct that humans share with other organisms
-

# Psychological factors

---

## *Learned behavior*

- aggression is a learned form of social behavior
    - acquired and maintained as other forms of activity
  - A. Bandura
    - persons engage in assaults because they
      - acquired aggressive responses through past experience
      - receive or anticipate various forms of reward for such actions
      - directly instigated to aggression by specific social or environmental conditions
-

# Social factors

---

## *Frustration*

- the single most potent means of inciting human beings to aggression
- frustrated persons do not always respond with aggression
  - resignation, depression, despair



# Social factors

---

- important factors
    - frustration increase aggression when the frustration is intense, and
    - frustration is likely to facilitate aggression when it is perceived as arbitrary or illegitimate
-

# Social factors

---

## *Direct provocation*

- physical or verbal abuse

## *Television violence*

- link between aggression and exposure to televised violence

## *Environmental factors*

Noise

Crowding

---



# Situational factors

---

## *Physical arousal*

- competitive activities
- exercise
- provocative films

## *Sexual arousal*

## *Pain*

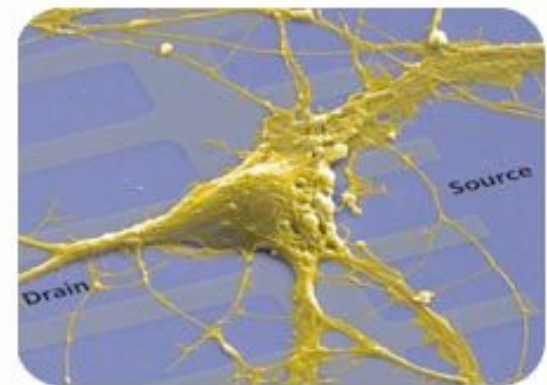
- may lead to aggression against any target – including the ones that are not involved in persons discomfort
-

# Biological factors

---

## *Neurotransmitters<sup>1</sup>*

- **induction of aggression – cholinergic and catecholaminergic systems**
- inhibiting aggression – serotonergic and GABA systems



---

<sup>1</sup>Sadock BJ, Sadock VA. Kaplan and Sadock's synopsis of psychiatry : behavioral sciences, clinical psychiatry. Philadelphia, PA: Lippincott Williams & Wilkins; 2002

# Biological factors

---

- dopamine facilitate aggressive behavior
  - androgen levels – testosterone
    - some studies showed that increased levels in males are linked with social aggressivity, not necessarily with violence
-

# Biological factors

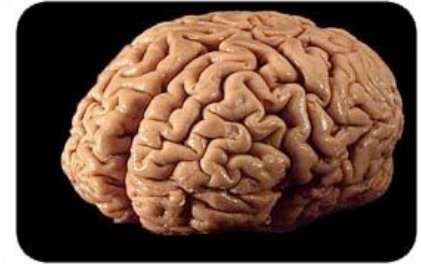
---

- serotonin
    - increasing serotonergic activity → decreasing violence outbursts in psychiatric patients
    - persons with the history of violent behavior → lower CSF serotonin levels
    - some authors point out on increased levels of testosterone and lowered serotonin
    - borderline personality disorders – deficits in central serotonergic function
-

# Biological factors

---

## *Neuroanatomical bases*



- model by Davidson et al.<sup>2, 3</sup>
  - impulsive aggression – arising from dysfunction in a set of interrelated brain structures that regulate emotional processing and reactivity
    - including the prefrontal cortex (orbitofrontal and ventromedial), the anterior cingulate cortex and subcortical-limbic structures (amygdala, hippocampus and hypothalamus)

---

<sup>2</sup>Davidson RJ, Putnam KM, Larson CL. Dysfunction in the neural circuitry of emotion regulation--a possible prelude to violence. *Science*. 2000 Jul 28;289(5479):591-4.

<sup>3</sup>Patrick CJ. Psychophysiological correlates of aggression and violence: an integrative review. *Philos Trans R Soc Lond B Biol Sci*. 2008 Aug 12;363(1503):2543-55.

# Biological factors

---

- subcortical elements play a primary role in activating emotional states, whereas the anterior cingulate and prefrontal cortices detect circumstances under which affective control is needed and to implement control processes
  - repetitive episodes of impulsive aggression reflect a breakdown in the normal capacity to recognize and respond to signals of possible provocation as they arise and/or to modulate defensive reactivity
-

# Posttraumatic stress disorder

---

- DSM IV criteria
    - A. the person has been exposed to a traumatic event
    - B. the traumatic event is persistently reexperienced
    - C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness
-

# Posttraumatic stress disorder

---

- D. Persistent symptoms of increased arousal
    - difficulty falling or staying asleep
    - **irritability or outbursts of anger**
    - difficulty concentrating
    - hypervigilance
    - exaggerated startle response
  - E. duration more than 1 month
  - the disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning
-

# Stressor

---

- stressor alone does not suffice to cause the disorder<sup>1</sup>
- important preexisting
  - biological factors
  - psychosocial factors
  - events before and after the trauma

---

<sup>1</sup>Sadock BJ, Sadock VA. Kaplan and Sadock's synopsis of psychiatry : behavioral sciences, clinical psychiatry. Philadelphia, PA: Lippincott Williams & Wilkins; 2002

# Risk factors

---

- childhood trauma
  - personality disorder traits (borderline, paranoid, dependent, antisocial)
  - low social support
  - female gender
  - genetic vulnerability
  - stressful life changes
  - external locus of control (natural cause) rather than internal (human cause)
  - excessive alcohol intake
-

# Biological factors

---

- stress leads to acute and chronic changes in neurochemical brain systems – which lead to long term changes in brain circuits involved in stress response<sup>4</sup>
- different biological models of PTSD<sup>5</sup>

---

<sup>4</sup>Vermetten E, Bremner JD. Circuits and systems in stress. II. Applications to neurobiology and treatment of PTSD. *Depress Anxiety*. 2002;16:14-38.

<sup>5</sup>Pivac N, Kozarić-Kovačić D. *Neurobiology of PTSD*. Amsterdam: IOS Press; 2007. str. 41-62.

# Biological factors

---

## *Neurotransmitters*<sup>1,6,7</sup>

- changes in different neurotransmitter systems
  - noradrenergic
  - dopaminergic
  - serotonergic
  - GABA
  - glutaminergic
  - endogenous opiate system
  - HPA (hypothalamus – pituitary – adrenal) axis

---

<sup>1</sup>Sadock BJ, Sadock VA. Kaplan and Sadock's synopsis of psychiatry : behavioral sciences, clinical psychiatry. Philadelphia, PA: Lippincott Williams & Wilkins; 2002

<sup>6</sup>Kozarić-Kovačić D, Pivac N. Novel approaches to the diagnosis and treatment of posttraumatic stress disorder. Amsterdam: IOS Press; 2007. str. 41-62.

<sup>7</sup>Bremner JD. Dialogues in Clinical Neuroscience. 2006;8(4):445-61.

# Biological factors

---

## *Neuroanatomy*<sup>8</sup>

- relatively consistent findings of increased amygdala responsiveness in patients with PTSD
- because of heightened responsiveness of the basic threat circuitry – suggestion of the increased risk for reactive aggression in PTSD patients
- threat stimulus that might elicit freezing in a healthy individual – more likely to elicit reactive aggression in a PTSD patient
  - because the basic threat system is primed to respond by the earlier trauma

---

<sup>8</sup>Crowe SL, Blair RJ. The development of antisocial behavior: what can we learn from functional neuroimaging studies? Dev Psychopathol. 2008 Fall;20(4):1145-59.

# Biological factors

---

- also associated with decreased responding within regions of the middle prefrontal cortex<sup>8</sup> and orbitoprefrontal dysfunction<sup>9</sup>
- given that these frontal regions may regulate the responsiveness of the basic threat circuitry
  - possible that the increased risk for reactive aggression in PTSD patients reflects a reduction of this frontal regulation

---

<sup>8</sup>Crowe SL, Blair RJ. The development of antisocial behavior: what can we learn from functional neuroimaging studies? Dev Psychopathol. 2008 Fall;20(4):1145-59.

<sup>9</sup>Dileo JF, Brewer WJ, Hopwood M, Anderson V, Creamer M. Olfactory identification dysfunction, aggression and impulsivity in war veterans with post-traumatic stress disorder. Psychol Med. 2008 Apr;38(4):523-31.

# Biological factors

---

- important distinction – individuals with psychopathic tendencies are at increased risk for reactive and instrumental aggression<sup>8</sup>
  - difference
    - psychopathy is associated with decreased amygdala responsiveness, whereas PTSD is associated with increased amygdala responsiveness
    - therefore dysfunction occurring in psychopathy - incompatible with that observed in PTSD

---

<sup>8</sup>Crowe SL, Blair RJ. The development of antisocial behavior: what can we learn from functional neuroimaging studies? Dev Psychopathol. 2008 Fall;20(4):1145-59.

# PTSD and aggression

---

- similarities – from basic to higher functioning
    - neuroanatomical circuits
    - neurotransmitters (catecholaminergic systems – norepinephrine)
    - physical arousal
    - frustration and social factors
-

# Our studies

---

- recent study on association of PTSD diagnosis and aggressive traits
    - inpatients treated in Department of psychiatry, University hospital Dubrava
    - part of the larger study, results not yet published
-

# Our studies

---

- for this study information from each patient was collected using
  - structured psychiatric interview
  - psychiatric and psychological scales
    - Clinician-Administered PTSD Scale (CAPS)<sup>9</sup>
    - Minnesota Multiphasic Personality Inventory-2 – MMPI-2<sup>10</sup>

---

<sup>9</sup>Blake DD, Weathers FW, Nagy LM, Kaloupek DG, Gusman FD, Charney DS, et al. The development of a Clinician-Administered PTSD Scale. J Trauma Stress. 1995;8:75-90.

<sup>10</sup>S.R. Hathway, J.C. McKinley, Minnesota multiphasic personality inventory, 1st ed., University of Minnesota, Minneapolis, MN, 1989.

