Conferinţa Diaspora în Cercetarea Ştiinţifică şi Învăţământul Superior din România

Bucureşti, 21-24 Septembrie 2010

Psihologie şi Tehnologie

Roboterapie, Tehnologii Virtuale şi Informatice: Implicaţii şi Aplicaţii în Ştiinţele Cognitive Clinice

Cadrul General al Workshopului

Professor, Ph.D., Daniel DAVID

•Babeş-Bolyai University, Romania

•Mount Sinai School of Medicine, USA (adjunct professor)

Consultant (materiale/prezentare): Dr. Albert Rizzo, Institute for Creative Technology/University of Southern California; prezentare in 2007 la UBB

Scopul Workshop-ului

- Workshop-ul va explora dezvoltările interdisciplinare de frontieră privind relaţia dintre Psihologie şi Tehnologie, mai precis între robotică, tehnologii virtuale şi informatice pe de o parte şi ştiinţele cognitive clinice (ex. psihodiagnostic, psihologie clinică/psihoterapie) pe de altă parte. Implicaţiile vor fi discutate atât la nivelul mecanismelor etiopatogenetice ale sănătăţii şi bolii, cât şi la nivelul tehnologiilor psihologice de tratament (inclusiv reabilitare), de promovare a sănătăţii mintale şi de optimizare psihologică a (minţii) subiectului uman (ex. optimizarea memoriei, învăţării, deciziei, autocontrolului emoţional şi comportamental, calităţii vieţii şi funcţionării sociale).

- Abordarea va fi una interdisciplinară, la Workshop participând psihologi, informaticieni, ingineri, medici, biologi, precum şi alţi specialişti implicaţi în domeniu.

- Vom ţinti şi crearea unei reţele internaţionale în domeniu, care să susţină aplicaţii de granturi şi colaborări.

- Vom prezenta Platforma de excelenţă în roboterapie şi psihoterapie prin realitate virtuală existentă în ţară – Platform for Robotherapy and Virtual Reality Psychotherapy (http:www.psytech.ro) – şi vom analiza cum poate fi ea utilizată pentru cercetări, servicii şi activităţi didactice internaţionale.

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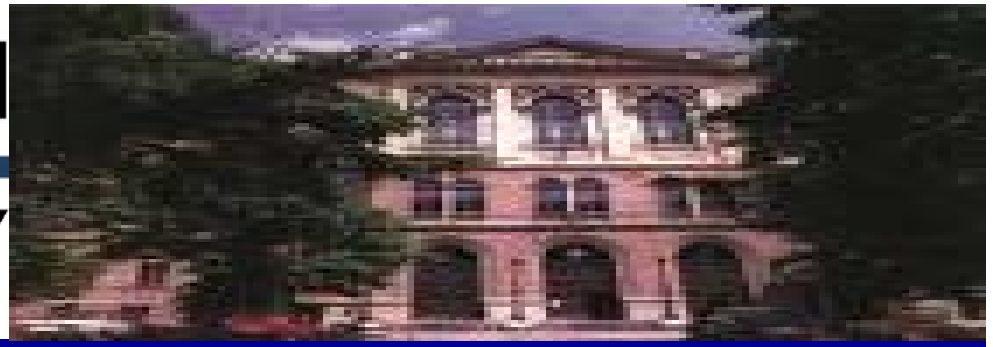
Agenda

- Despre noi...
- Cadrul Ştiinţific General şi Fundamente ale Tematicii Workshop-ului

BABEŞ-BOLYAI UNIVERSITY



- **Its history starts in 1581**
- **Motto: "Truth Through Justice and Scientific Work" sau "Traditio Nostra Unacum Europae Virtutibus Splendet"**
- **Today:**
  - **the most diversified (in terms of specializations) and the most complex higher education institution in Romania**
  - **+ 50 000 students**
    - **bachelor/master/doctoral/postdoctoral**
  - **Three main lines of studies**
    - **Romanian; Hungarian; German; Others: (e.g., Hebrew, Chinese)**
  - **Ranking**
    - **First in Romania – according to (a) the National Council for Research (CNCSIS 2005-2010); (b) Kienbaum Management Consultants**
    - **600+ in "Times" Ranking (UBB-500 Project)**
  - **Schools of Excellence:**
    - **Chemistry (organometallic)**
    - **Physics (nanotechnology, computational)**
    - **Geology**
    - **Biology (genetics and molecular)**
    - **(Clinical) Cognitive Sciences**
    - **European Philosophy/Logics/Argumentation**

UNIVERSITAS NAPOCENSIS
TRADITIO NOSTRA
UNACUM EUROPAE
VIRTUTIBUS SPLENDET
1581
ROMÂNIA
BABEŞ-BOLYAI

Universitatea
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UNIVERSITAS NAPOCENSIS
1581
ROMÂNIA
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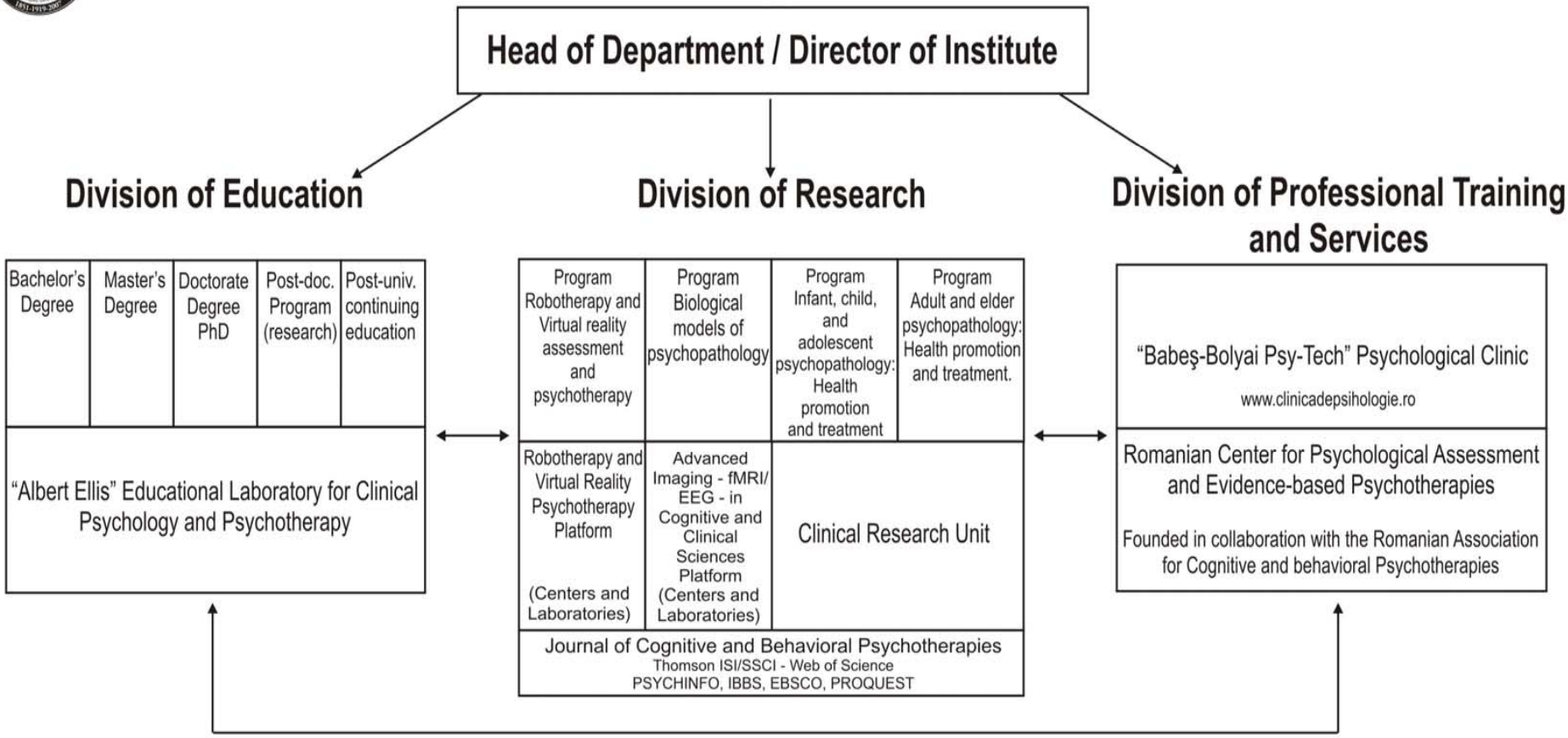
About the Clinical Program

- Department of Clinical Psychology and Psychotherapy
  - Its history starts from Wundt-Goangă-Roşca-Radu-today...
  - Ranked on the first place in Romania by the Romanian Association of Researchers “Ad-Astra”
  - Undergraduate
  - Graduate
    - Master
    - Doctoral
  - Postgraduate/Postdoctoral

- **Fours research programs**
  - **Robotics/robotherapy and Virtual reality assessment and psychotherapy. Program director: Dr. Daniel DAVID. Infrastructure: The Platform for Robotics/Robotherapy and Virtual Reality Therapy (www.psytech.ro) (Centers and Laboratories)**
  - **Biological models (e.g., ethological, evolutionary) of psychopathology. Program director: Dr. Alina RUSU/Dr. Ovidiu ANDRONESI. Infrastructure: The Platform for Advanced Imaging - fMRI/EEG - in Clinical Cognitive Sciences and the Clinical Research Unit**
  - **Infant, child, and adolescent psychopathology: Health promotion and treatment Program directors: Dr. Viorel LUPU (associate member), Dr. Daniel DAVID, and Dr. Anca DOBREAN. Infrastructure: The Clinical Research Unit**
  - **Adult and Old Age Psychopathology: Health promotion and treatment. Program director: Dr. Aurora SZENTAGOTAI. Infrastructure: The Clinical Research Unit**

Babeş-Bolyai University
Department of Clinical Psychology and Psychotherapy ⟷ **The International Institute for the Advanced Studies of Psychotherapy and Applied Mental Health**

www.clinicalpsychology.ro www.psychotherapy.ro



Note: The Institute is the spearhead of the Department of Clinical Psychology and Psychotherapy in the international-level competition.

