Virtual reality: innovative technology for the treatment for victims of terrorist bus bombing with post-traumatic stress disorder (PTSD)

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- **Since the beginning of the Intifada (uprising) in September 2000, Over 1000 Israelis have been killed in a prolonged series of attacks, including: shooting incidents, car bombings and suicide bomb attacks on public transport.**

- **On the other side, between September 29, 2000 and July 8, 2003, 2,572 Palestinians have been killed, and more than 41,000 injured**

- **6979 Israeli civilians have been treated for trauma by the first aid in the aftermath of deadly terrorist attacks.**

No one wins…..

- **Many victims of terrorism display severe emotional reactions, even in the absence of a physical injury**
- **Some develop Posttraumatic Stress Disorder (PTSD)**
- **PTSD Symptoms include shock and numbness, fear, anger, depression**
- **Some victims may even refrain from performing daily occupational or leisure-based activities**

Who is affected by terrorism?

- People who personally witnessed or were victims of the terrorist attack.
- People who have relatives, friends and acquaintances who were subject to trauma.
- People who provide aid and assistance to terror victims.

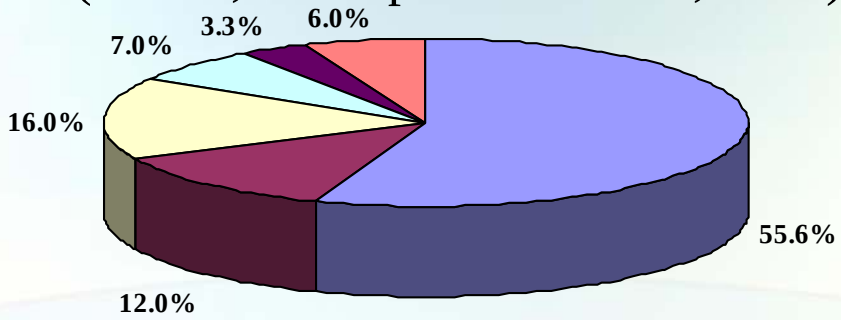
(Shalev, Peri, Canetti, & Schreiber, 1996; Somer, Keinan, & Carmil, 1996)

Exposure to terrorism in Israel

- **Bleich, Gelkopf & Solomon (2003) examined the impact of terrorism on nationally representative population samples and the psychological impact of ongoing terrorism in Israel.**
- **Telephone survey conducted using a strata sampling method, with 512 final participation.**

Exposure to terrorism

(Bleich, Gelkopf & Solomon, 2003)