# Our studies

---

- diagnosis was made by the psychiatrist using DSM IV TR classification<sup>11</sup>
- study included 216 patients
  - PTSD patients (n=161)
  - other psychiatric diagnoses (depression, anxiety disorders) (n=55)

---

<sup>11</sup>American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders : DSM-IV-TR. 4th ed. (text revision) Washington, DC: American Psychiatric Association; 2000.

# Our studies

---

- possible associations between aggressive items and PTSD diagnosis
    - CAPS item 14 - irritability or outbursts of anger
    - MMPI
      - ASP – antisocial behavior
      - CYN – cynicism
      - ANG – anger
      - PD – psychopathic deviation
-

# Our studies

---

- results

---

|       | Items                              | <i>p</i>    |
|-------|------------------------------------|-------------|
| MMPI2 | Antisocial behavior                | ,824        |
|       | Cynicism                           | ,085        |
|       | Anger                              | ,941        |
|       | Psychopathic deviation             | ,940        |
| CAPS  | Irritability or outbursts of anger | <b>,002</b> |

---

# Our studies

---

- results
    - only CAPS D criterion - Irritability or outbursts of anger was found as significantly statistically different between two groups
    - MMPI 2 cynicism item close, but not significant
-

# Our studies

- similar as our previous studies - where CAPS criterion D (hyperarousal symptoms) was shown as linked with PTSD diagnoses<sup>12</sup>

| Z-score | Attribute                                                                                            |
|---------|------------------------------------------------------------------------------------------------------|
| 221.43  | CAPS criterion D (hyperarousal symptoms)                                                             |
| 190.53  | CAPS total score                                                                                     |
| 164.48  | PANSS additional criteria score (anger, difficulty in delaying gratification and affective lability) |
| 148.10  | group of comorbid diagnoses – neurotic, stress-related, and somatoform disorders                     |
| 141.78  | CAPS criterion C (avoidance symptoms)                                                                |

<sup>12</sup>Marinić I, Supek F, Kovacic Z, Rukavina L, Jendricko T, Kozarić-Kovačić D. Posttraumatic stress disorder: diagnostic data analysis by data mining methodology. Croat Med J. 2007 Apr;48(2):185-97.

# Our studies

- similar as our previous studies – results from the technological project, not published

| Combination of characteristics |                                                  |                                           | Sens. (%) | Specif. (%) |
|--------------------------------|--------------------------------------------------|-------------------------------------------|-----------|-------------|
| Rule                           | Characteristic 1                                 | Characteristic 2                          |           |             |
| 1.                             | MPTSD more than 138.5                            | weighted CAPS total score more than 161.0 | 60.8      | 100.0       |
| 2.                             | CAPS C avoidance<br>an numbing<br>more than 19.5 | percentage of disability more than 19.5   | 47.1      | 100.0       |
| 3.                             | CAPS D<br>hyperarousal<br>symptoms               | hypnotics in therapy                      | 52.9      | 100.0       |
| Total                          |                                                  |                                           | 90.2      | 100.0       |

# Conclusions

---

- possible explanation
    - patients are under continuous psychiatric care
    - improvement in some symptom clusters
    - have social support
    - improvement of socioeconomic status
    - suicidal behavior – diagnosed in a small number of veterans
    - more/less socially compensated in a stable and protective environment
-

# Conclusions

---

- but – underlying biological features cause irritability or outbursts of anger
  - therefore – importance of long term integrated health care
-

---

Thank you for your attention!

---

# The Use of Virtual Reality in the Continuum of Care for the Warfighter

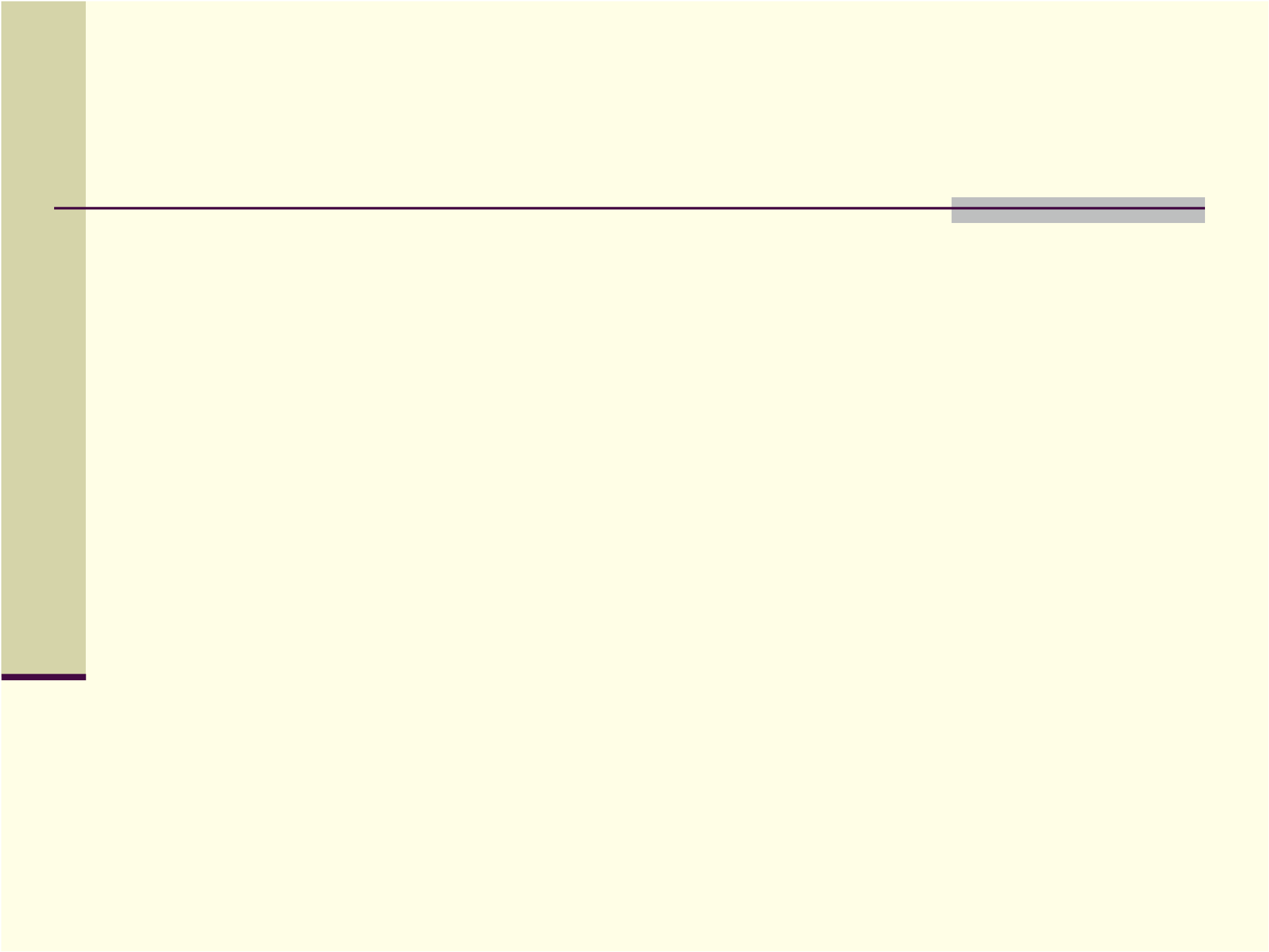
Dennis Wood, PhD, and Brenda Wiederhold, PhD  
Virtual Reality Medical Center

*Presented by  
Jim Spira, PhD, MPH, RTI International*



*This workshop  
is supported by:*

The NATO Science for Peace  
and Security Programme





# ***SELECT PROJECTS & PRODUCTS***

Selected examples of the projects and products VRMC and its partners have developed or are developing, include:

- Stress Inoculation Training
- Injury Creation Science
- Combat Medic Training
- Mixed Reality Rehabilitation
- Cognitive Rehabilitation
- Post Traumatic Stress Disorder Treatment
- Pain Distraction Treatments



*This workshop  
is supported by:*

**The NATO Science for Peace  
and Security Programme**

# Overview

---

- Continuum of Care
  - Support across the range of problems associated with wounds of war
    - *Polytrauma vs “pure PTSD”*
  - Support throughout the deployment cycle
    - Predeployment
    - Combat Deployment
    - Post-deployment
- Current Progress, Barriers, and Future Directions