About Department/Institute

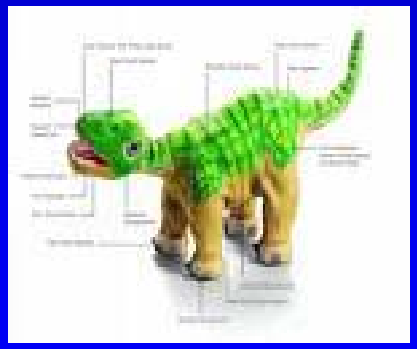
- **Paradigms:**
  - **Evidence-based (e.g., Clinical trials)**
    - **Efficacy/effectiveness**
    - **Theory/mechanism of change**
    - **Cost-effectiveness**
  - **Clinical Cognitive science (cognitive-behavioral therapies)**
    - **Knowledge**
    - **Computational**
    - **Algorithmic-representational**
    - **Implementational (neurobiological)**

About Department/Institute

- The team:
  - Psychologists, physicians, biologists, sociologists, computer scientists
  - Trained both in Romania and abroad (USA, UK, France)

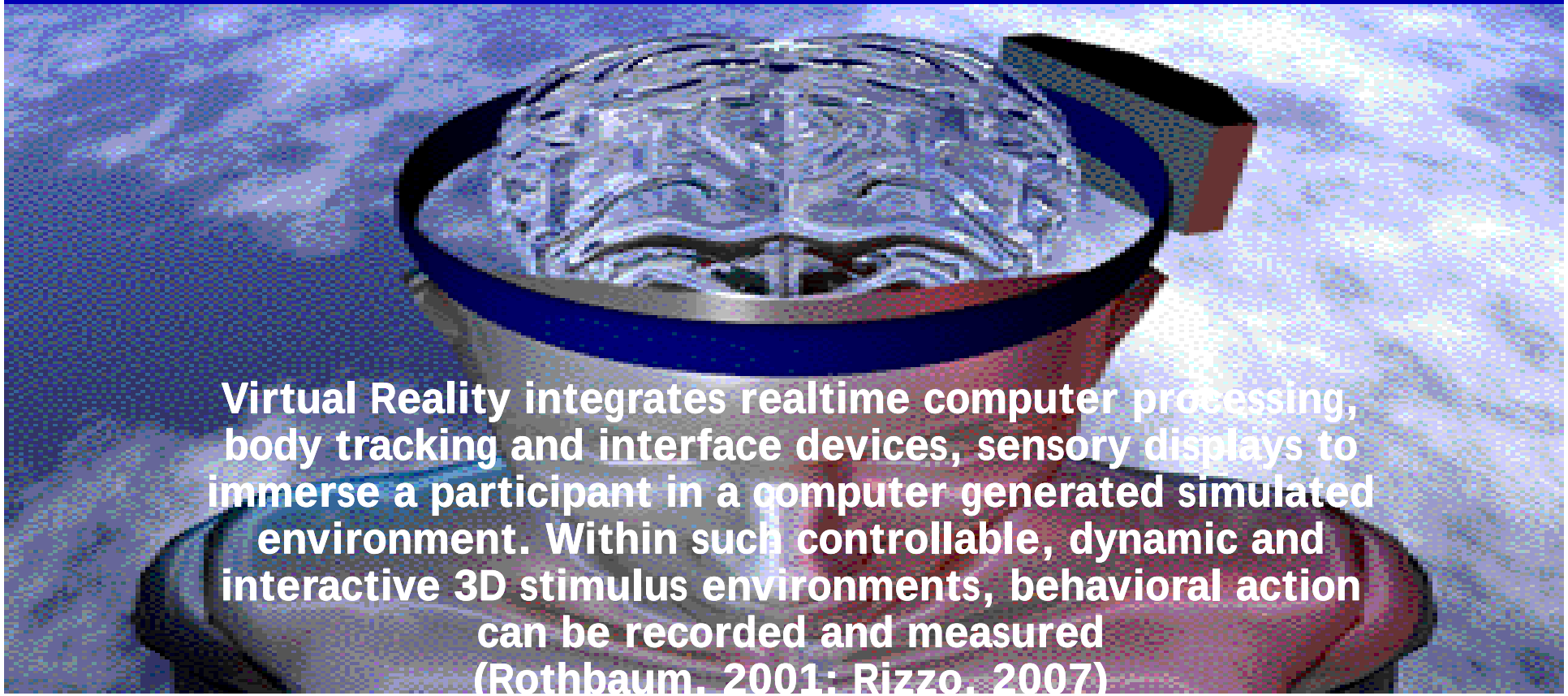
About Department/Institute

- **Robotherapy and Virtual Reality Therapy Platform**
  - **Robotherapy (examples from international studies)**



About Department/Institute

- **Robotherapy and Virtual Reality Therapy Platform**
  - **Virtual Reality - Definition**



Virtual Reality integrates realtime computer processing, body tracking and interface devices, sensory displays to immerse a participant in a computer generated simulated environment. Within such controllable, dynamic and interactive 3D stimulus environments, behavioral action can be recorded and measured (Rothbaum, 2001; Rizzo, 2007)

About Department/Institute

Five top VR Laboratories, all equipped with the latest technology (see at http://www.psytech.ro):

(1) ”*Stress Control” Lab.* (set up based on the collaboration with Virtually Better, USA);

(2) ”*Virtual Classroom” Lab.* (set up based on the collaboration with Institute for Creative Technology, USA);

(3) ”*Pain Control” Lab.* (set up based on the collaboration with Imprintit, USA);

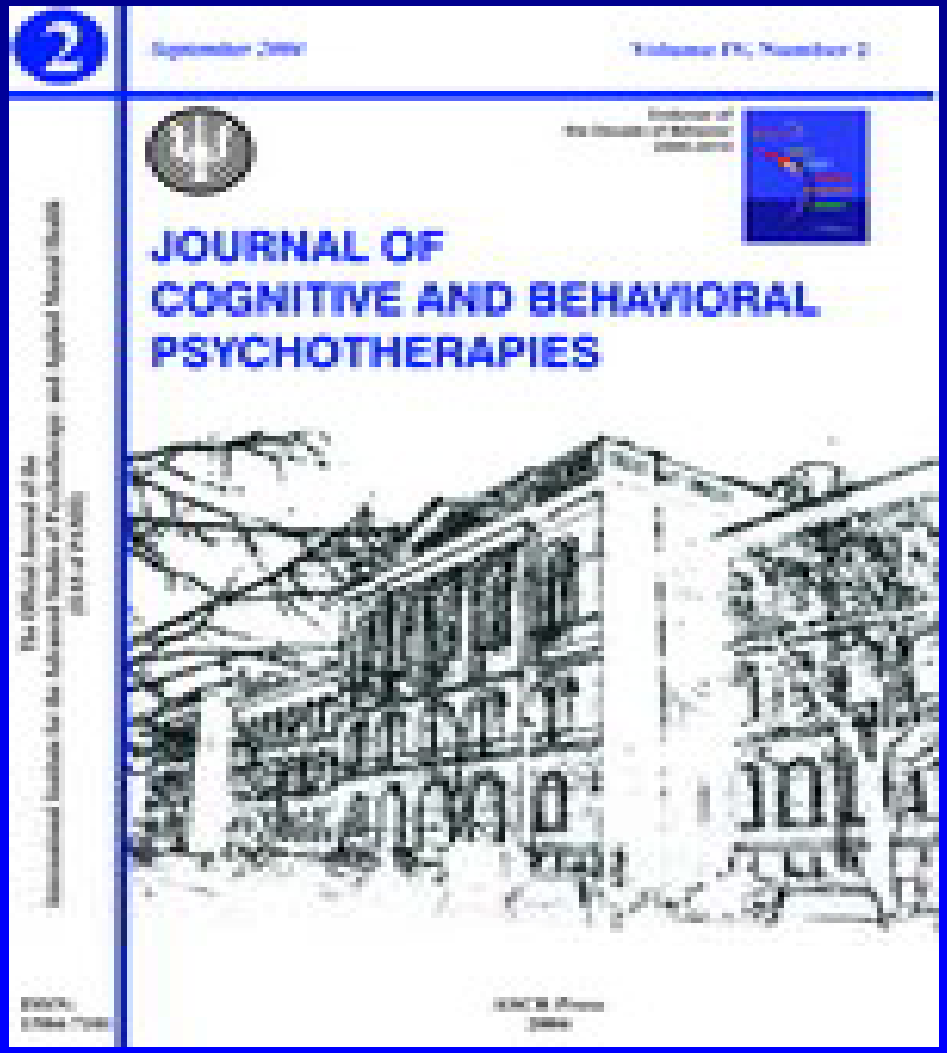
(4) ”*Data” Lab.* (mainly related to Robotherapy);

(5) ”*Star Trek –Holodeck*” Lab. (set up in collaboration with Eon Reality, USA).