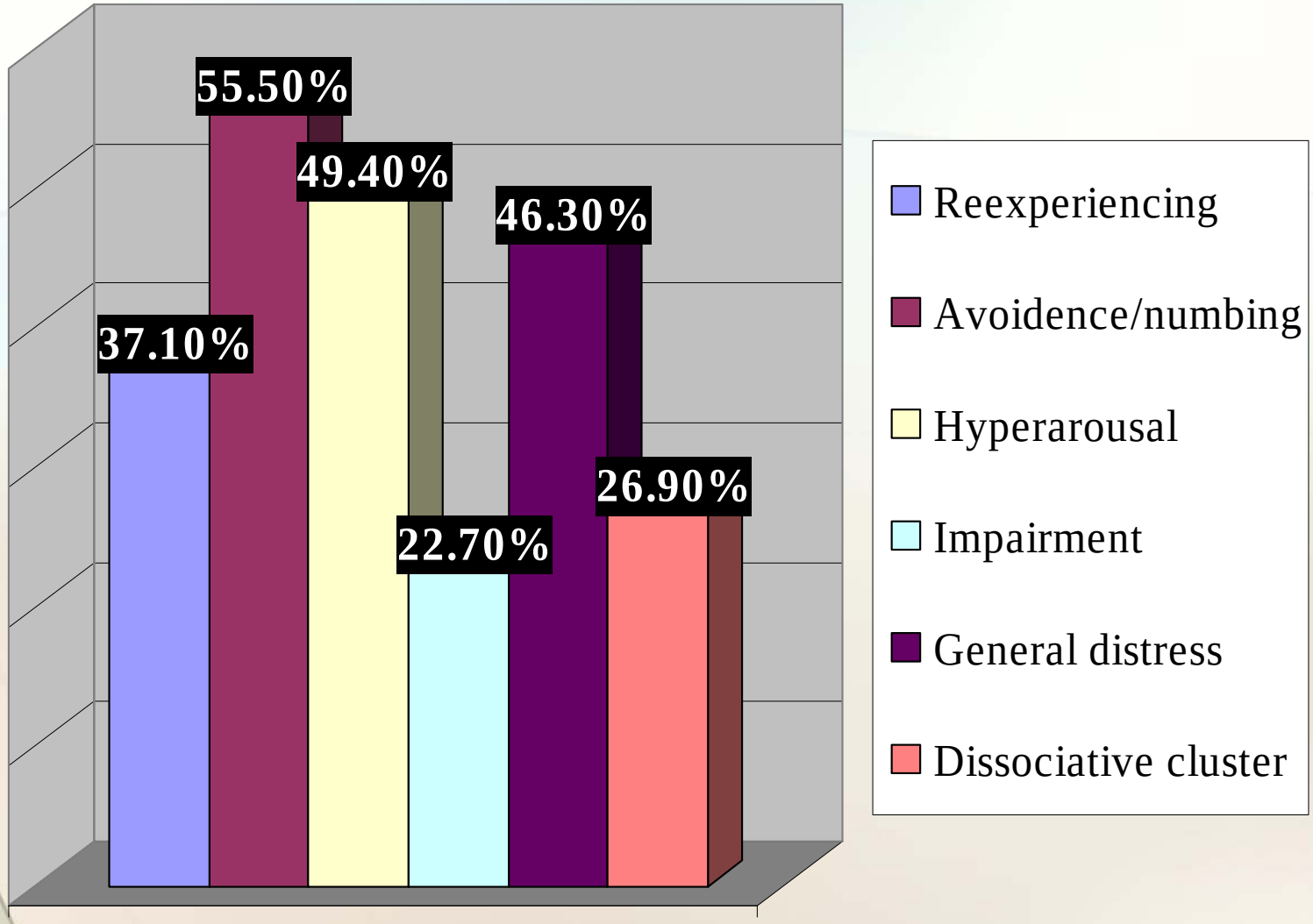
(N=512)

No personal exposure and no exposure of friends and relatives	55.6%
No personal exposure but exposure of friends and relatives, not wounded	12%
No personal exposure but exposure of friends and relatives, who were wounded and/or died	16%
Personal exposure and no exposure of friends and relatives	7%
Personal exposure and exposure of friends and relatives, who were exposed but not wounded	3.3%
Personal exposure and exposure of friends and relatives, who were wounded and/or died	6%

More than 45% of Israeli have been exposed or have friends or relatives who have been exposed.

Frequency of PTSD and ASD Symptoms

(Bleich, Gelkopf & Solomon, 2003)



Therapeutic Approaches Used to Treat PTSD

- *Cognitive behavioral therapy (CBT)*
  - *Exposure therapy*
- *Pharmacotherapy*
- *Eye Movement Desensitization and Reprocessing (EMDR)*
- *Group treatment*
- *Brief psychodynamic psychotherapy*

Virtual reality as an intervention of PTSD

- VR has been shown to be highly effective for the treatment of **phobias** (Hodges, Anderson, Burdea, Hoffman, & Rothbaum, 2001).

- Virtual Vietnam (VV) - developed as part of a treatment to evaluate the therapeutic effectiveness of VR exposure for the treatment of **combat-related PTSD** experienced by soldiers who had been in Vietnam as one component of a comprehensive treatment program (Hodges, et al., 1999).