*This workshop  
is supported by:*

The NATO Science for Peace  
and Security Programme

# Assisting Throughout the Deployment Cycle

---

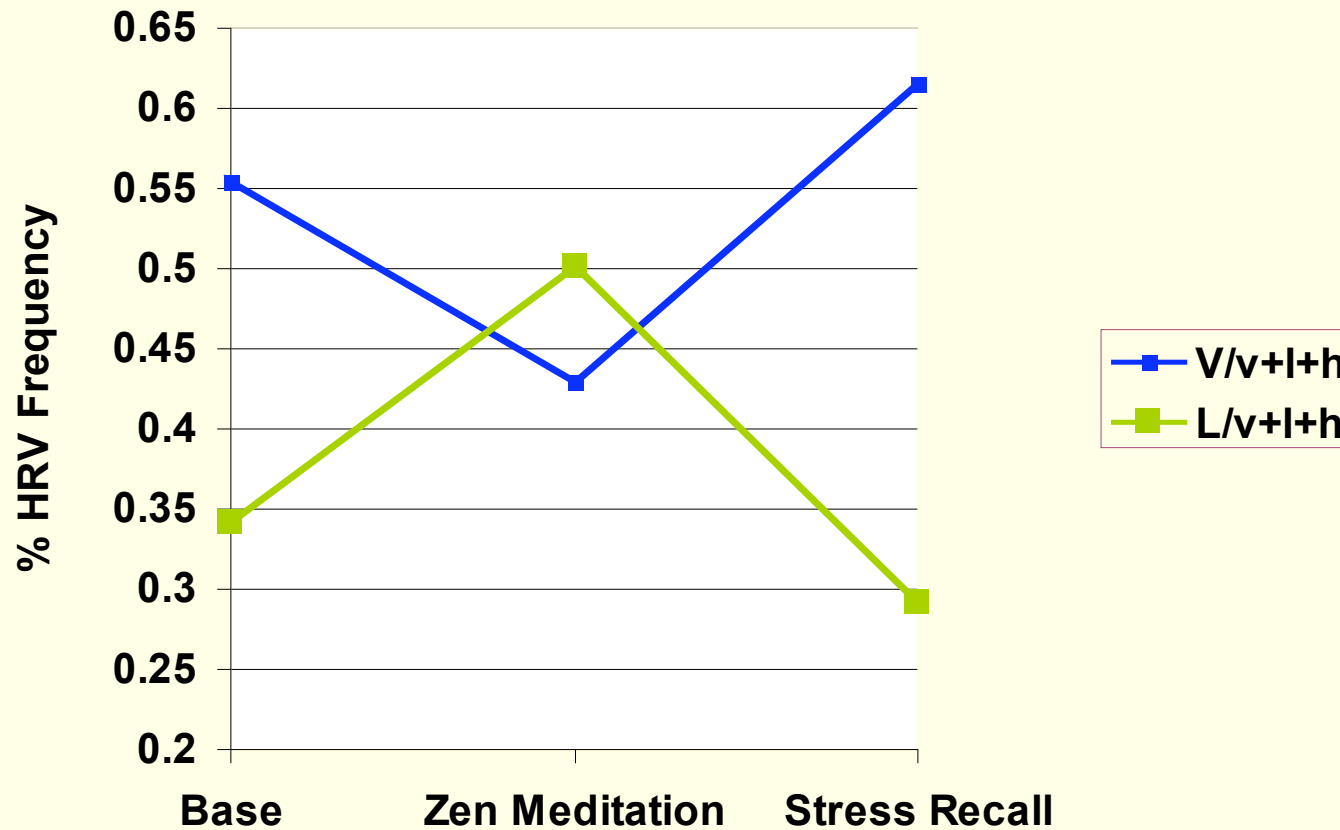
- Primary Prevention
  - Preventing PTSD
  - Assessing who is at greatest risk
    - For development of PTSD
    - For treatment type and resistance
- Secondary Prevention
  - Monitoring those at greatest risk
  - Preventing worsening Sx for those at greatest risk

# Two Approaches to Stress Inoculation

---

- 1) Exposure Only
  - Leading to arousal habituation
  - Very specific to that situation
  
- 2) Arousal Control and Attentional Focus
  - Leads to recognition and control of ANS
  - Trains one to recognize distraction and stay absorbed in the mission at hand
  - Generalizable to multiple situations

## Heart Rate Variability Frequency Distribution During 5" of Baseline, Zen Meditation and Stress Recall



26 consecutive patients referred for Stress Management. 1<sup>st</sup> session data  
Spira, 2006: Funded by Dept of the Navy

# Primary Prevention

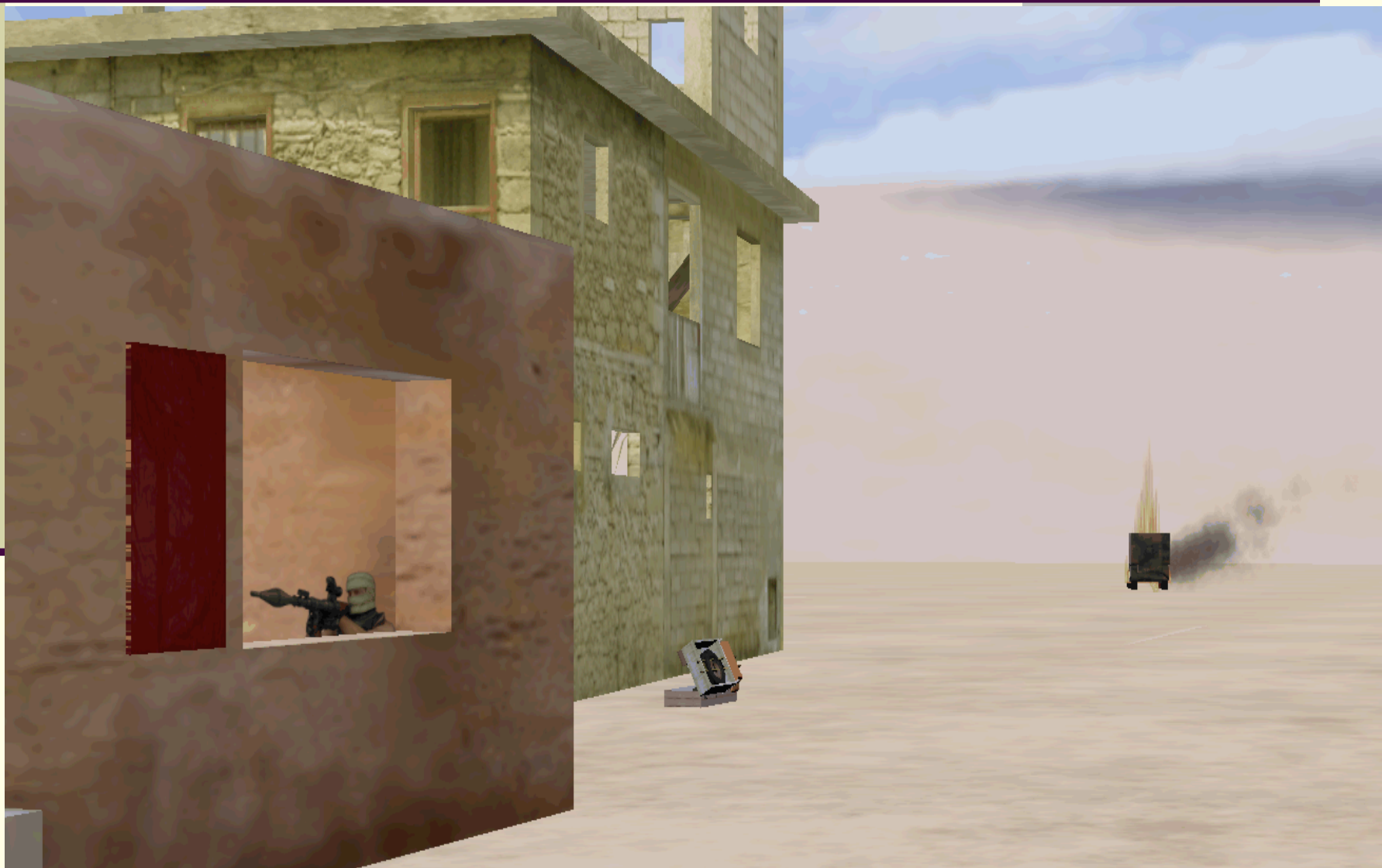
## Pre-deployment Stress Inoculation Training (ONR)

- 800 Marines – part of predeployment workup
- Assess with HRV and RT during a virtual mission
- RCT:
  - ½ lecture only
  - ½ Zen practice
- Field practice
- Re-assess
- Follow for reduced rates of PTSD post deployment
- Preliminary Findings:
  - HRV and speed/accuracy both improve in the first 30 Tx group v control group



# Pre-SIT (video RT task)

---



# IIT (CP) Iraqi Village Training



# Primary Prevention

---

- Handheld Technology for Personal Monitoring and Intervention Devices:
  - **ANAM** (DoD): Baseline neuropsychological testing with (and in context), in country (if a TBI), and upon return (to determine risk for PTSD based on poor cognitive functioning)
  - **StressEraser** (APA) personal biofeedback device
    - Useful in the field (or returning home) to improve sleep and recuperate from stressful periods
  - **iPhone/iTouch & Windows Mobile 6.0** (CDMRP) for assessment and intelligent streaming support
    - Useful for assessing in real time and offering support needed in that moment (HRV-stress; Sleep; intrusive thoughts, etc.)

# Secondary Prevention

---

## ■ Wounded Warrior Family Resiliency Program (BUMED)

- For about \$250/family, we were tasked with helping 5000 wounded warriors and their primary support person.
- Assess each service member and family member on a 20 minute web based assessment, f/u every three months.
- Case manager calls (webcam or phone) to discuss results, and triage into specific workshops (or, if severe, to healthcare in their area) based on areas of concern or interest by participants.
- A general (normalizing) 90 minute introduction, followed by several different 4-week groups 60 minute groups (depending upon need).
- Workshops are Psycho-Educational webcam based interactive groups
  - Introducing a general principles (such as communication in relationships, or adapting from what's appropriate for a war environment to what's important for a home-life mentality),
  - Exercises to individualize for each person
  - Discussion to work on what interferes with implementing this.

# Secondary Prevention

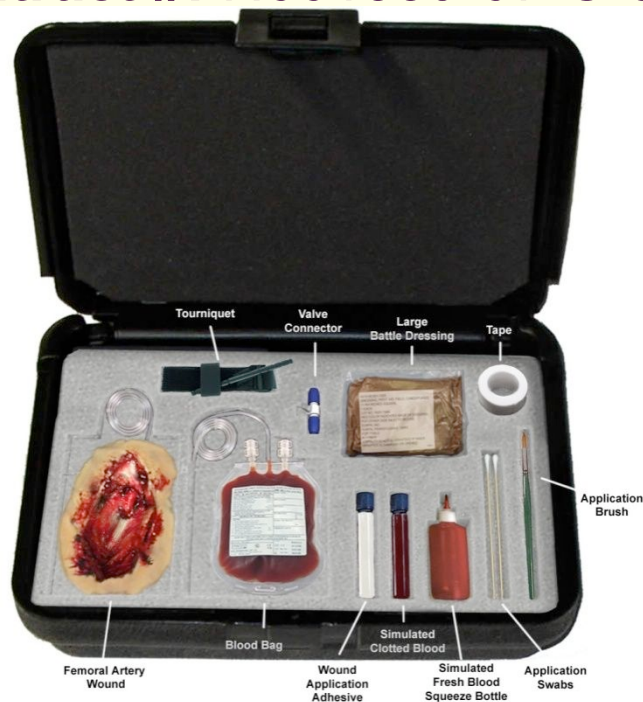
---

- Wounded Warrior Family Resiliency Program
  - Web-cam internet based groups to bring geographically separated families together, or to bring families who are distant from therapeutic centers together with the therapist and peers.
  - Web-based assessments and support (streaming audio-video support; homework assignments, and chat rooms for graduates of programs).
  - Hoping to add additional distance-based programs:
    - Webcam-based meeting for teens to reduce substance abuse (perhaps using 2<sup>nd</sup> life for feasibility)
    - [www.WebKids.Com](http://www.WebKids.Com): Internet-based programs for kids playing therapeutic games with avatars (getting points for correctly identifying feelings of others, choosing the best responses to difficult situations, learning breathing techniques, and other healthy activities. Points help to personalize one's own avatar, and also to enter into new rooms (including chat rooms with others).