A Sample of our International Contributions

- David, D., Lynn, S., & Ellis, A. (in press). Rational and irrational beliefs in human functioning and disturbances. London: Oxford University Press.·
- David, D., Schnur, J., şi Birk, J. (2004). Functional and dysfunctional emotions in Ellis' cognitive theory; An empirical analysis. Cognition and Emotion, 18, 869-880.
- David, D., Montgomery, GH., Macavei, B., & Bovbjerg, D. (2005). An empirical investigation of Albert Ellis' binary model of distress. Journal of Clinical Psychology, 61, 499-516.
- David, D., & Szentagotai, A. (2006). Cognition in cognitive-behavioral psychotherapies; toward an intergrative model. Clinical Psychology Review., 26, 284-298.
- David, D., Montgomery, GH., & Bovbjerg, DH. (2006). Relations between coping responses and optimism-pessimism in predicting anticipatory psychological distress in surgical breast cancer patients Personality and Individual Differences, 40, 203-213.
- Rescorla, L., Achenbach, T. M., Ivanova, M., Dumenci, L., A., Almqvist, F., Bilenberg, N., Bird, H., Broberg, A., Domuta, A., Döpfner, M., Erol, N., Forns, M., Hannesdomir, H., Kanbayashi, Y., Lambert, M., Leung, P., Minaci, A., Mulatu, M., Novik, T., Oh, K., Roussos, A., Sawyer, M., Simsek, Z., Steinhausen, H. C., Weintraub, S., Winkler-Metzke, Ch., Wolanczyk, T., Zilber, N., Zukauskiene, R., & Verhulst, F., (2007). Epidemiological Comparisons of Problems and Positive Qualities Reported by Adolescents in 24 Cultures. Journal of Consulting and Clinical Psychology, 75, 2, 351-358.
- Rescorla, L., Achenbach, T. M., Ginzburg, S., Ivanova, M., Dumenci, L., A., Almqvist, F., Bathiche, M., Bilenberg, N., Bird, H., Domuta, A., Erol, N., Fombonne, E., Fonseca, A., Frigerio, A., Kanbayashi, Y., Lambert, M., Liu, X., Leung, P., Minaei, A., Roussos, A., Simsek, Z., Weintraub,, S., Wolanczyk, T., Zubrick, S., Zukauskiene, R., Verhulst, F. (2007). Consistency of Teachers-Reported Problem for Students in 21 Cultures. School Psychology Review, 36, 1, 91-110.
- Rusu, A.S., Krackow, S. (2005). Agonistic onset reflects dispersal propensity and emotional changes in maturing male wild house mice (Mus domesticus). Journal of Comparative Psychology, 119: 58-66.
- Rusu, A.S., Krackow, S. (2004). Kin-preferential cooperation, dominance-dependent reproductive skew, and competition for mates in communally nesting female house mice. Behavioral Ecology and Sociobiology, 56: 298-305.
- Rusu, A.S., Koenig, B., Krackow, S. (2004). Pre-reproductive alliance formation in female wild house mice (Mus domesticus): the effects of familiarity and age-disparity. Acta Ethologica, 6: 53-58.

About the Department/Institute



About Virtual Reality…

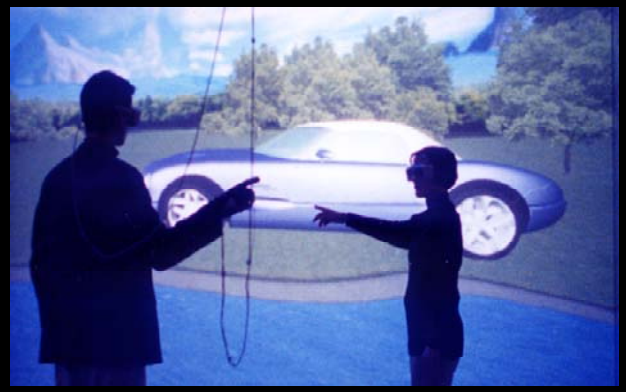
About Virtual Reality

"…a way for humans to, interact with computers and visualize complex data in a more ecological fashion – 3D environments."

Virtual Reality integrates realtime computer processing, body tracking and interface devices, sensory displays to immerse a participant in a computer generated environment. Within such controllable, dynamic and interactive 3D environments, behavioral action can be rigorously recorded and measured (Rothbaum, 2001; Rizzo, 2007)

FUNDAMENTAL ELEMENTS (Rizzo, 2007)

- Immersion/Presence
- Interactivity



Psychology - Assessment

Assessment

- **Psychological factors:**
  - **Clinical symptoms/signs**
  - **Etiopathogenetic factors**

- **Psychological test**
  - **A standardized measure of a sample of behaviors**
    - **Sample to Population**
    - **Predictors (sample; Lab)-Criteria**

Problems Based on Elkind et al. 2001 analysis

- "…Neuropsychologists and other clinicians often comment on the minimal relationship that frequently exists between formal assessments of executive functions, analysis of findings, recommendations, and the person's real-life functioning. The authors' believe that current assessments of executive functions do not transfer easily to real-world behavior. There are limitations in the current examinations and in the settings in which they are given. The tests are artificial and the test settings lack the usual stresses, distractions, and multiple demands common to real life. The interactions are unlike what they experience in everyday life. The examiner often, but unintentionally orients the participant to relevant information that in turn can help the person compensate for the difficulties with executive control processes and bias the findings…"

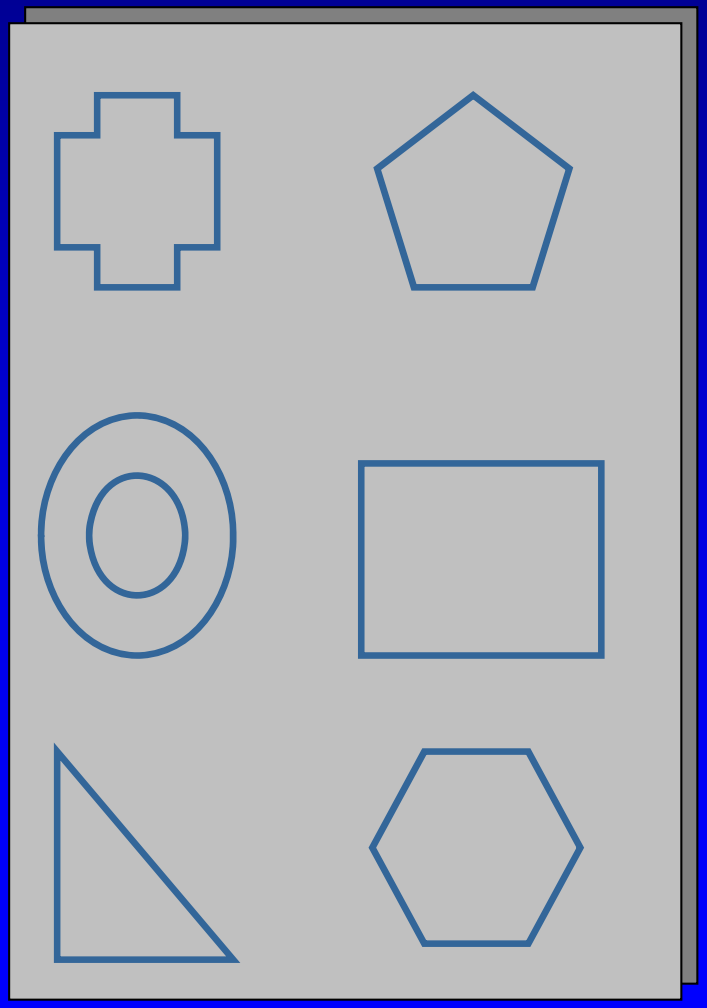
  - A Simulated Reality Scenario Compared with the Computerized Wisconsin Card Sorting Test: An Analysis of Preliminary Results
    - James S. Elkind, Erica Rubin, Saul Rosenthal, Barry Skoff, Penny Prather. CyberPsychology & Behavior. August 2001, 4(4): 489-496. doi:10.1089/109493101750527042.