  Results: being immersed in VV can be an effective aid to assist PTSD sufferers in imagining, visualizing and describing their traumatic experiences.

Virtual reality as an intervention of PTSD

- Second study of Virtual Vietnam - Results: participants experienced a 34% decrease in symptoms on clinician-rated PTSD and a 45% decrease on self-rated PTSD. Treatment gains were maintained at the 6-month follow-up examination (Rothbaum, et al., 1999).
- Difede & Hoffman (2002) developed a virtual environment to treat **PTSD** following the collapse of the **Twin Towers**. Results: Depression and PTSD symptoms and Clinician Administered PTSD Scale indicated a large reduction (83%) in depression, and large reduction (90%) in PTSD symptoms.

The Essence of Occupation

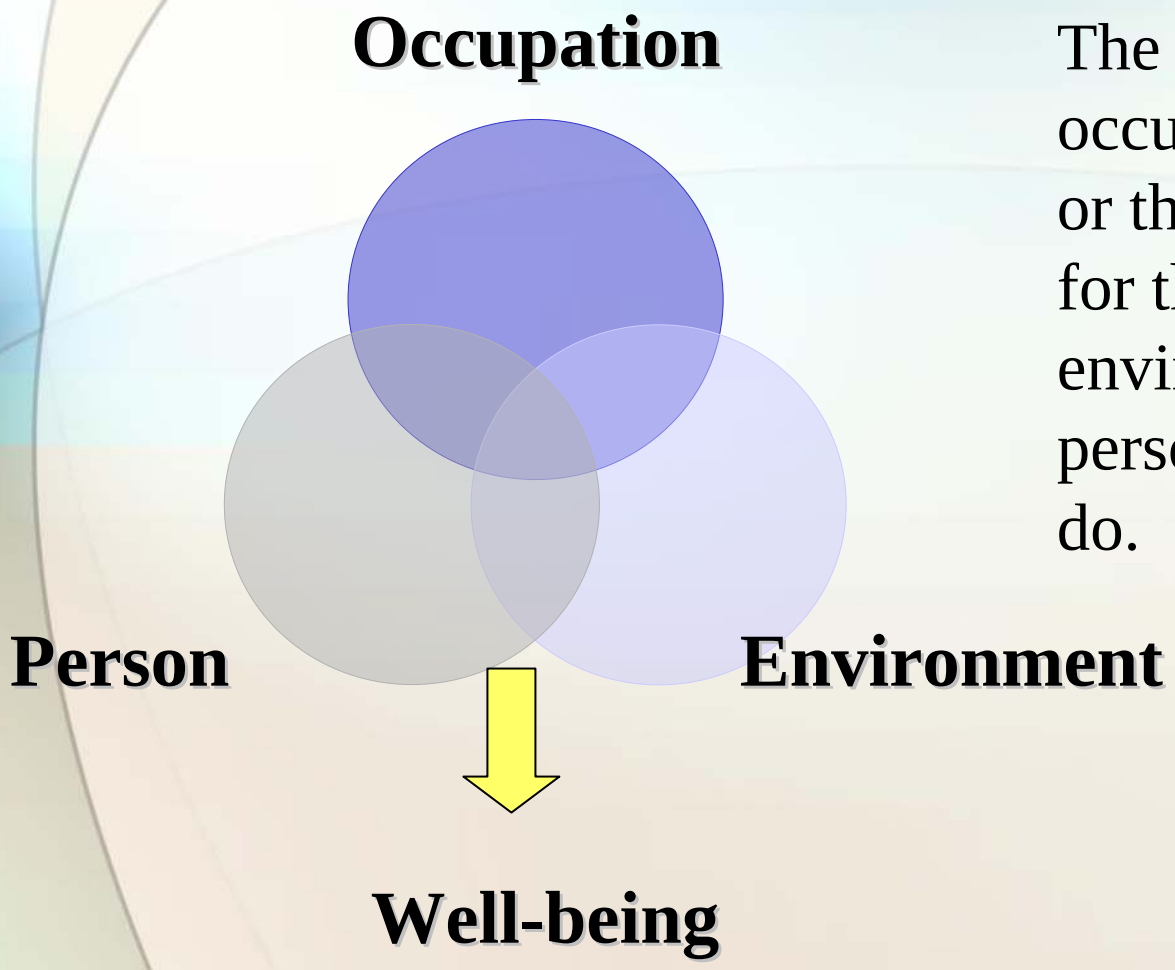
- **The major goal of occupational therapy is to enable the client to achieve a satisfying and productive life by the development or rehabilitation of occupation-related skills, which facilitate functioning at a satisfactory personal and interpersonal level.**
- **The desired outcome of intervention is for the client to be able to meet his own needs, as far as possible, and to have the motivation to continue working towards achieving his full potential.**