# INJURY CREATION SCIENCE

- Validating the effectiveness of improving trauma training skills with a combination of SIT and training with prototype kits of life-like human tissue
- **Deliverable:** Trauma Training Kits
- **Military Relevance:** Advanced medical training tools
- **Endorsements:** U.S. Army, Shands Jacksonville
- **Contract #:** N661339-07-C-0035 (RDECOM STTC)



TATRC



# COMBAT MEDIC

- Developed, tested, and validated a low cost interactive simulation (video game) to augment trauma care training for Army Combat Medics
- Using a commercially available video game engine (Quest 3D), developed an adjunct to the 68W Combat Medic Advanced Skills Training Curriculum (CMAST)
- **Deliverable:** Combat Medic Simulation Trainer
- **Military Relevance:**
  - Simulate the stages of Tactical Combat Casualty Care (TCCC)
  - Care Under Fire, Tactical Field Care, and Combat Casualty Evacuation Care
- **Endorsements:** Office of the Surgeon General (Army) recruiting van



TATRC

# VR for Treating Combat Stress

---

- Virtual Reality Facilitated Exposure Therapy
  - Funded by ONR in 1994
  - Why VR?
    - for this population: concrete (50% had blast injury); therapy averse; enjoys games
  - Three approaches:
    - PE alone
    - VR-PE
    - VR-PE-AC



*This workshop  
is supported by:*

The NATO Science for Peace  
and Security Programme

# VR for Treating Combat Stress

- PE alone
  - Good outcomes with single index trauma from assault and MVA civilian patients (mostly female)
  - May not be directly transferable to mostly male combat related PTSD without requiring modifications, due to:
    - Complex chronic PTSD (multiple co-morbidities, including SA/pain/tbi)
    - No specific index trauma, but an accumulation of stress over many deployments
    - Personality Style (concrete cognition/emotionally blunted; hyper-aroused and flooded with intrusive thoughts and feelings; etc).
    - Problem with drop out rates (as high as 50% in studies of PTSD or with exposure based therapies).



*This workshop  
is supported by:*

The NATO Science for Peace  
and Security Programme

# VR for Treating Combat Stress

---

- PE + Virtual Reality
  - Similar to PE, but therapist controls exposure
  - Reliance upon sustained exposure for treatment efficacy
  - Useful for those who have low visual imagery
  - Useful for those prone to avoidance
  - Benefits include controlling stimuli intensity
  - Effective for phobias
  - Effective for PTSD
  - Effective for combat-related PTSD
- Two small single group studies (one in 1999, one just completed) with combat-PTSD showed 70% clinically significant reductions in PCL scores and more than half no longer meeting PTSD criterion
- However, this was with completers
- 60% drop out rate (half of those after Tx began); no intention to treat

# VR for Treating Combat Stress

---

- PE + Virtual Reality + Arousal and Attentional Control
  - Based upon Stress Inoculation Therapy: skills + situational practice
  - Similar to PE, but therapist controls exposure AND trains patient to control reactivity (before and after each session, & in session prn)
  - Reliance upon control of somatic and cognitive reactivity for treatment efficacy
    - Helps engage patient more fully in therapy
    - Helps with in-vivo homework
    - Helps with daily living (staying more fully engaged v distracted)
  - Effective for phobias; PTSD; combat-related PTSD
  - Effective for a wide range of co-morbid conditions
    - Useful in any situation where one's mental, emotional and physical reactivity need control
      - Pain, insomnia, anger, night terrors, mTBI
      - Waking up with nightmares; hearing a backfire or helicopter in the street

# VR for Treating Combat Stress

---

## Exposure experience

### breaks conditioning

(emphasis on exposure)

(specific to area of concern)

## Arousal control

### brakes the conditioning

(emphasis on skill development)

(Generalizes to many Sx)

## Low Initial Exposure

(build gradually)

## Talk Therapy

## Systematic Desensitization

## Threshold Exposure

(build rapidly to the  
to the extent tolerated)

## Prolonged Exposure alone

(Foa/Rothbaum)

## Prolonged Exposure with Arousal Control

(Spira/Wiederhold)



*This workshop  
is supported by:*

The NATO Science for Peace  
and Security Programme

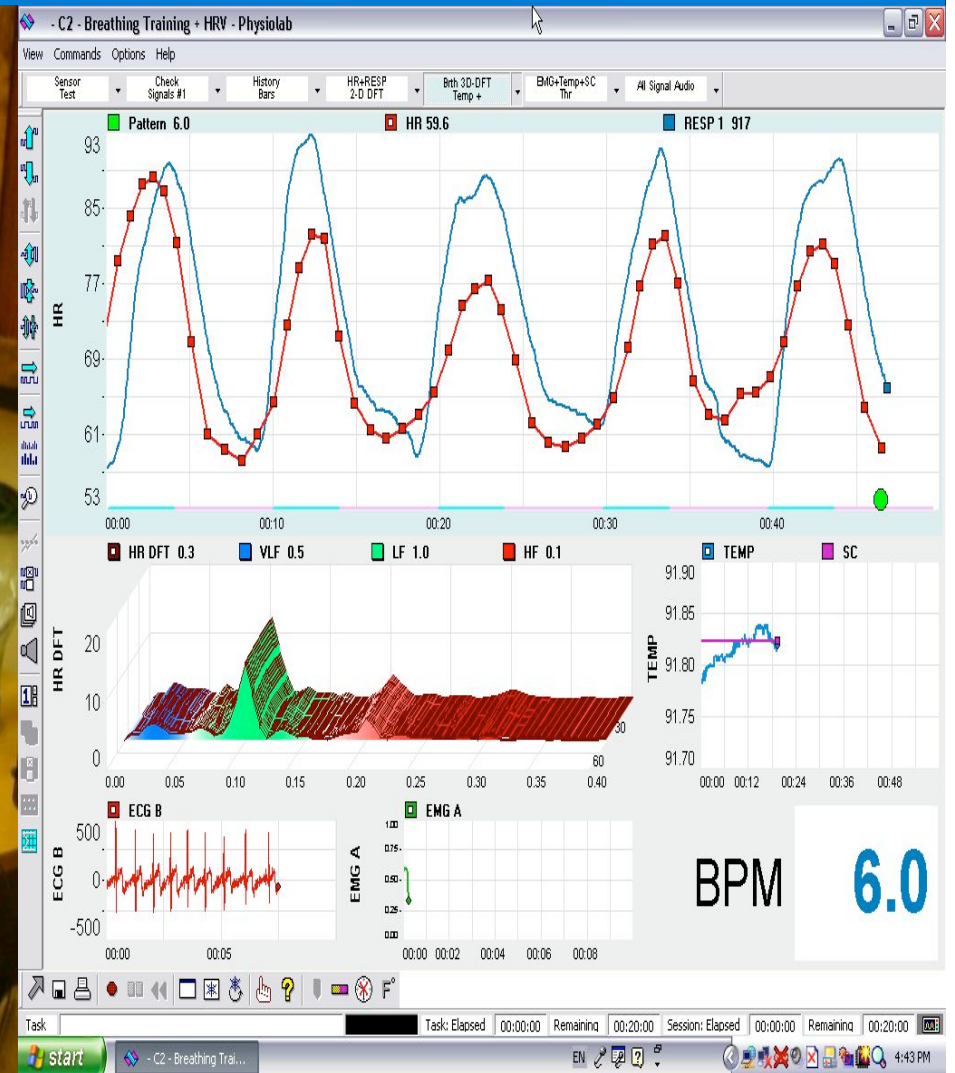
# VR for Treating Combat Stress

---

## Exposure Therapy with Integrated Arousal Control

- Patients are first taught to control their autonomic arousal and attend more fully in the moment
- Once achieved (after the first or second session, and with homework practice), they apply these skills in VR
- Patients are continually physiologically monitored (HRV, SC, Respiration)
- Arousal is observed, allowed to increase to specified parameters, and then patients are asked to decrease their arousal and focus in the moment without reactivity until arousal decreases sufficiently.
- This is repeated continually until patients no longer become significantly aroused during sessions or outside of sessions

# VR EXPOSURE



# VR for Treating Combat Stress

---

- Pilot Results:
  - 22% drop out (intention to treat); but NO drop outs once treatment began;
  - 72% significant decrease in PTSD Sx (PCL-m scores).
- RCT:
  - NO drop outs in Tx condition
  - 70% clinically significant decrease in PTSD (CAPS) in an RCT tx group (vs 10% in non-exposure based TAU).
  - 66% of treated subjects were deemed fit for full duty.
  - 83% of patients significantly improved depression (PHQ-9).
- Less somatically aroused patients were more cognitively engaged during tx.
- Thus, arousal control, when used appropriately, can help patients engage in exposure therapy more fully

# VR for Treating Combat Stress

---

- What is the effect of treatment on autonomic reactivity?