Memory Assessment (Rizzo, 2007)

Verbal

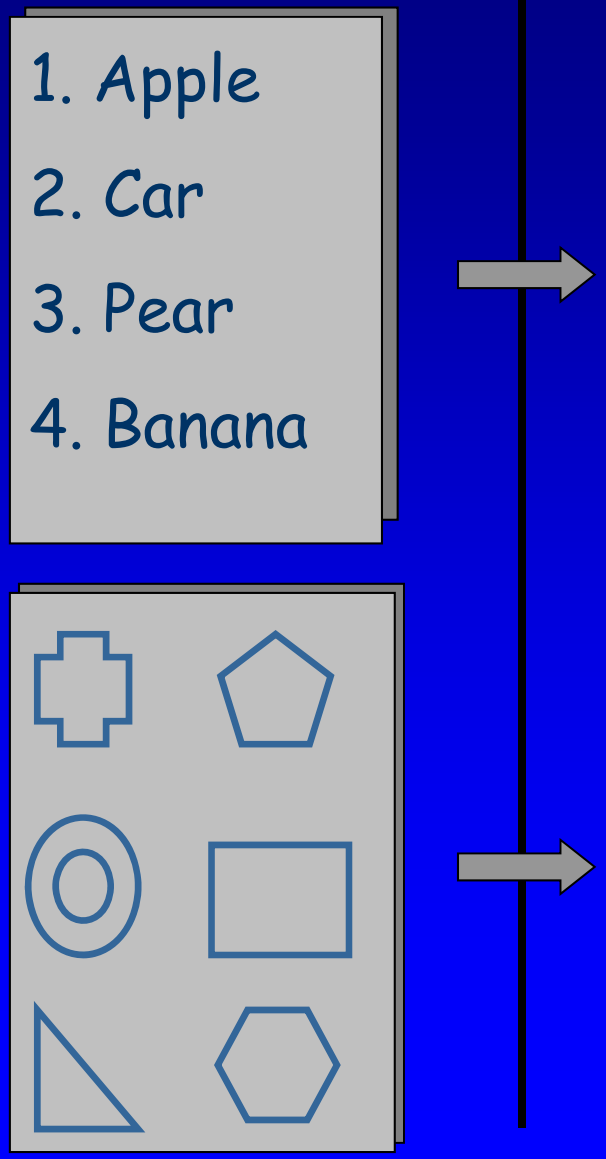
1. Apple
2. Car
3. Pear
4. Motorcycle
5. Orange
6. Bicycle
7. Banana
8. Subway

Visual



Generalization of Ability

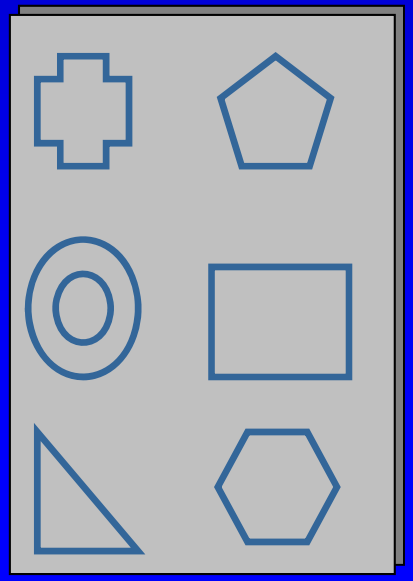
(Rizzo, 2007)



Generalization of Ability

(Rizzo, 2007)

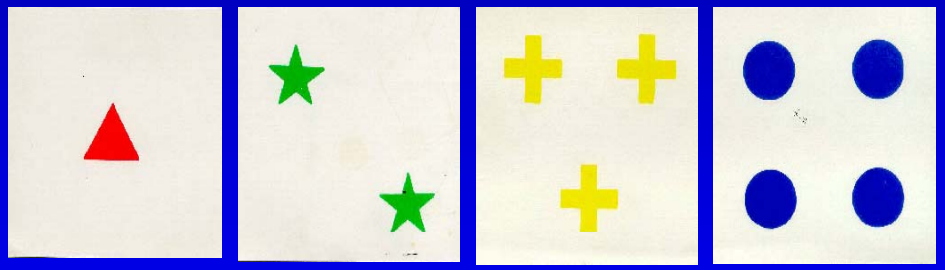
1. Apple
2. Car
3. Pear
4. Banana

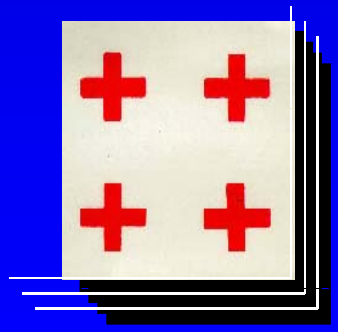


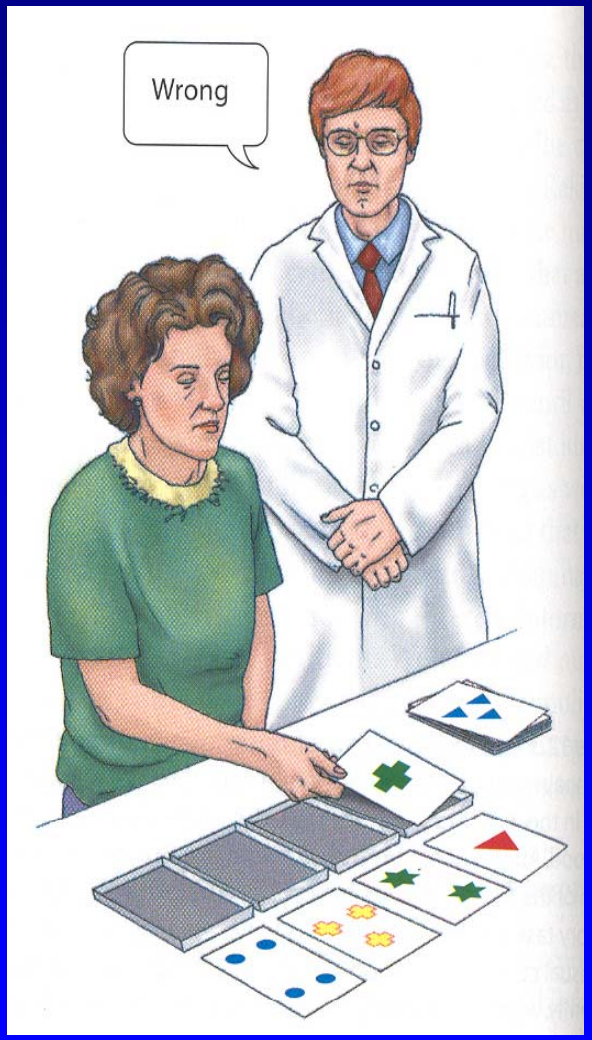
Wisconsin Card Sorting Task

(Rizzo, 2007)