The Essence of Occupation

- **Sub-goals which lead to the major goal are to:**
  - **Assess the client needs in terms of the occupations which are important to him;**
  - **Identify the skills needed to support those occupations;**
  - **Remove or minimize barriers to successful occupational performance;**
  - **Assist the client to develop, relearn or maintain skills to a level of competence that will allow him to perform occupations to his own satisfaction;**
  - **Help the client to achieve a satisfactory balance of activities in his daily life.**

Occupational Performance - Model

(Christiansen & Baum, 1991, 1997)



The main focus is on occupational performance, or the intersection point for the person, the environment, and what the person wants and needs to do.

Occupational Performance- Central to Models of Occupational Therapy

- **The concept of occupational performance has become a mainstay in the development of models of occupational therapy. It operates as a means of connecting the individual to roles and to the socio-cultural environment (Reed & Sanderson, 1999).**
- **Most studies conducted with VR and PTSD focus on symptom reduction or relief. We suggest that client occupation is also a main concern to be evaluated and treated.**

Research Goal

The goal of this study is to investigate whether Virtual Reality Exposure Therapy with an added focus on human occupation may constitute an effective clinical technique for treating people for PTSD in the aftermath of bus bombings.

Research Objectives

- **To study the utility and efficacy of Virtual Reality Exposure (VRE) for the treatment of PTSD related to terrorist bus bombing attacks in Israel, by gathering preliminary data on five clients with PTSD.**
- **To evaluate the occurrence and severity of PTSD symptoms before and after the intervention.**
- **To investigate the involvement of clients in their occupations before and after the intervention.**
- **To assess and determine the ‘sense of presence’ as experienced by clients immersed within the VR environment.**