*This workshop  
is supported by:*

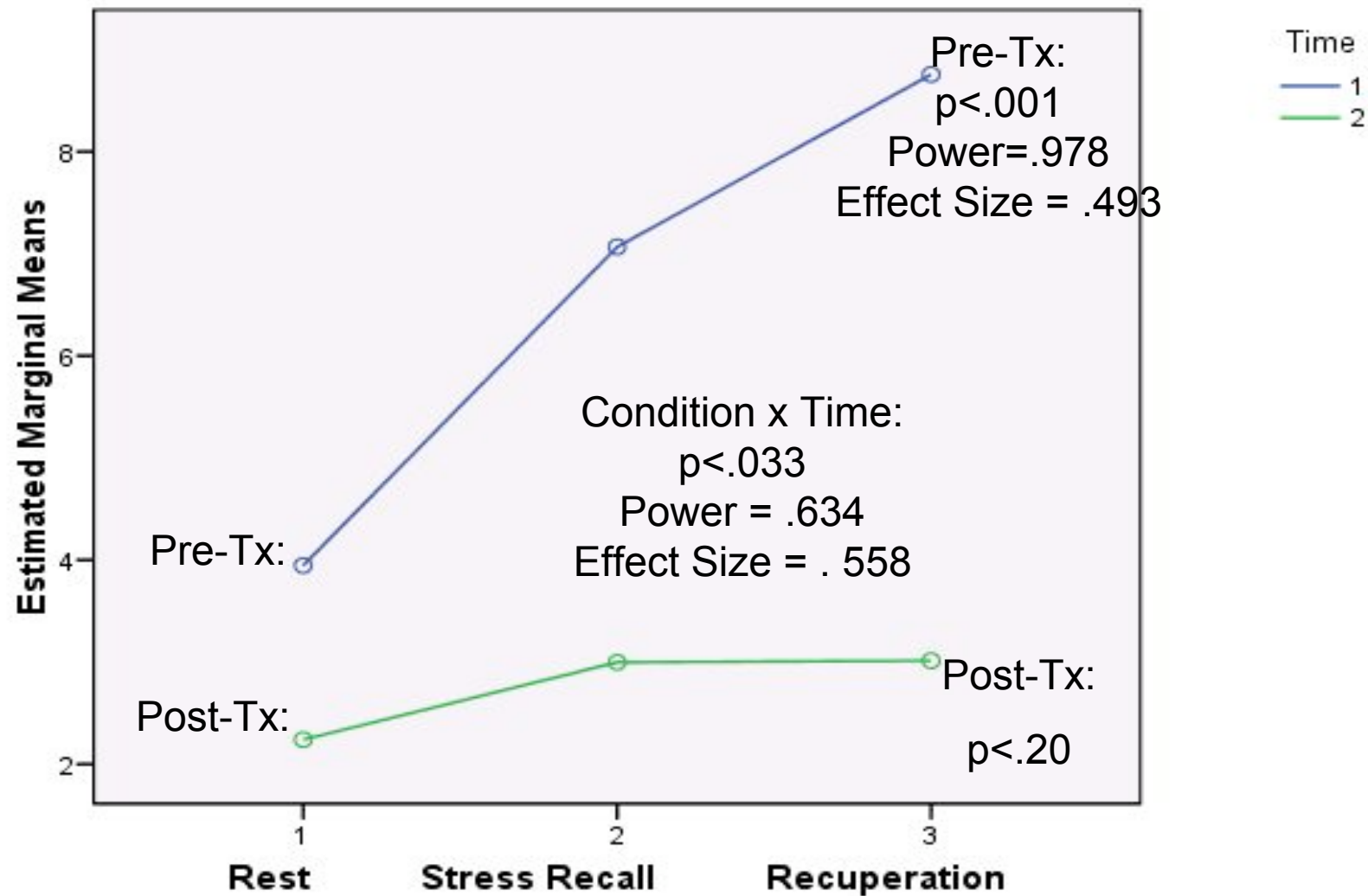
The NATO Science for Peace  
and Security Programme

# Co-morbid Conditions: Effects of blast exposure?

---

- Three conditions were assessed at Study Baseline and Follow-up:
  - 5" **Rest** (sit quietly as we make sure the equipment is working)
  - 5" **Stress Recall** (what are the most troubling thoughts and feelings you have associated with your combat experience?)
  - 5" **Recuperation** (put those thoughts out of your mind and rest as comfortably as you can)

### Condition x Time Repeated Measures



**Skin Conductance over 3 conditions pre and post Tx**

# Co-morbid Conditions: Effects of blast exposure?

---

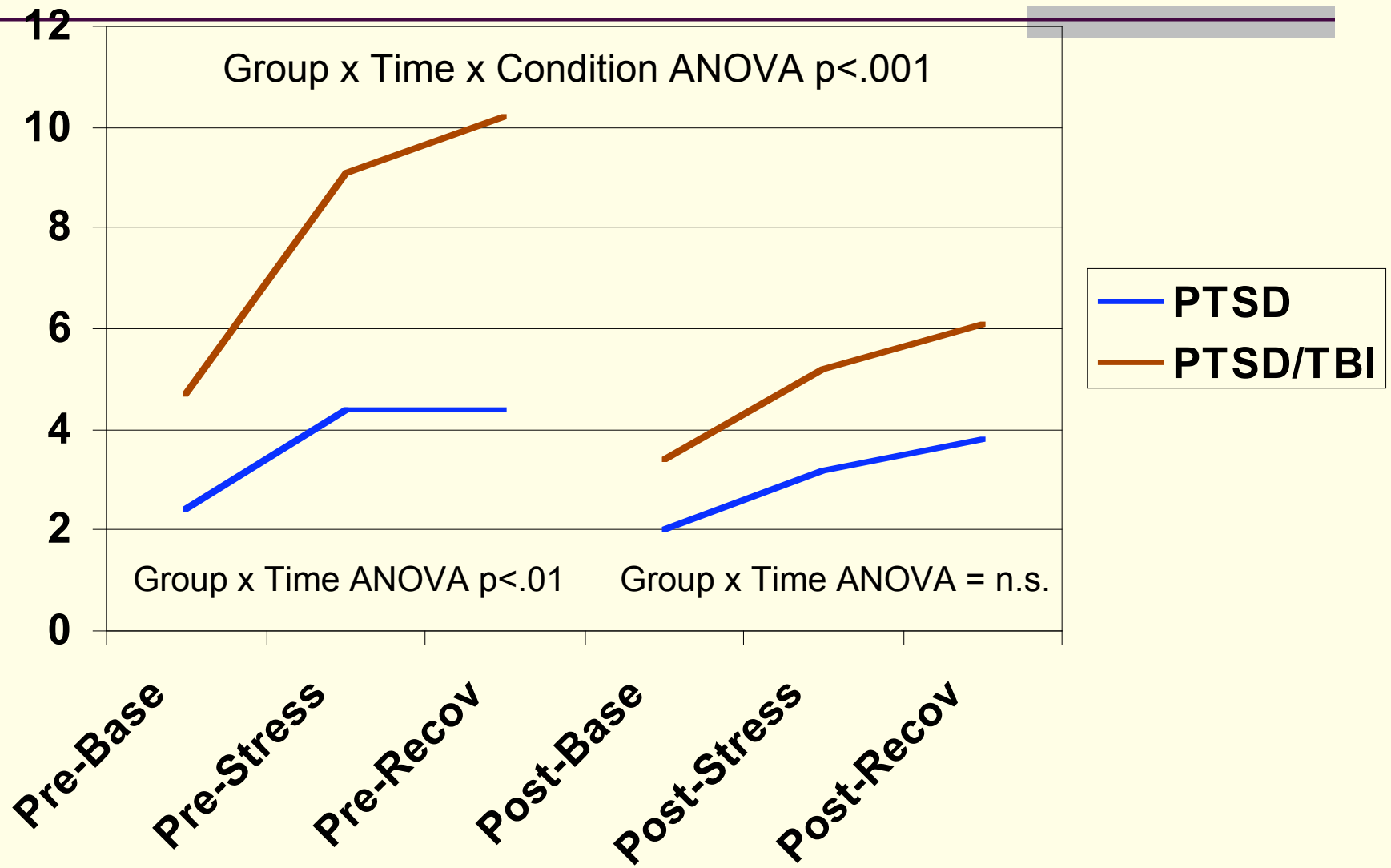
- What is the effect of blast exposure (mTBI) on the ability to control arousal?
- 19/39 patients (49%) of patients with PTSD also were exposed to blast and experienced being “dazed and confused”
- Separate by blast exposure vs no blast exposure

# Effects of Blast Exposure

---

- Regression analysis revealed that *prior to treatment*:
  - the more effects of blast (exposure, dazed and confused, memory loss)
    - the greater the autonomic dysregulation (SC and HRV)
    - the less likely to be able to recover, compared to those with no blast exposure
    - ( $p < .01$ )
  - Exposure treatment with arousal control eliminated these differences

# SC Reactivity per condition for PTSD vs PTSD/mTBI patients Pre vs Post Tx





# DEPLOYED PTSD SYSTEMS



➤ 86% success rate



*This workshop  
is supported by:*

The NATO Science for Peace  
and Security Programme



# ***DEPLOYED PTSD SYSTEMS***

VRMC PTSD systems are currently being used at VA hospitals and medical institutions throughout the country.



Our systems are also currently deployed in Iraq, Poland, and Croatia.

# Optimizing Treatments

---

- The next step (current proposal):
  - N=240, 10 VA sites (systems already in place)
  - CPT vs PE vs VR-PE vs VR-PE-AAC
  - Who benefits most from these approaches?
    - Substance Abusers; Pain; mTBI; Cognitive Style (concrete/reflective); women/men;
  - And in what ways?
    - PTSD Sx/Dx, Drop-out rate; neuro-cognitive functioning; substance use; somatic reactivity; quality of life; relationships; etc.