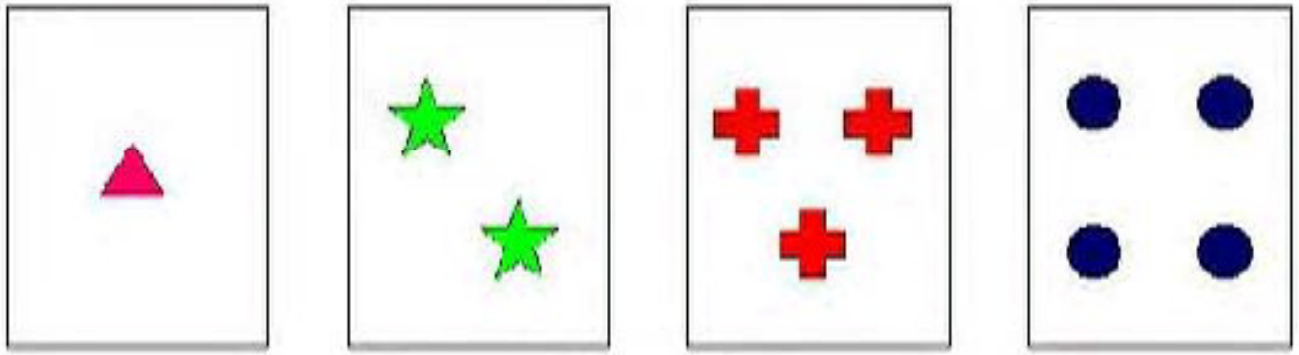
- Weinberger et al., 1986

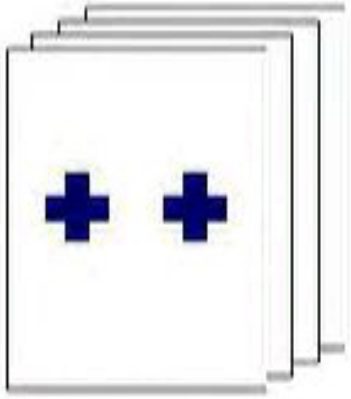


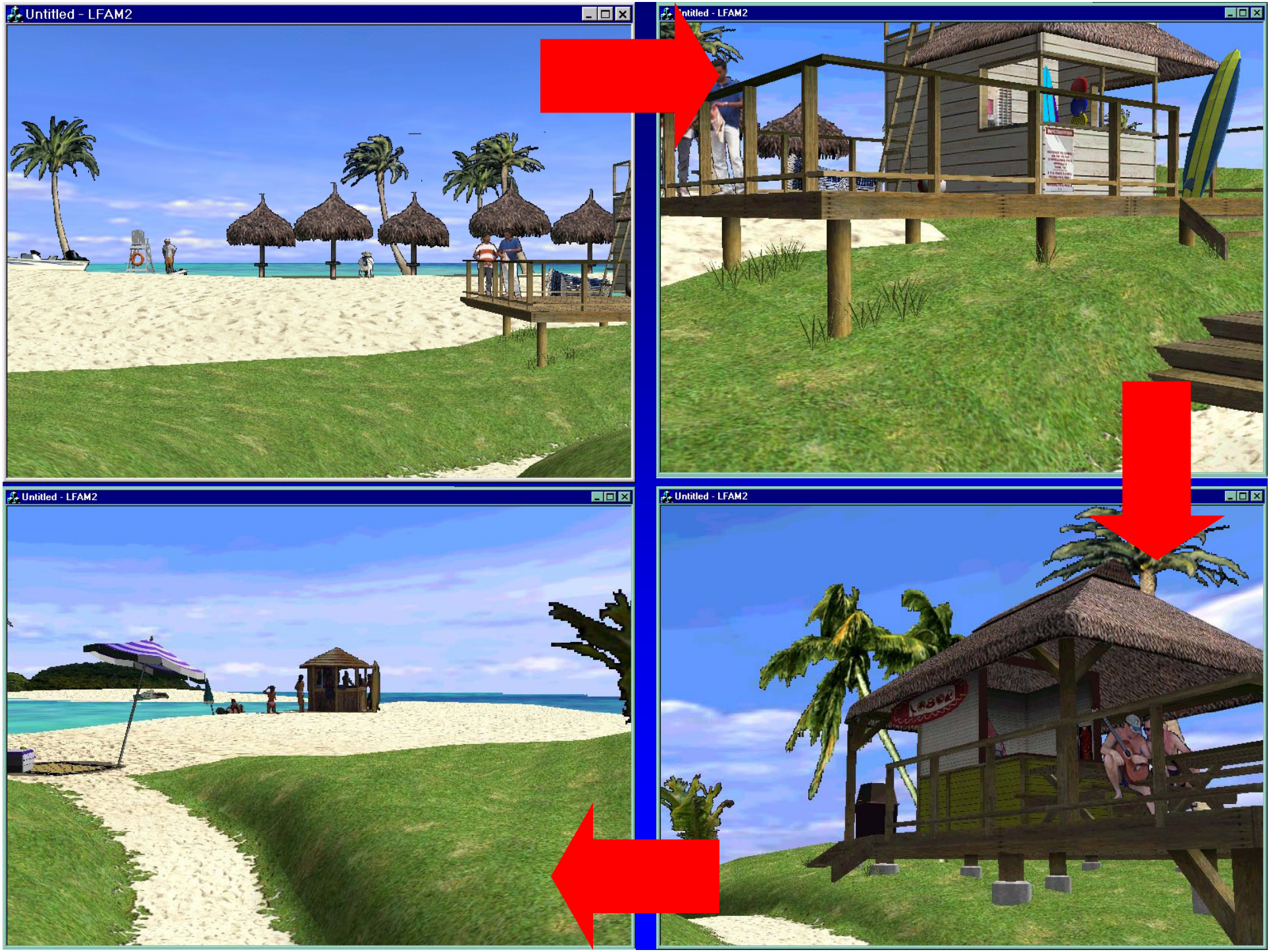




Wisconsin Card Sorting Test



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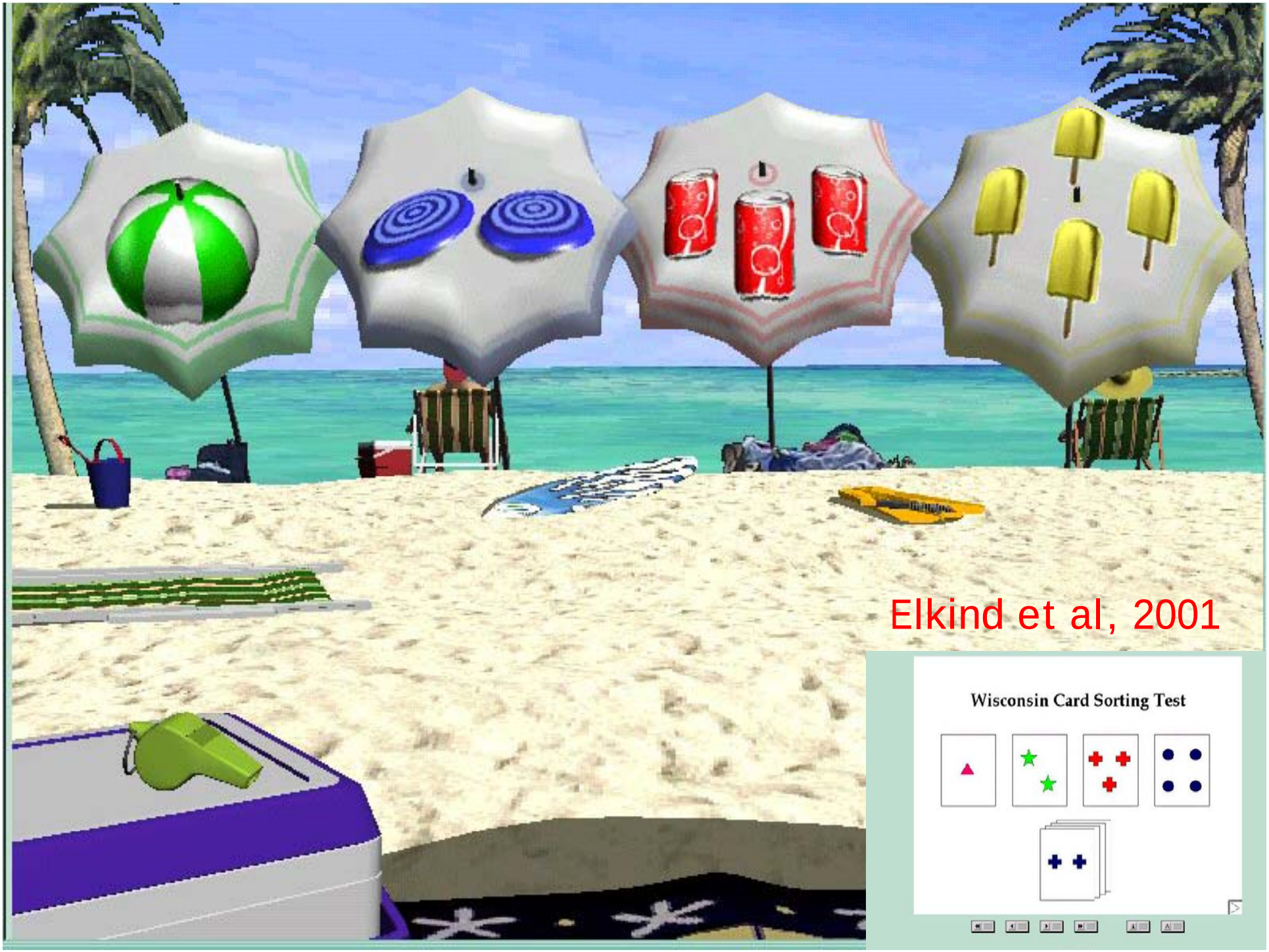

Elkind et al, 2001
Wisconsin Card Sorting Test

LFAM was a more difficult, but more enjoyable and engaging task than the WCST (Rizzo, 2007)

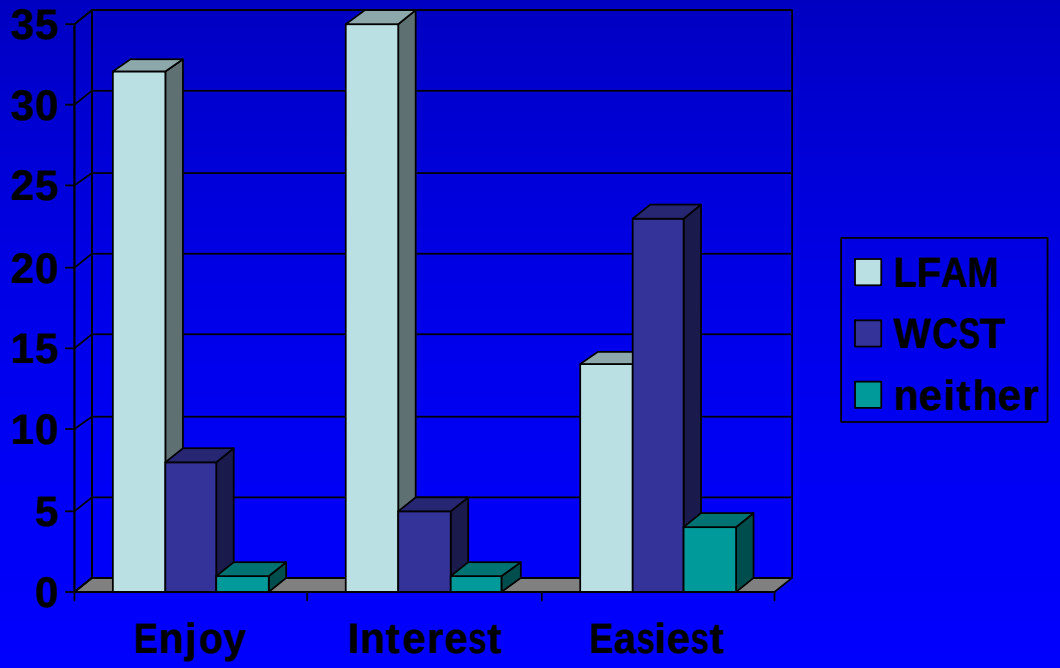
Elkind et al., 2001

Subjective Data:

More enjoyable

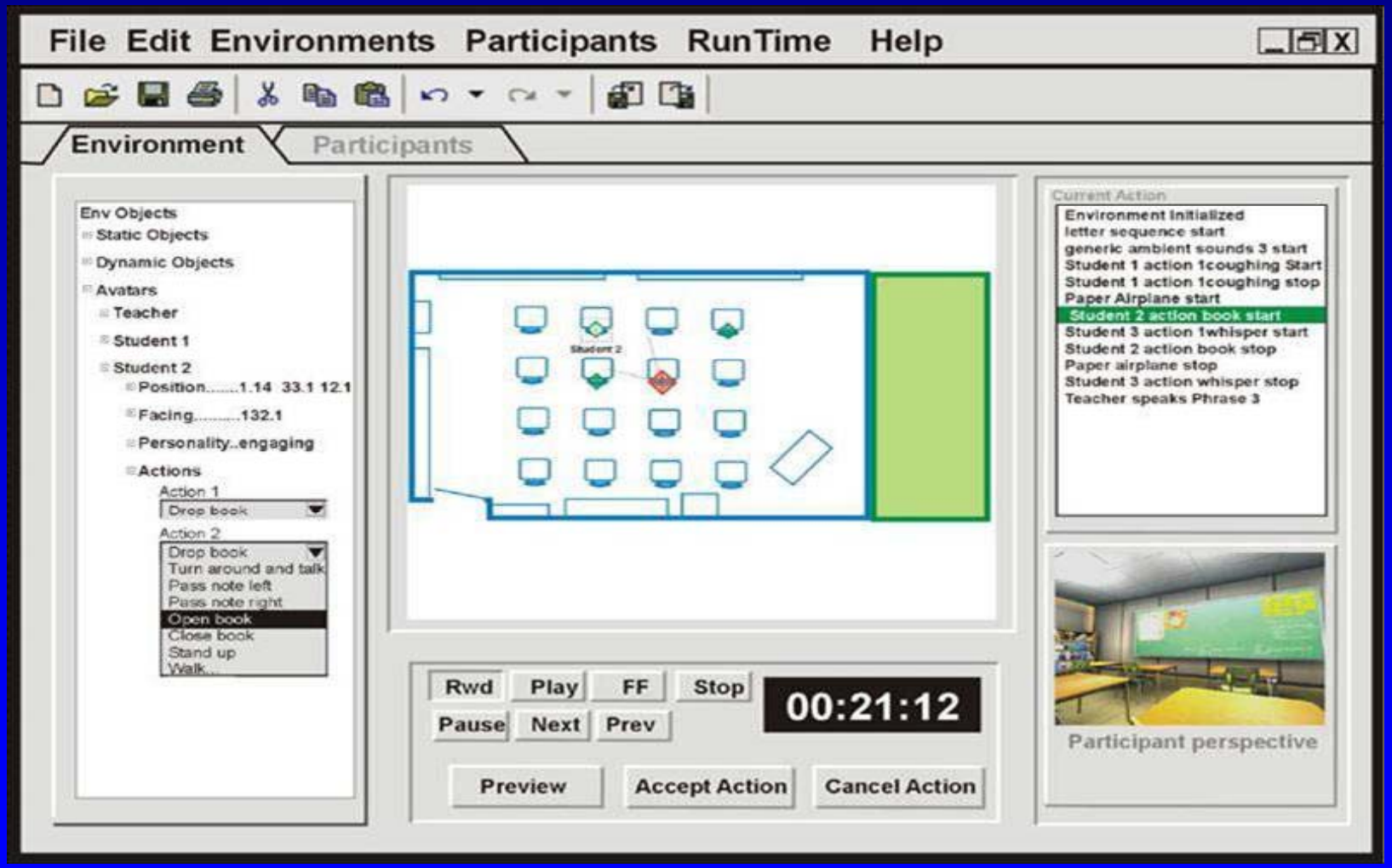
More interesting

More difficult

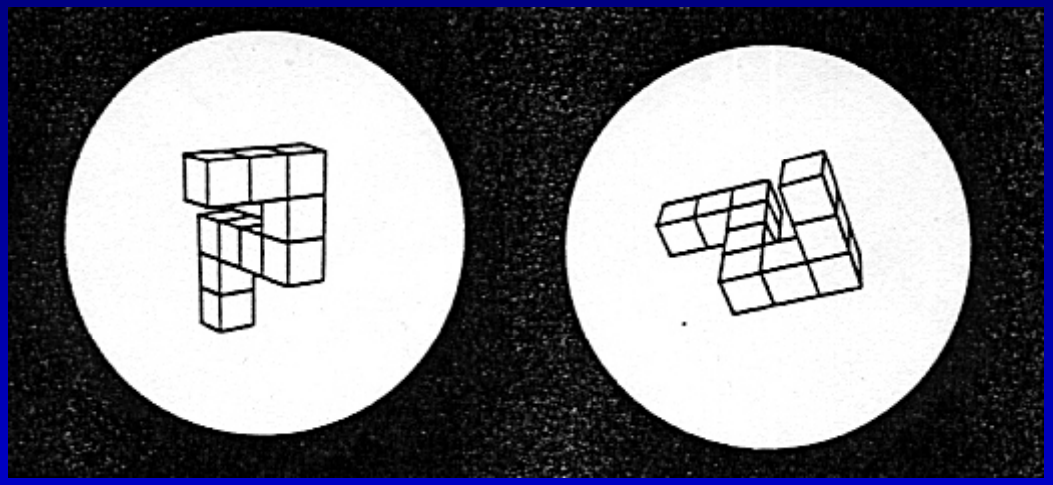


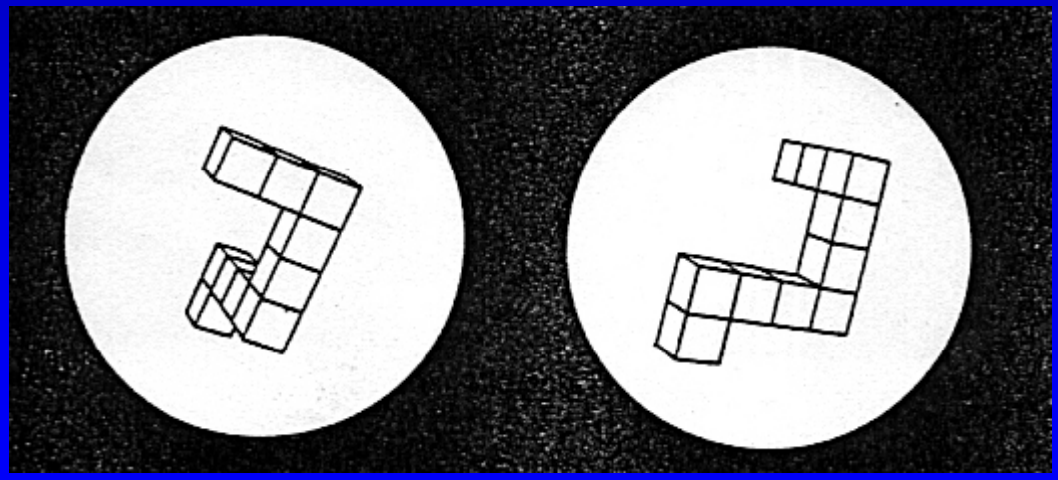
Virtual Classroom

Virtual Classroom



Mental Rotation Task





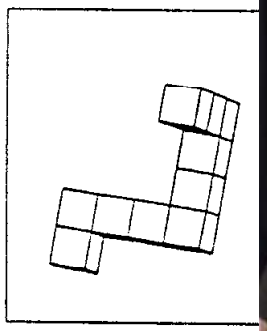
Shepard and Metzler, 1971

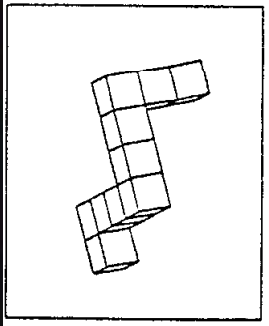
Mental Rotations Task (MRT)

(Vandenberg and Kuse, 1978)

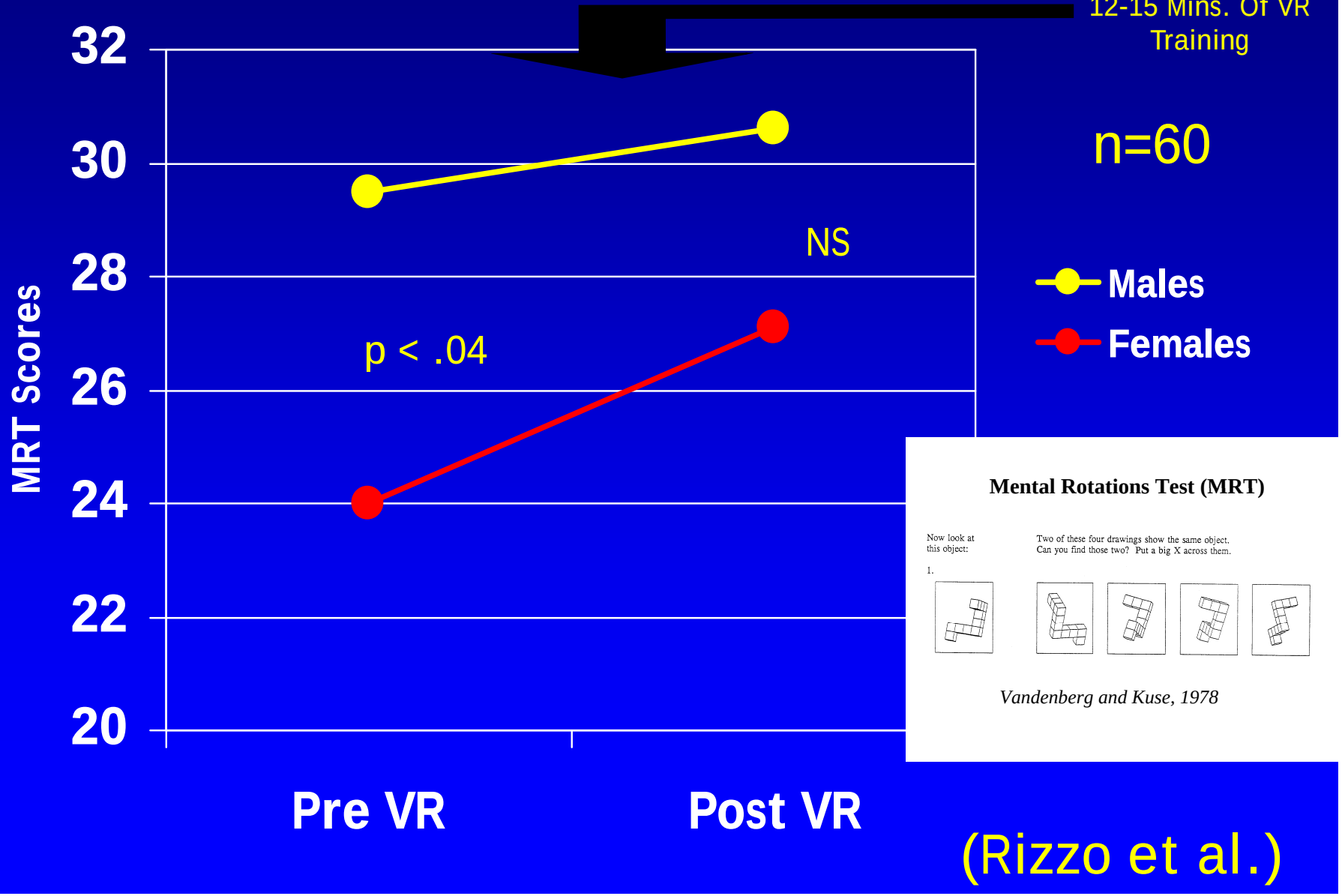
Now look at
this object:

1.





Mental Rotation Scores - Pre/Post VR for *Males* vs. *Females* (Rizzo, 2007)



(Rizzo et al.)

Mental Rotation Scores – VR vs. Control group for *poor initial performers (male & females combined)*

(Rizzo, 2007)

12-15 Mins. Of VR Training

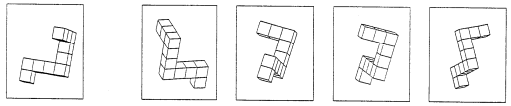
n=60

Mental Rotations Test (MRT)

Now look at this object:

Two of these four drawings show the same object. Can you find those two? Put a big X across them.

1.



Vandenberg and Kuse, 1978

(Rizzo et al.)

Lessons…

- Classical assessments:
  - Do not measure the criterion
    - Measure the predictor in order to have an idea about the criterion
      - A better control!
  - Are not ecological (sample to population)
  - Miss some processes
  - Do not have a formative/dynamic component

Psychology - Psychotherapy

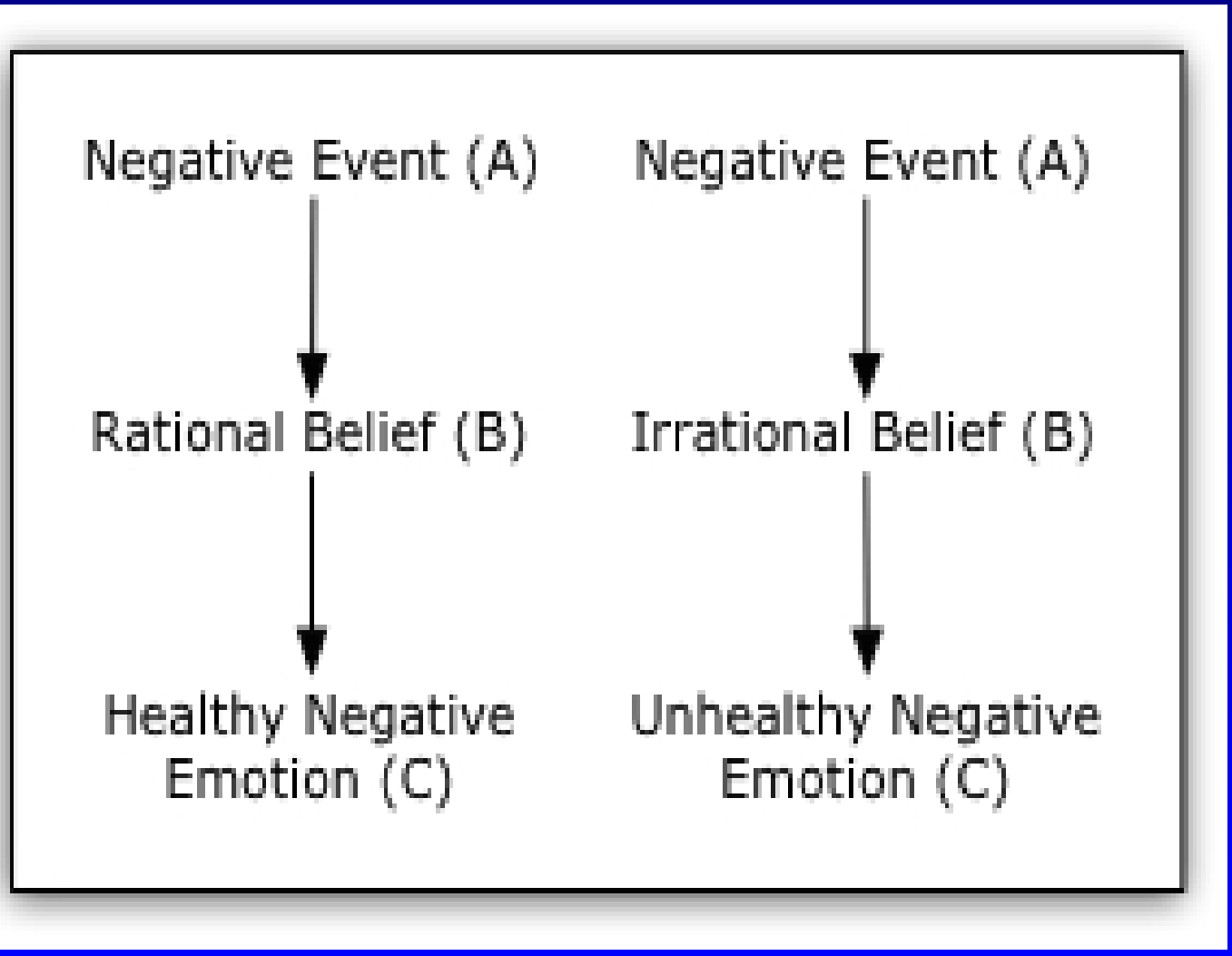
Psychotherapy

- **Psychotherapy – psychological intervention for:**
  - **Health promotion**
  - **Treatment of mental disorders and/or other disorders which involved psychological factors in their etiopathogenetic mechanisms**

Virtual Reality in Psychotherapy

- Activating events to prime, in a controlled environment:
  - Behaviors
  - Cognitions
  - Emotions
  - Physiological reactions
- Cognitive restructuring
- Behavioral modifications
  - Exposure
  - Systematic desensitization

Ellis & Beck's models



Social Phobia
Légeron, Roy, Klinger et al., 2003

Cue Exposure: Virtual Crackhouse (Astur et al)

Virtual Vietnam PTSD Studies

- **Ready et al. (1998) – Atlanta VA - pilot study**
  - **34% decrease in clinician-rated PTSD symptoms**
  - **45% decrease in self-rated PTSD symptoms**
- **Rothbaum et al. (1999) - case study + 6-month Follow-up**
- **Rothbaum et al. (2001) – clinical trial (n=16)**

Psychology - Rehabilitation

Cognitive Rehabilitation

"…The therapeutic process of increasing or improving an individuals capacity to process and use information in order to allow an increased functioning in everyday life…"

(Solhberg & Mateer, 1989)

Restorative Approach (Rizzo, 2007)

- Brain – the Muscle Analogy
- Systematic Drill and Practice
- Immediate Feedback
- Hierarchical Presentation
- Repetitive

Functional Approach (Rizzo, 2007)

- Focuses on the stepwise training of observable behaviors, skills, and IADLs
- Training in targeted work environments, kitchens, factories, homes, offices, etc.

Limitations of current cognitive approaches (Rizzo, 2007).....