Worldwide collaboration

Interdisciplinary aspects of the study

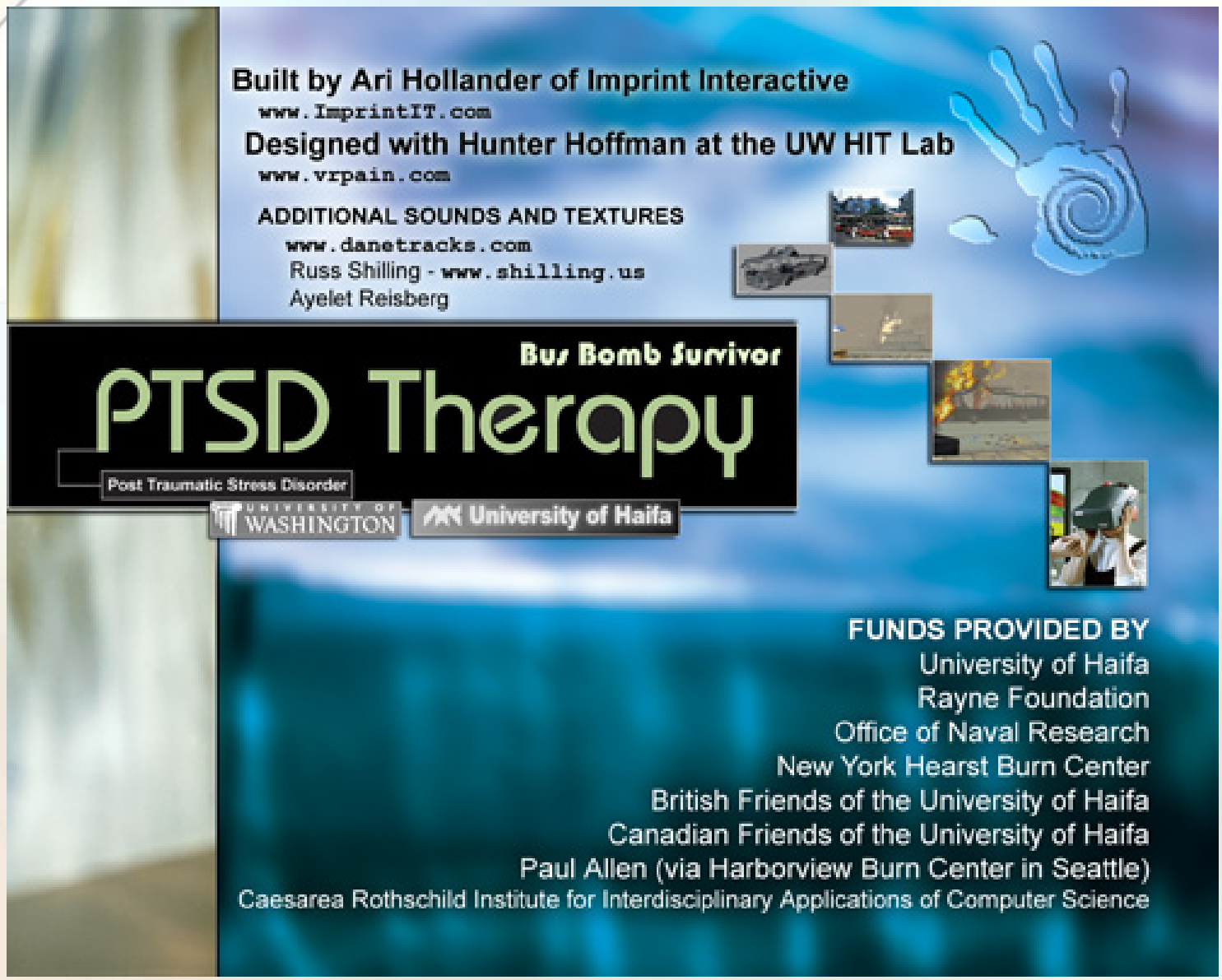
The research team members have diverse backgrounds that draw from the major disciplines of psychotherapy, psychology, occupational therapy, technology and programming.

Method

- A Single Case Study Design methodology with five male and female participants.
- First stage of the project focuses on the technology and programming aspects.
- Second stage of the project focuses on the psychological and occupational therapy intervention.

Method

Video


Built by Ari Hollander of Imprint Interactive
www.ImprintIT.com
Designed with Hunter Hoffman at the UW HIT Lab
www.vrpain.com
ADDITIONAL SOUNDS AND TEXTURES
www.danetracks.com
Russ Shilling - www.shilling.us
Ayelet Reisberg
Bus Bomb Survivor
PTSD Therapy
Post Traumatic Stress Disorder
UNIVERSITY OF WASHINGTON
University of Haifa
FUNDS PROVIDED BY
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Office of Naval Research
New York Hearst Burn Center
British Friends of the University of Haifa
Canadian Friends of the University of Haifa
Paul Allen (via Harborview Burn Center in Seattle)
Caesarea Rothschild Institute for Interdisciplinary Applications of Computer Science

Measures

Six different assessment tools are used in this study; all questionnaires are standardized with Hebrew translations:

- The **Clinician Administered PTSD Scale (CAPS):** A standardized diagnostic interview to determine DSM-IV criteria for the PTSD questionnaire (Blake et al., 1990).
- **Post Traumatic Diagnostic Scale (PDS):** A standardized self-report questionnaire to measure PTSD symptoms (Foa, 1995).
- **Beck Depression Inventory (BDI):** A standardized questionnaire measuring symptoms of depression (Beck & Steer, 1987).