# Co-morbid Conditions: Effects of blast exposure?

---

- Post Concussive Syndrome stems is associated with sensitivity to light and sound, changes in taste and smell, problems with balance and dizziness, headaches, and problems with STM, focus, confusion, emotional lability, impulsivity, etc.
- Is PCS associated with mTBI (no findings on imaging) that lasts more than six months essentially PTSD, as Hogue and DVBIC have suggested?
  - If so, then treat all PCS>6mo as PTSD
  - If not, then we are condemning these patients to a lifetime of cognitive problems.
    - **If PCS due to mTBI is not treated aggressively with appropriate Cognitive Remediation within the first year (ideally, the first six months), then it is far less likely to resolve.**

## **2008 MHB DoD Anonymous Survey**    *N=32,000 (RTI)*

% respondents reporting 3 or more PCS-PDHA Sx 1yr post- deployment

|                |   | <b>PCL</b>    |              |               |
|----------------|---|---------------|--------------|---------------|
|                |   | <u>&lt;30</u> | <u>31-49</u> | <u>&gt;50</u> |
| <b>Blast</b>   | N | ---*          | pcs**        | PCS***        |
| <b>Exposed</b> | Y | pcs^          | PCS^^        | <b>PCS^^^</b> |

- **\*\*\* Only PTSD: no blast, high PCLs** report many PCS Sx; perhaps somaticising their PTSD, or simply super sensitized to sensations due to sleep deprivation or limbic changes. This supports Hoge's contentions.
- **^Only PCS: Blast exposed, low PCLs** - likely true PCS, can't be easily explained by PTSD. These are the disenfranchised doomed to a lifetime of dysfunction if Sx are dismissed as merely PTSD.
- **Both PCS and PTSD: Blast exposed moderate (^) and high PCL (^^)** report more PCS than can be accounted for by PCLs alone (compared to equivalent levels of PCL in non-blast patients)



# ***MIXED REALITY REHAB***

- Partnered with the University of Central Florida to develop a tool that:
  - Scans in a relevant environment (e.g. kitchen)
  - Lets patients see them moving their real arm and interacting with real objects (e.g. cup) in the virtual environment.
- Used in transitional phases of Physical/Occupational Therapy to improve physical functioning in a realistic situation
- Also useful for providing cognitive rehabilitation for warfighters suffering from TBI



### 1. Participant's Kitchen



### 2. Kitchen Capture:

1. Behavior (Video)
2. Audio (Ambient Surround)
3. Spatial (Visual Laser Scan)



### 6. Embedded Program:

Surround Audio Cues,  
Voice Activation,  
Passive Tracking.

### 5. RECA (Real-time Experience Capture and Analysis):

Performance recording, Data  
Collection, Replay.

3D Audio Simulation

3D Visual Capture

Chroma-Key



4. HEM Kitchen: Experiment  
Design & Trainer GUI and Operation

### 3. Story: Dynamic Scenario Scripting

Virtual Capture:  
Audio, Visual,  
Behavior

Simulated Cues:  
Audio, Visual,  
Spatial

Spatial  
Context:  
(Passive  
Haptic):  
Modular  
Green Screen

# VR in Pain Management

---

- Includes:

- Absorption into the moment

- and away from one's absorption with one's pain
    - Traversing the terrain
    - Game Playing for fuller involvement

- Skill Development

- Relaxation
    - Self-hypnosis
    - Meditation



*This workshop  
is supported by:*

The NATO Science for Peace  
and Security Programme

# The Use of VR in Pain Self Management

---

## ■ Acute Pain

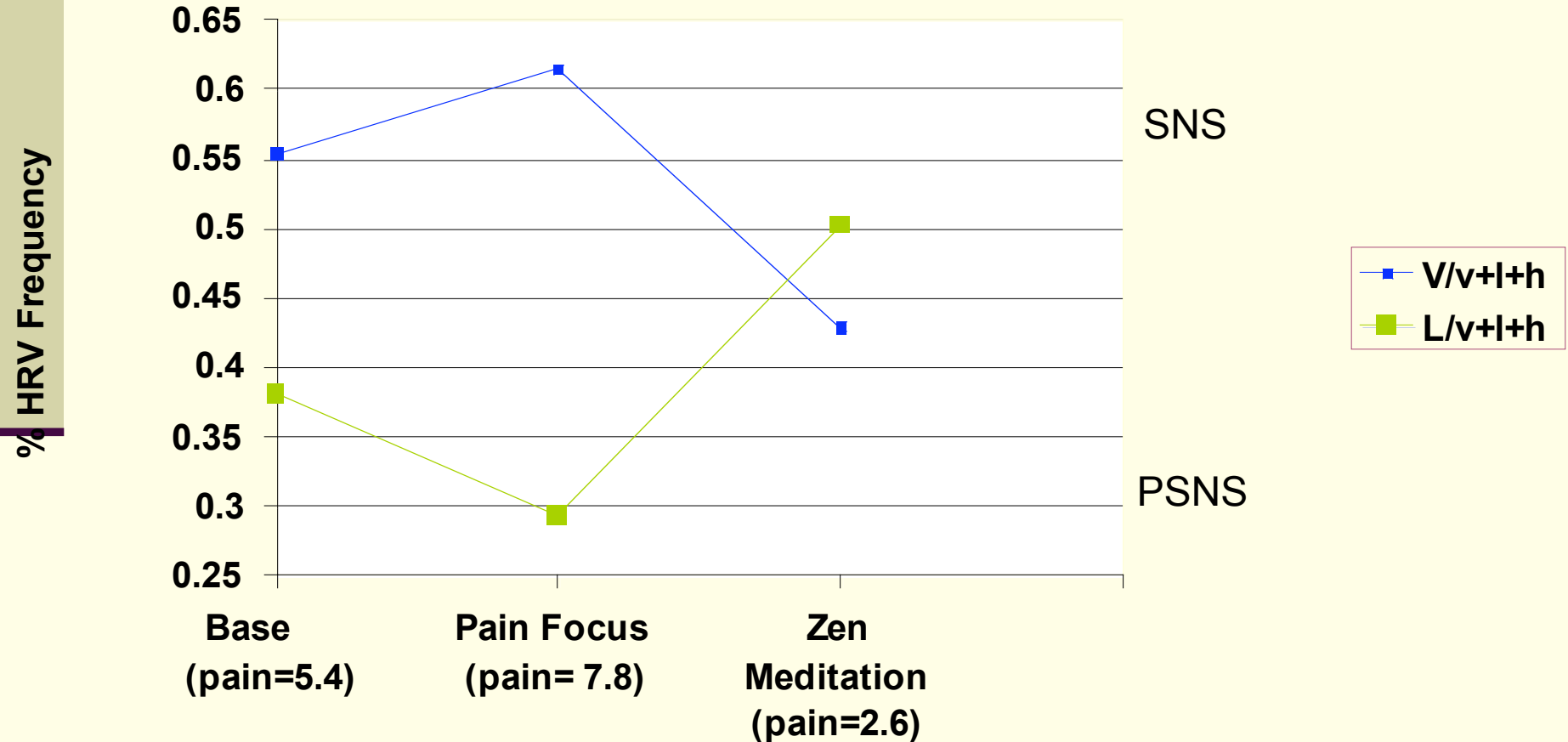
- distraction
- switching modalities
- Skill development

## ■ Chronic Pain

- lessons learned
  - If you have less pain being absorbed in this game, then what can you do to be more absorbed in your daily life activities?
- skills training
  - relaxation
  - Self-hypnosis
  - Meditation (attentional retraining)

# Effectiveness of Meditation for Pain Control

Heart Rate Variability Frequency Distribution During Baseline, Zen Meditation and Pain Focus

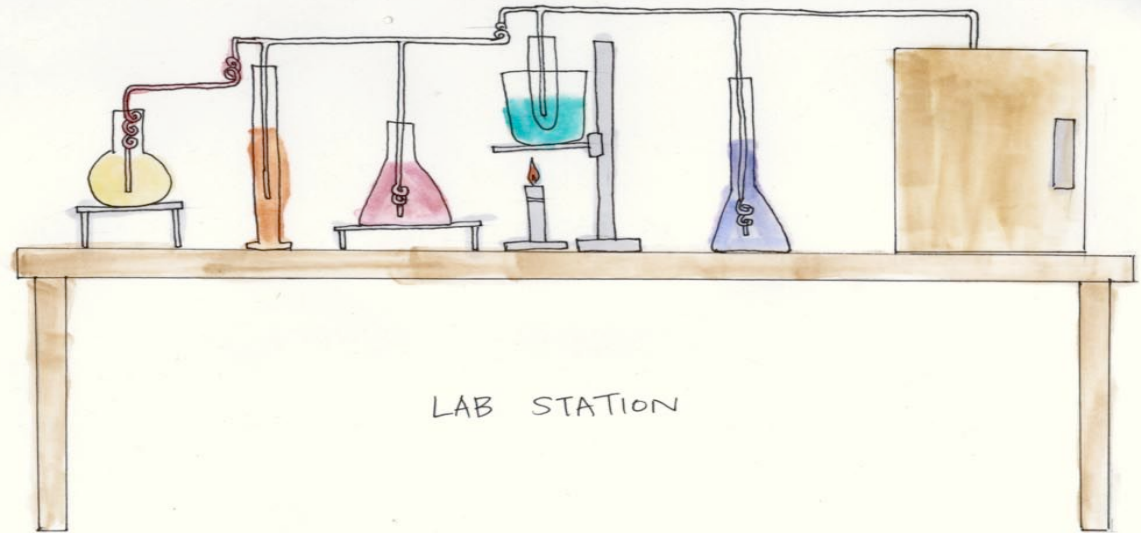
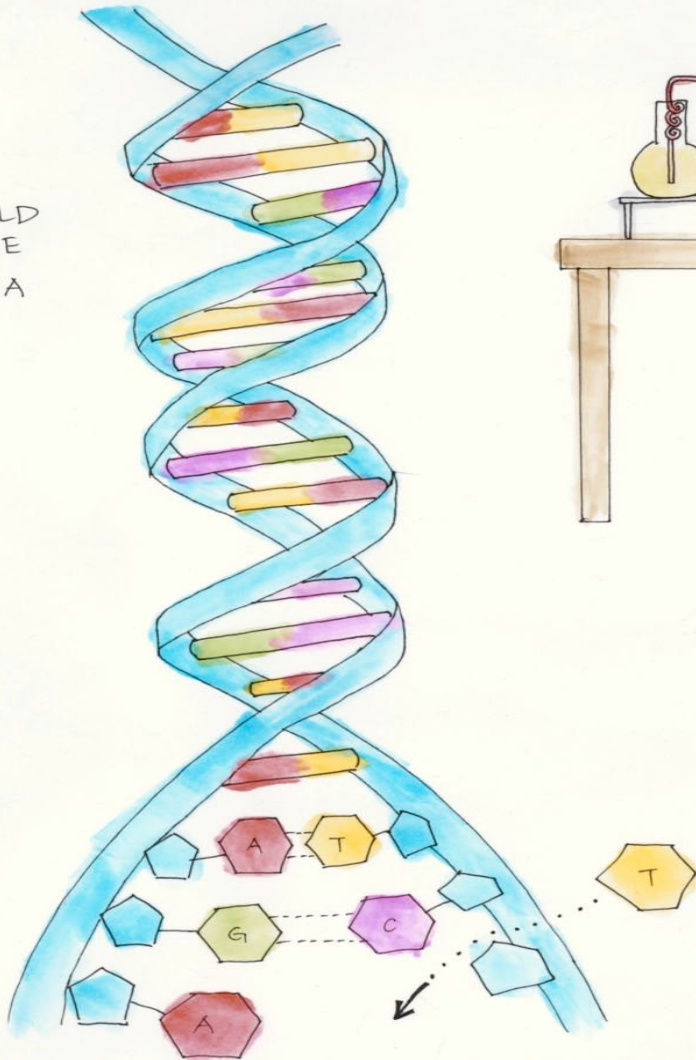