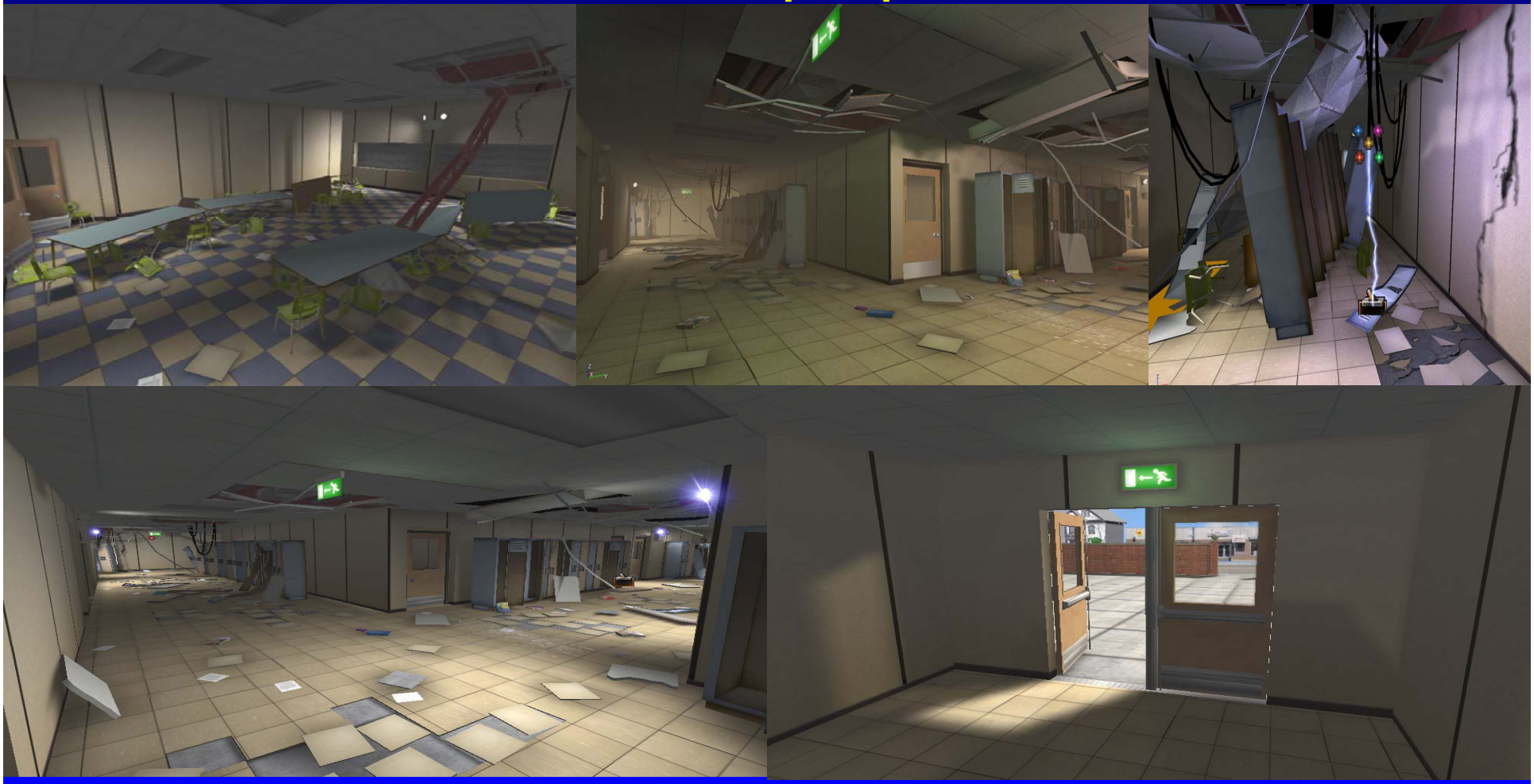
- RESTORATIVE/COMPENSATORY...
  …uncertainty of how interventions apply to the “real world”!
- FUNCTIONAL……limited control and therefore difficult to replicate and establish validity & reliability data for good science!

SOLUTION!

"…Virtual Environments that provide systematic restorative training within the context of functionally relevant, ecological valid, simulated environments!..."

(Rizzo, 2007)

Flexible reconfiguration of this “Archetypic” scenario for other purposes: (Rizzo, 2007)



Virtual Earthquake safety training tool for children with developmental and learning disabilities. (Aristotle University of Thessalonica, Greece)


PATHNODES
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1386.32,229.29,-2297.15
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65119,3193,0
ANG:17.54,176.56
PATHNODES
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Psychology - Somatic Medicine

Comparison: Video game and VR for Pain

Video game during wound care

In VR during wound care

Hoffman, Doctor, Patterson, Carrougher & Furness, T.A. III (2000). Use of virtual reality for adjunctive treatment of adolescent burn pain during wound care: A case report. Pain.

Rationale for VR/Games Pain Distraction

Limited-Capacity of Attention

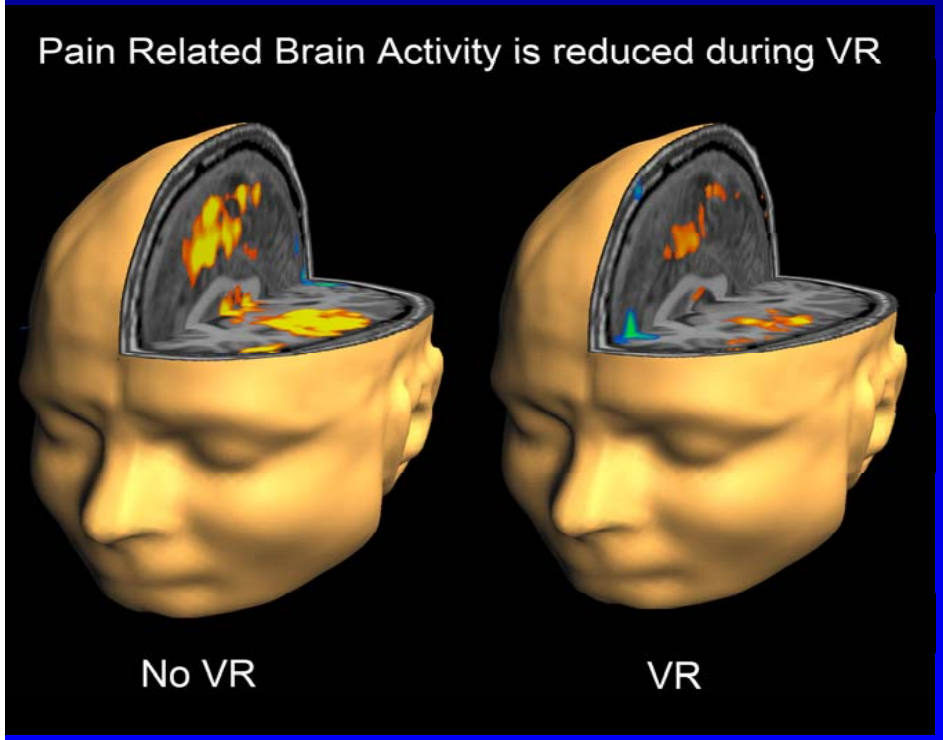
(e.g., Broadbent, 1958; Shiffrin & Schneider, 1977)

Attention and Pain (Rizzo, 2007)

- Pain perception requires attending to noxious stimuli
- Pain can be reduced by distributing attention
- Effectiveness related to intensity, novelty, & unpredictability of distracting stimuli (McCaul & Malott, 1984).
- VR/Games are based upon attentional resources
- HMD prevents visual perception of environment

Burn Wound Care & Physical Therapy (Hoffman et al.)

fMRI VR Pain Distraction
(Hoffman et al.)



Reduced Activation in: Primary & Secondary Somatosensory Cortex, Anterior Cingulate, Thalamus and Insula

Other Applications

Figure 5. Stroke patient exercising on the Rutgers Ankle system

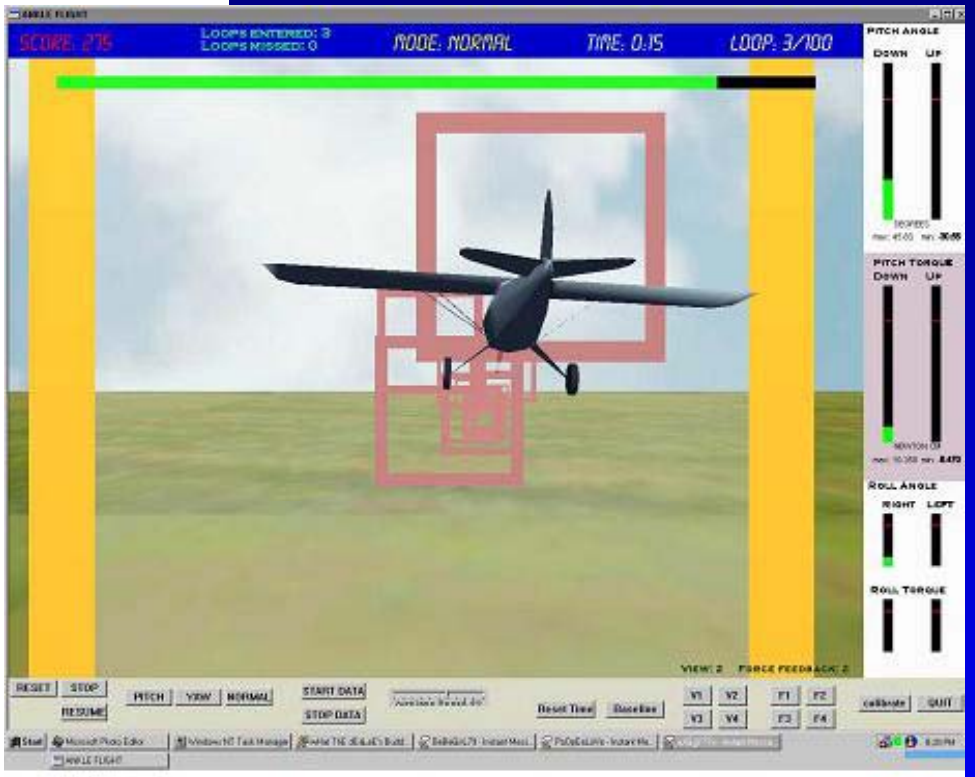


Figure 4. Exercise screen showing the airplane piloted by the patient's ankle

(Burdea et al.)