Measures

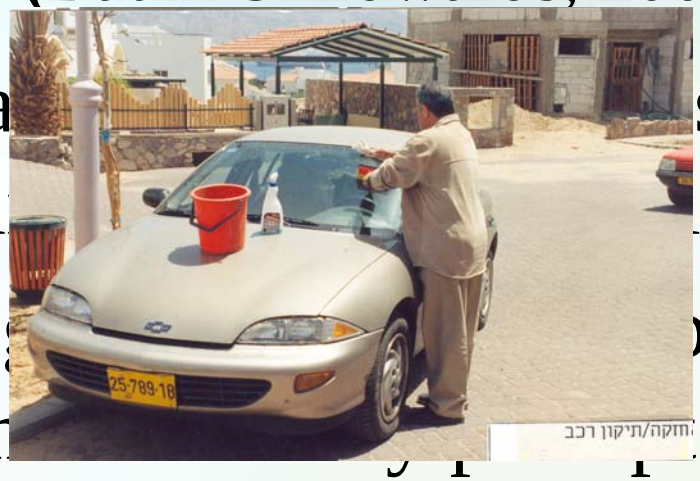
- **Brief Symptom Inventory (BSI):** A standardized questionnaire measuring symptoms (Derogalis & Melisaratos, 1983).

- The **Presence Questionnaire (PQ):** a standardized questionnaire to investigate perceptions and feelings of presence in the VR environment (Witmer & Singer, 1998).

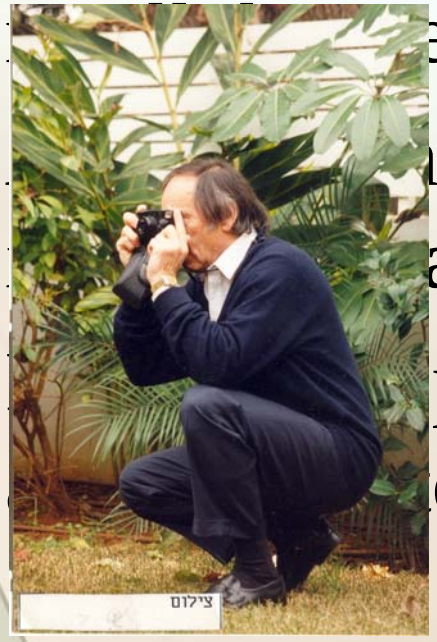
- The **Activity Card Sort (ACS):** a standardized measure of activity participation (Baum & Edwards, 2000). The ACS employs pictures of people involved in real-life activities and thus can elicit vivid responses from participants. This instrument was adapted to Israeli culture through several in-depth studies (Katz, Karpin, Lak, Furman, & Hartman-Maeir, 2003; Sachs & Josman, 2003).

The Activity Card Sort (ACS)

(Baum & Edwards, 2000)



- Requires a s that depict activities i ly engage.
- The sortin le actually engaged in s the person to esence of act her life.
- ts to describe that an ad on their a
- percentage o tivities or of occupa ement.