# VR in Pain Management





BUILD  
THE  
DNA



LAB STATION

FANTASY CREATURE



# VR in Pain Management



# VR in Pain Management

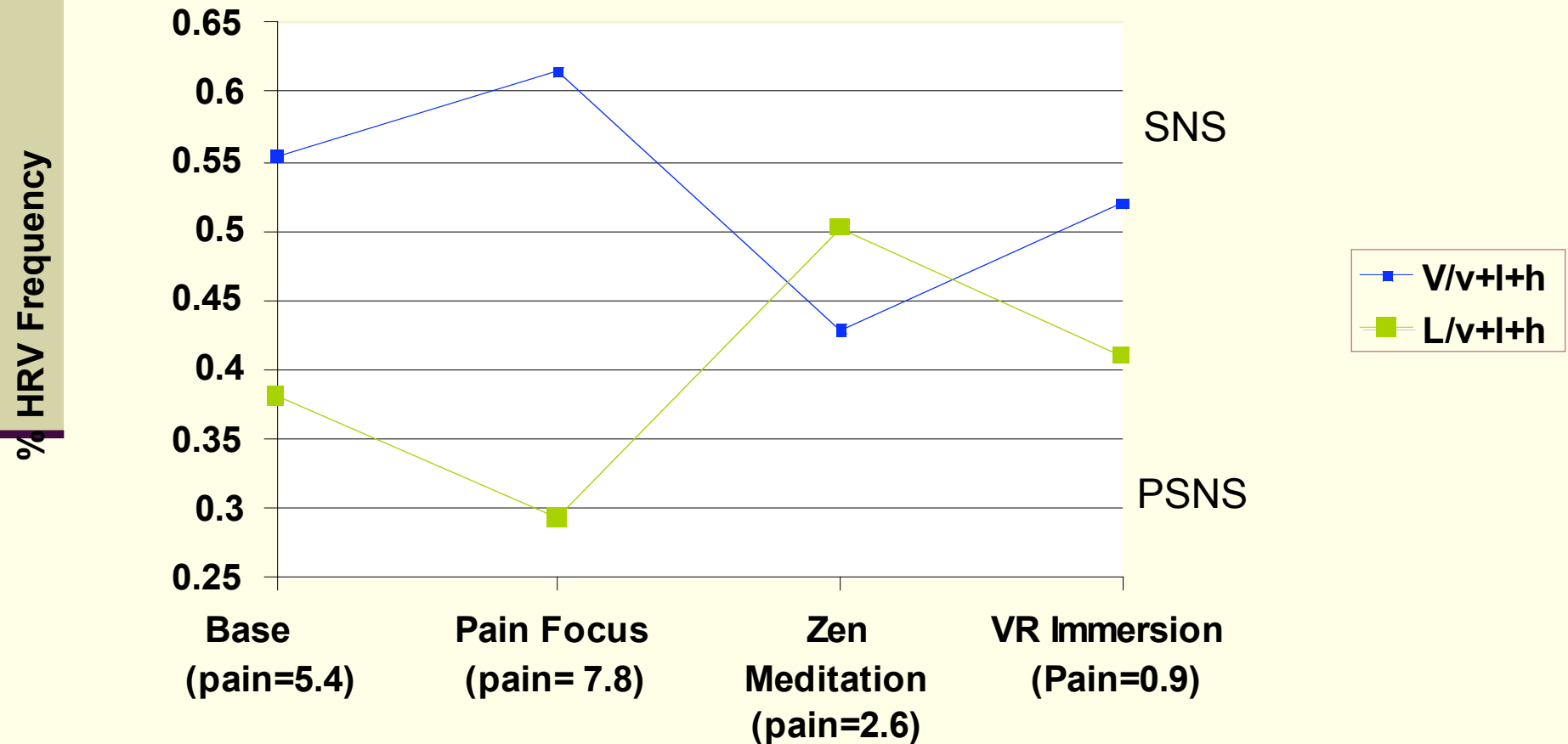


# VR in Pain Management



# Effectiveness of Meditation for Pain Control

Heart Rate Variability Frequency Distribution During Baseline, Zen Meditation and Pain Focus



# Mobile Technology

---

- Need for daily practice and support
  - Audio guidance (skill development)
  - Video guidance (absorption)
  - Audio-video interaction (interactive therapeutic gaming)
  
- Mobile technology
  - MP3 (audio)
  - MP4 (video)
  - Cell phones
    - Audio
    - Video
    - Interactive



