Acrophobia - VR exposure in a cognitive - behavioural psychotherapy setting

Marcel Delahaye, COAT-Basel
A multi-disciplinary Team:

- Neurologists (medical doctors)
- Psychiatrists
- Psychologists (specialists for cognitive ergonomics, organizational psychology and clinical psychology)
- Engineers (SW and HW)
- Experts in Ethics
Areas of research:

- Immersive Therapy (acrophobia + claustrophobia) since 1995
- Evaluate usability of VR, Intuitive Interfaces, BCI, EEG
- In-Vehicle Systems
- Workload by on-line and real-time physiological sensing,
- Measure attention/vigilance
Equipment:

- VR-Systems: 3-Sided “Powerwall” (only 5 VR systems in Switzerland!) HMDs (V8, eMagine Z800, SVGA, 3DOF)
- Real Car Driving Simulator (the only real-car simulator in Switzerland)
- Real-time sensing capabilities of behavioural and physiological parameters, including 64-channel EEG, mobile modular neurophysiological test battery
Research activities

**Passed EU Projects**
- ..., Safeguard, Awake (Vigilance, Testing of Warning Systems)

**Current EU projects**
- Intuition, Sensation, Ask-IT, Islands, HUMABIO, GOOD ROUTES
- Managing the proposal of c-IT and Marvin

**Pharma Industry**
- Sertraline (in the driving simulator)

**Under preparation:**

Project with the University of the German Army Munich
- Treatment of Post Traumatic Stress Disorder (PTSD)
Network of Excellence on Virtual Reality and Virtual Environments
Applications for Future Workspaces

EC co-funded project (IST)
• 58 contractual partners
• Funding: 6M€
• Duration of EC Funding: 4 years
• Start Date: 1st Sep. 2004
Intuition Organisational

Network Assembly

Network Management Committee

Integration Activities
- Aerospace
- Automotive and Transport
- Constructions & Energy
- Entertainment and Culture
- Medicine/Neuroscience
- Education and Training
- Augmented Reality
- Engineering/Design
- Evaluation and Testing
- Haptic Interaction
- VR / VE Technologies

Research Activities

Dissemination Activities

Management Activities

Advisory Board

INTUITION Forum
Topics of interest are:

• Brain Computer Interfaces
• Neuroscience and VR, simulator sickness
• VR for diagnostics, training and rehabilitation

• Contact:
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  – Marcel Delahaye (key@coat-basel.com)
  – Oliver Stefani (ols@coat-basel.com)
Treatment of Acrophobia in VR

- Is VR exposition an effective treatment for Acrophobia?
  - Is anxiety experienced in VR?
  - Is the threat as intensive as in the real world?
  - Does a transfer effect succeed?
    in case a desensitisation in VR is successful, does the transfer of the outcomes of the exposition to real situations succeed?
PHOBIAS

- Epidemiology:
- Lifetime prevalence of Anxiety disorders: 10- 15 %
- 6 month prevalence 5 - 10%
- Gender distribution: 17.5 % female; 8.5 % male
- Specific phobia: WHO ICD-10 classification:
  - F40.2
General criteria of anxiety disorders

• Intensive experience of fear, resp.:  
• Avoidance  
• Physiological correlates  
• Expectations  
• Fugitive thought
Indicators of pathological anxiety

- anxiety is not appropriate to the situation
- anxiety reactions take clearly more time than would be necessary
- rational access to the anxiety does not cure
- anxieties lead to clear impairments of life of the concerned persons

- crucial: Discernment that the behaviour is exaggerated
Treatment:
- Exposition
- Goal: desensitisation
- Lege artis: anxiety hierarchy
- Horizontal and vertical analysis

  • First manifestation/ Triggers
Anxiety circuit

View into the abyss

Thought: "I could fall"

Decrease of the anxiety but:
Generalisation: thought:
"When I go to work today
I have to look down … …“

Physiological reactions:
tension, tachycardia, sweating,
globe, hyperventilation

Avoidance

Intensive anxiety

Negative enforcement
Expected and actual course of the Anxiety

- Expected
- Exposition
- Avoidance
Psychoeducation

• thoughts
• feelings
• physical reaction
• behaviour
• Which further restrictions?
  – Job-related
  – Private

• Counteractive measures?
  – Alcohol

• Attempts of treatment?
  – „On one's own account“
  – Professional help?
Which physical symptoms appear in the anxiety situation?

- Shortness of breath or breathlessness
- Feeling of suffocating or choking feeling
- Heart palpitation, tachycardia
- Chest Pain or trepidation
- Perspiration
- Dizziness, drowsiness or gone feeling
- Nausea or stomach-/intestinal trouble
- Feelings of irreality or being detached
- Deafness or prickle in bodily parts
- Hot flashes or chills
- Shiver or tremble
Dysfunctional thoughts

• Catastrophizing
  • The railing is unsteady!
  • No railing is safe to 100% but (almost) each balustrade can catch a downfall. How relevant is the stability of the balustrade?