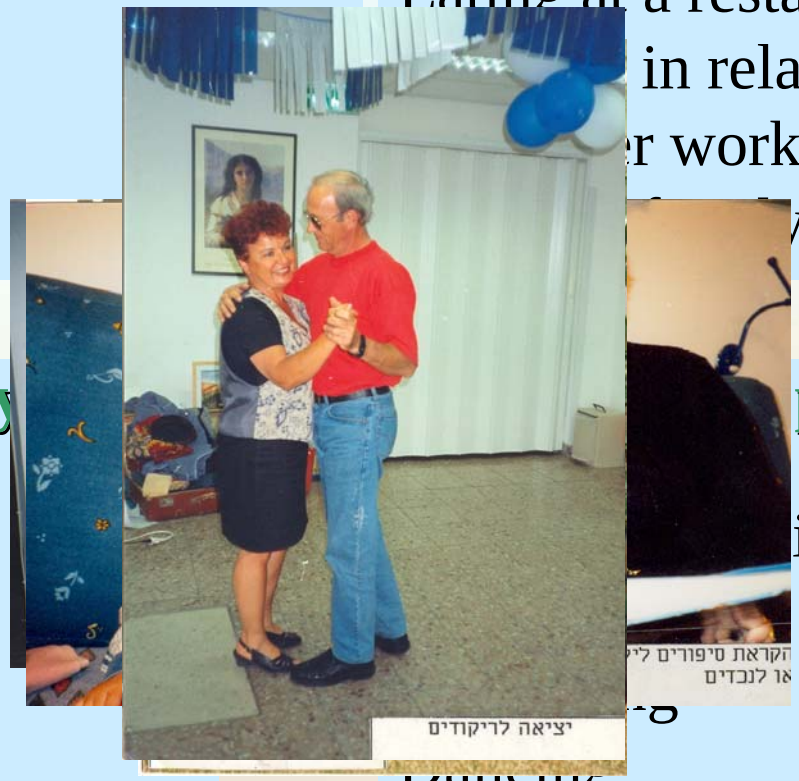
Sample of activities included in ACS

Instrumental activities-IADL:

Grocery shopping
Washing dishes
Doing laundry
Cooking meals
Driving

Social activities:

Going to parties
Eating at a restaurant
in relationship
r work
events



Leisure - low phy physical demand:

Using computer
Photography
Reading
Watching TV
Spectator sports

ing/exercise
Dancing
Fishing

Treatment

- The treatment program is an adaptation of an empirically validated CBT program, Prolonged Exposure (PE), developed by Foa & Rothbaum (1998).
- The focal component of the program - prolonged exposure to traumatic memories, is usually conducted by priming imagination. We will implement virtual reality (VR) to provide prolonged exposure.
- Treatment duration is based upon the therapist's judgement, and at the minimum consists of 10-15 weekly sessions.
- Generally we plan to use the Foa & Rothbaum (1998) improvement criterion: A substantial improvement in symptom severity, defined as 70% improvement from pre-treatment of PTSD symptoms on the PTSD Diagnostic Scale (PDS - Foa, Cashman, Jaycox, & Perry, 1997) and returning to previous occupations.

Treatment program components:

1. We use a multiple baseline design (Botella et al., 2000). Three patients with a one week- and 2 with two week baseline. This is used as a *pseudo* waiting-list condition. We use 6 key measures from the PDS relating to fear, avoidance, and re-experiencing symptoms related to the trauma.
2. Education about the common reactions to trauma.
3. Breathing retraining.
4. VR exposure to the traumatic event. Homework for VR exposure: The patients use a DVD of the VR (Bus World) or asked to listen to their own description of the traumatic event for one hour per day.
5. In-Vivo Exposure: Patients are instructed to engage in daily in-vivo exposure to PTSD-related avoided situations (e.g., restaurants, shopping malls).

Progress to Date

- The intervention commenced with the first client - a bus driver. This client witnessed a bus bombing in the city of Haifa. He has been diagnosed with chronic severe PTSD and has not returned to his work as a driver since the attack a year and a half ago. He is employed by the bus company in an office job.
- The patient experiences additional difficulties in his marital life, avoids social interactions, and refrains from previously enjoyable recreational activities.