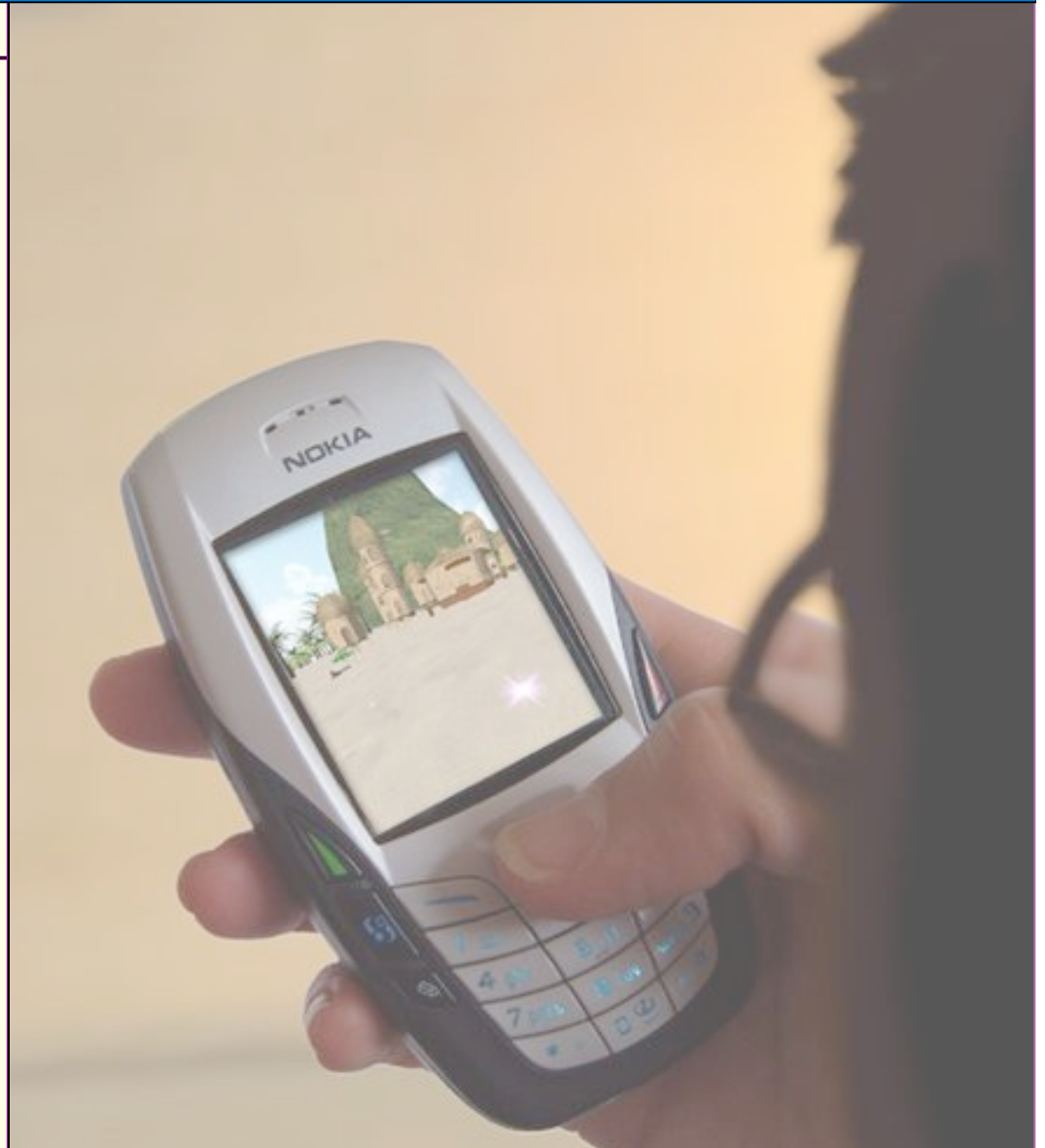
*This workshop  
is supported by:*

The NATO Science for Peace  
and Security Programme



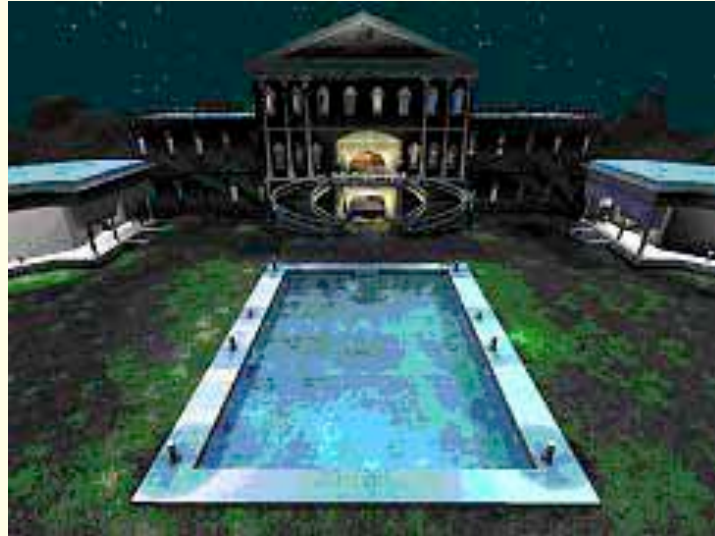
# ***PAIN DISTRACTION***

- An immersive virtual reality pain treatment system environment that relieves pain
- Delivered over multiple platforms providing the patient with 24 hour access to pain relief
- **Deliverables:** Pain Treatment System
- **Military Relevance:** Applicable to soldiers with injuries or PTSD



# Mobile Technology

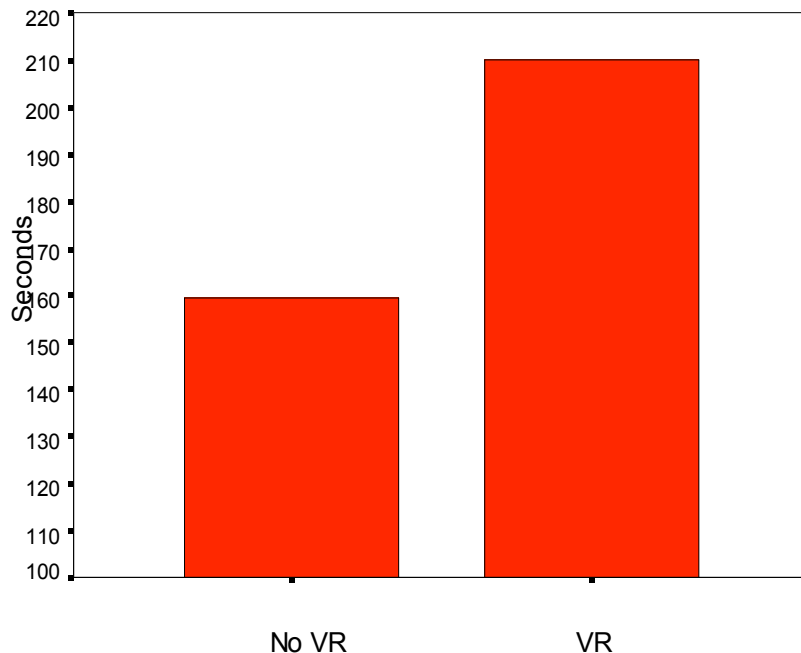
---



- The same technology that has been developed for a PC and head mount can be used on many mobile and smart phones
  - With less immersion
  - With less interactive sophistication
  - With less tie to a therapists office
  - With positive results

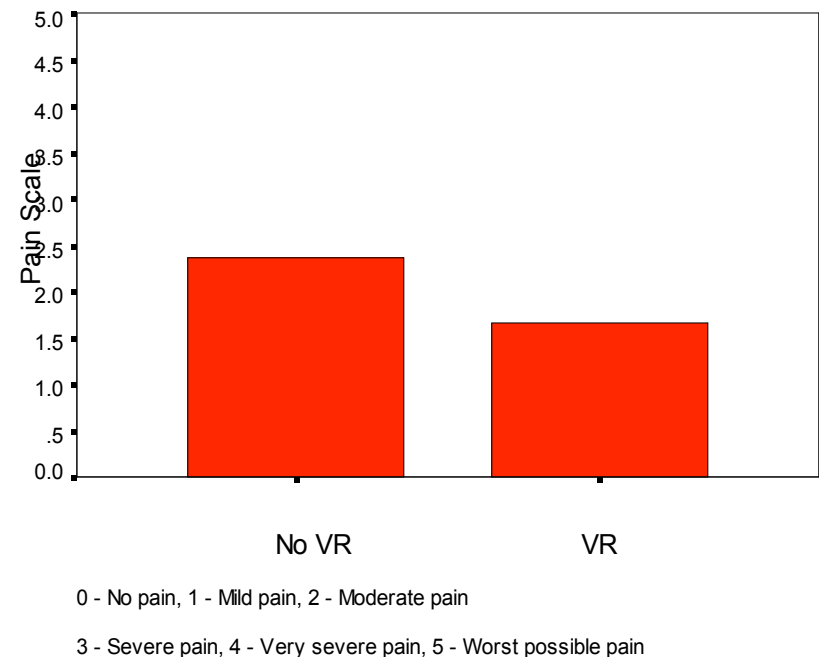
# Mobile Technology

Length of Hand Submersion in Cold Water



6 patients were able to hold their hands in the cold water for a significantly longer period of time (25% longer) using cell phone VR.

Simple Descriptive Pain Intensity Scale



6 chronic pain patients described less pain with the use of cell phone VR than without it.

- Ice challenge w/ immersive VR (75% improvement):  
NO VR, Pain = 5.5; VR, Pain = 1.3
- No Ice challenge (28% improvement):  
No Cell Phone, Pain = 2.5, Cell Phone Pain = 1.8

# Future Directions

---

- Web-based Applications:
  - Group Therapy (participants being anywhere)
  - Helping Teens avoid substance abuse (Second Life)
  - Helping kids learn stress management and communication skills (with web-based games)
  - VR Therapy conducted over the web
  - Training of therapists in videoconferencing seminars (where the SME needs to see what they are doing)
  - Etc – anything we can do currently in the office can theoretically be done over the web
    - With what trade offs?

**AUDIO**

Transmitting

Locked

Mic Vol 

Andy Saman

Jared



Meeting Information

Name: 4111

Port: 1925

Email Invitation

Email Subject: My Meeting

Host Name: Jared

Meeting Name: 4111

Comment: Hey Y'all, come chat with me

Stored Contacts

Add to Recipients

Refresh

Email:

Add to Recipients

Recipients:

bob.white@aol.com

Remove

Remove All

☐ Send as BCC

Send Cancel

Total Attendees: 2

Turn Video Off

Video Options...

Chat Window

Install ShowMyDesktop...

Computer Sharing

Host Options...

(All) ☒ Chat Sound

Jared

Submit

Host Options

User Rights Invitations

Polls Seating

Surveys Video Layout

High Quality Video

Broadcast Interface

Clear Chat History

☐ Note Board

☐ Connection Info

☒ Meeting Info

Close

## AUDIO

Hold to Transmit

Lock

Mic Vol 

-  Charlie
-  Dan
-  Jason
-  Jason
-  K
-  Kay
-  Lynda
-  matt
-  Michaela
-  Natalie
-  Phil
-  Phil2
-  tina

Total Attendees: 13

Turn Video Off

Video Options...

ShowMyDesktop...

Computer Sharing...

Host Options...

LiveDemo



Kay



Phil



matt



Charlie



Phil2



Michaela



Natalie



tina



Lynda



Jason



Jason



K



Dan

## Meeting Information

Name: LiveDemoKay  
Port:1935  
Call in #: (712) 338-8661  
Access Code: 3291787

MegaMeeting.com®



Video &amp; Web Conferencing For ALL Of Us!

# Future Directions

- Situational Simulations:
  - Training: like combat medic program; SIT for any MOS
  - Support for PTSD Diagnosis
    - Combat Scenario for correspondance of subjective reactivity with psychophysiological reactivity (establish norms for PTSD vs no PTSD)
  - Return to Duty:
    - PTSD: Exposure simulation with performance metric (shoot / no-shoot)
    - mTBI: Complex multiple processing scenario (similar to operating in theater) with performance metric
  - Relationship Functioning
    - simulated scenarios for reintegration transition, etc.



*This workshop  
is supported by:*

The NATO Science for Peace  
and Security Programme



# PARTNERS & PROGRAMS



- Human Identification at a Distance
- Cultural Influences on Virtual Reality Environment Response Behavior
- Student State



- CDC VR Driving Simulator for Training and Evaluating Driver Behavior

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

- Science for Peace and Security
- North Atlantic Treaty Organization



- ARO Adaptive Displays Conference at AMC SIGGRAPH 2004



- Mobile Medical Monitor
- CAP Program



- BioWatch



- Combat Medic
- Injury Creation Science
- SIT for AeroMeds
- PTSD in Iraq
- PTSD Coalition Forces



- SIT
- PTSD
- Rehabilitation



- ICS Severe Trauma Training



- VR for Pain Distraction during Dental Procedures
- VR for Burn Pain Distraction
- VR for Chronic Pain
- VR and physiological Monitoring for pain
- Cyber Therapy Conference



- TBI Cognitive Rehabilitation



- Mixed Reality Rehabilitation System



# ***POINT OF CONTACT***

Professor Dr. Brenda K. Wiederhold, Ph.D., MBA, BCIA  
Executive Vice-President

U.S. Headquarters:

6155 Cornerstone Court East, Suite 210

San Diego, California 92121

(858) 642-0267

[bwiederhold@vrphobia.com](mailto:bwiederhold@vrphobia.com)

European Headquarters:

28/7 Rue de la Loi

B-1040, Brussels, Belgium

+32 2 286 8505

[b@vrphobia.eu](mailto:b@vrphobia.eu)



# GLOBAL RELATIONSHIPS