  • I will fall!
  • From where do I know that? Already happened?

• I might jump!
• Most people have these thoughts,
• Fear of loosing control: Do I eat grass?

• Generalisation:
  • Every height is dangerous.
  • Generally that’s right but height does not mean to fall!

• Intuitive – emotional argumentation:
  • It’s dangerous because I’m scared.
  • Are mystery stories also dangerous?
Psychological Symptoms

- Derealisation
- Depersonalisation
- Agony, fear of death
- To be afraid to go insane
- To be afraid to do something uncontrollable

Münster Strassburg
Study

- Subjects: N = 67
- 35 VR, 32 real Exposition (CG)
- Anamnesis:
- Criteria DIPS
  - Number of specific phobias
  - Number of symptoms:
  - First manifestation
  - Comorbidity
  - Quality of life
Anamnesis

- Exclusion from somatic treatment required diseases
- Exclusion from mental comorbidity
  - Particularly from other anxiety disorders
  - Addictions (e.g. drug…)
- Expectations: interested, euphoric, resigned, motivated
- Crucial:
  - Realistic briefing: possibility of failure
“Flooding” in VR

- Ascencion on top height without intermediate levels
- Feedback from patient (Subjective Unit of Discomfort Scale: 0 - 100 anxiety)
- End of session: when sig. decrease of anxiety on top height

- Variation of temporal dimensions of the expositions:
  - 25 minutes to 2.5 hours

- Goal of the therapy:
  - To lift the subject on virtual maximal height of 107 meters during three therapy sessions till an effect of habituation occurred.

- Drop out: with 9% very low.
Confrontation in vivo

- External staircase
- 11 floors (55 meters)
- (gradually exposition)

- Follow-up examination equal for both groups:
  - Basler Minster
    - 50 m
What is SUCCESS? (6 out of 9)

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<td>T1</td>
<td>1=yes / 0=no</td>
<td>Confirmation of benefit by the participant after 3rd session</td>
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<tr>
<td>T2</td>
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<td>Reach maximal height during therapy</td>
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<td>Progress in height &gt;30% over the three sessions of exposition</td>
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<td>T4</td>
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<td>Reach maximal anxiety value (SUD-scale)</td>
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<td>Reduction of symptoms &gt;30% in comparison to the first exposition</td>
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<td>Reach maximal height during behavior probe</td>
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<td>Reduction of avoidance behavior</td>
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<td>Long term effects: Lasting reduction of anxiety symptoms (by therapist)</td>
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<td>Confirmation of a lasting benefit of therapy by participant</td>
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<td>Resultat</td>
<td>Summation</td>
<td>Conclusion therapy outcome over all criteria</td>
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Results group „in vivo“
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<th>Proband</th>
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<th>Nachuntersuchung</th>
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• General: exposition height and SUD correlate positive in the beginning and negative with ongoing therapy (habituation)

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<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>95% Conf. Interval</th>
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<td>1. Measurement</td>
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<td>0.26</td>
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<td>Diff</td>
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<td>-47.93</td>
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<td>-56.12 - 39.75</td>
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Results

There is no sig. difference in the success rate between confrontation in VR and in Vivo Therapy effect 6 and more on evaluation scale:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>In vivo</th>
<th>VR</th>
<th>Test of significance P-Value</th>
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<tr>
<td>Therapy outcome</td>
<td>15/25</td>
<td>24/31</td>
<td>0.262 n.s.</td>
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</table>
• Effectiveness is evident
• (Simple) stimuli sufficient to trigger anxiety
• Relative performance measurement
• VR supports narration
• Creative usage
• Preparation for in vivo experiencing
• Standardized conditions (fMRT, EEG)
Our research investigates to find the best way for patients to resolve his acrophobia problems.

Phobia: Persistent and irrational fear in the presence of specific stimulus.
Acrophobia PROJECT: Fear Of Height
VR offers the advantage of a safer setting, less embarrassing and more cost-effective than producing real world situations and more realistic than just imagining the danger.
Software Architecture

**Control Computer**
- Tasks Scripts DB
- System Control Module
- Head Tracker
- GamePad

**Visualization Computer**
- Scene Graph Manager
- Virtual Objects DB
- Visualization Displays
- Sound Feedback
- HMD
- CAVE
- SINGLE SCREEN

**System Control Module**
- Control Computer
- Visualization Computer

**Visualization Displays**
- Sound Feedback
- HMD
- CAVE
- SINGLE SCREEN
Higher level of presence can increase a phobic response to a virtual anxiety producing stimulus, which is necessary for effective treatment.
“As human beings we all want to be happy and free from misery... we have learned that the key to happiness is inner peace. When you think everything is someone else’s fault, you will suffer a lot. When you realize that everything springs only from yourself, you will learn both peace and joy.”
Thank you!!!