Exposure to VR

Evaluation

- The Clinician Administered PTSD Scale (**CAPS**) = **82** (result > 80 is the cut-off point to be considered “severe”.
- Post Traumatic Diagnostic Scale (**PDS**) = **43**, considered severe PTSD.
- Beck Depression Inventory (**BDI**) = **22**, considered moderate to severe.
- Brief Symptom Inventory (**BSI**) = **78**
- The Activity Card Sort **(ACS) = 33%** current activities performed (20/58 previous activities now performed).
- In previous research with people suffering from Alzheimer disease the mean group of current activity performed was 52.5% (Baum & Eduards, 2001)

Evaluation:
The Activity Card Sort (ACS).

IADL	44% current activity performed; 7/16 previous activities now performed.
Social activities	24% current activity performed; 4/17 previous activities now performed.
Leisure-Low physical	50% current activity performed; 6/12 previous activities now performed.
Leisure-High physical	19% current activity performed; 2.5/13 previous activities now performed.
Total	33% current activity performed; 19.5/58 previous activities now performed.

Examples from ACS

ADL: Shopping

- Continued to do during illness
- Give up due to illness
- Beginning to do again
- New activity since illness
- Done previously

Examples from ACS

- Continued to do during illness
- Give up due to illness
- Beginning to do again
- New activity since illness
- Done previously

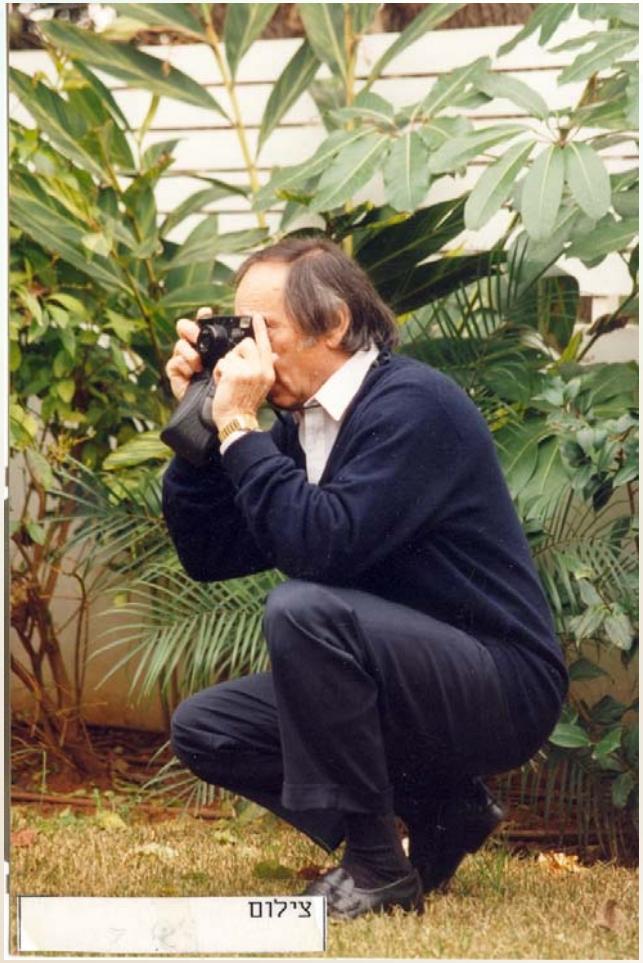
Social activities:

Reading stories

Examples from ACS

Leisure-Low : photographing

- Continued to do during illness
- Give up due to illness
- Beginning to do again
- New activity since illness
- Done previously



Examples from ACS

Leisure-High : Dancing

- Continued to do during illness
- Give up due to illness
- Beginning to do again
- New activity since illness
- Done previously

Summary (to date)

- Long distance and local collaborations working well
- Feasibility of system demonstrated
- Initial reactions to Virtual environment
- Treatment protocol
- Subject recruitment
- Future plans