Better, virtually: The past, present and future of Virtual Reality Cognitive Behavior Therapy

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Acknowledgements

- Some screenshots from Prof Skip Rizzo, some from Mimerse, some images from WikiCommons
- Conflict of interests: I have consulted for a now defunct start-up and receive royalties from a text book on clinical VR

Why do psychotherapy in VR?

- A great unmet need:
  - 27% of adult European population will experience a mental disorder this year ≈ 83 million people
  - Mental disorders are the third leading cause of disability-adjusted life years in Europe, after cardiovascular disease and cancers
  - Mental disorders are by far the leading contributor to years lived with disability
  - Only half of sufferers receive any treatment! (All WHO numbers)
- Cognitive behavior therapy (CBT) is an evidence-based collection of techniques for a range of mental disorders, but:
  - People are reluctant to seek traditional forms of psychotherapy
  - Even if no, they may not be able to access it
  - Even if they do, delivery may not be optimal or meet idiosyncratic needs
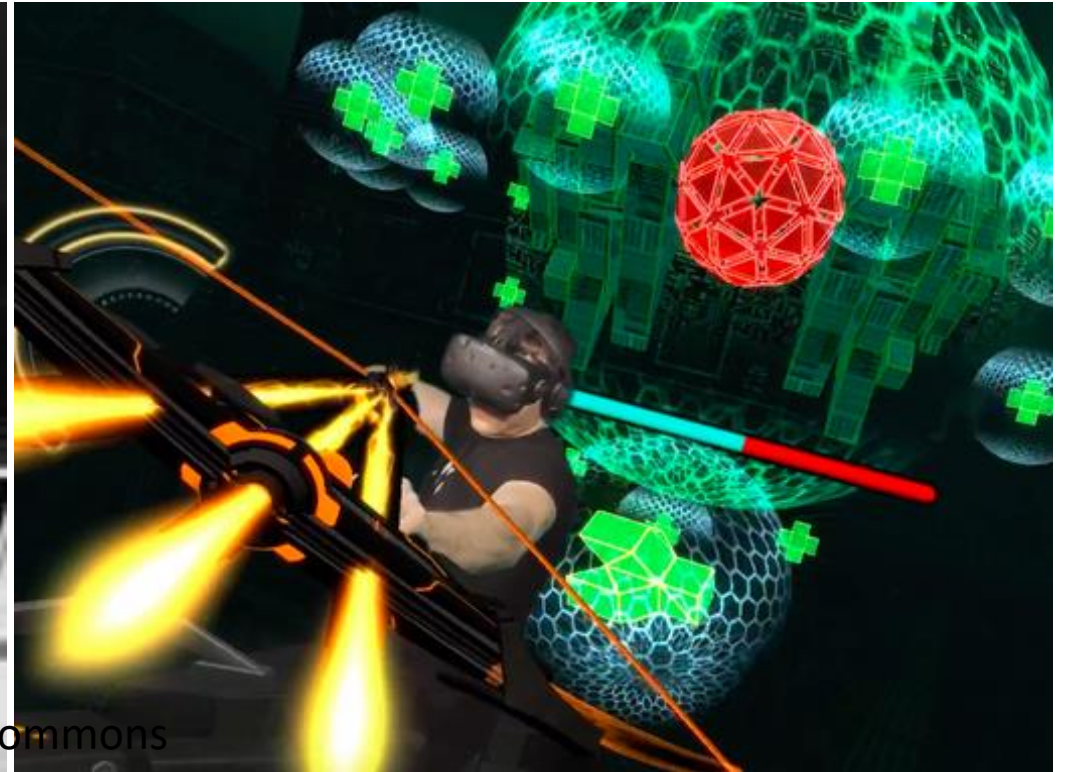
Why do psychotherapy in VR?

- A broad set eHealth solutions have attempted to address this issue, making use of the inherent advantages of technology, at least to some degree, e.g. scalability, interactivity, adaptability, and so on
- But why do it in VR specifically?
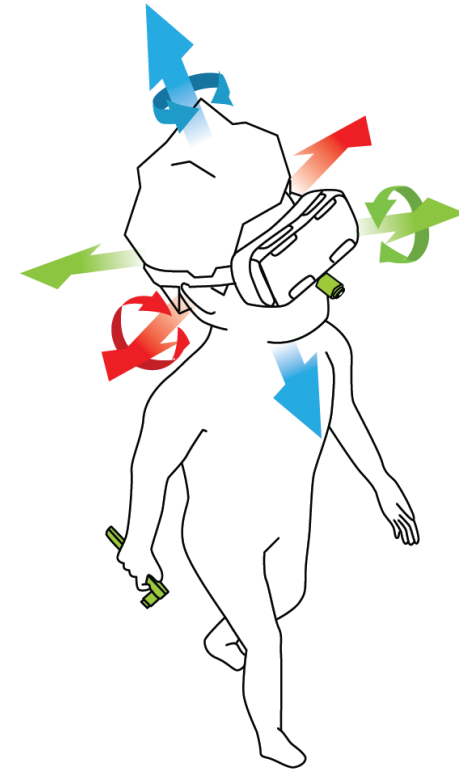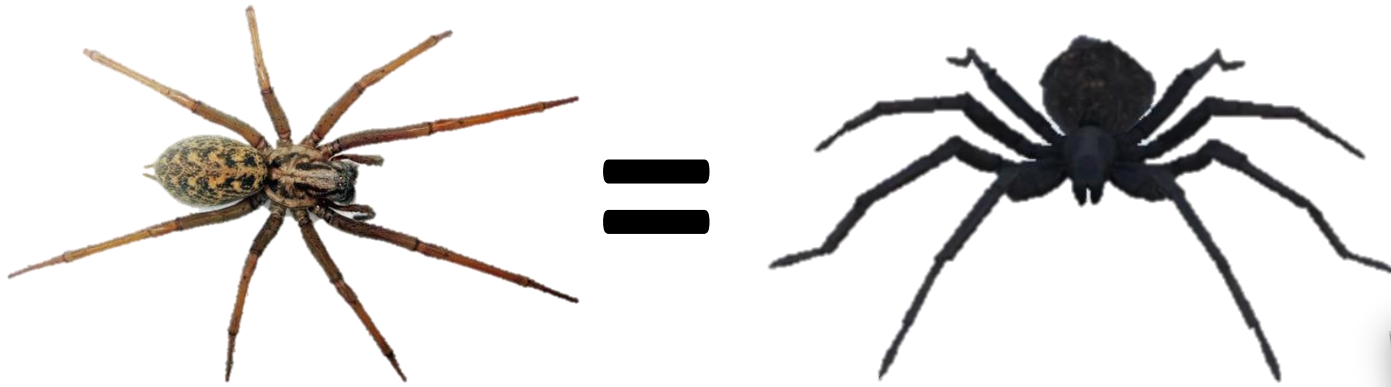
VR – a virtual "Skinner box"

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VR – the technology

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VR psychotherapy – some examples

VR psychotherapy – a brief history

Pixels per eye

Diagonal field of view

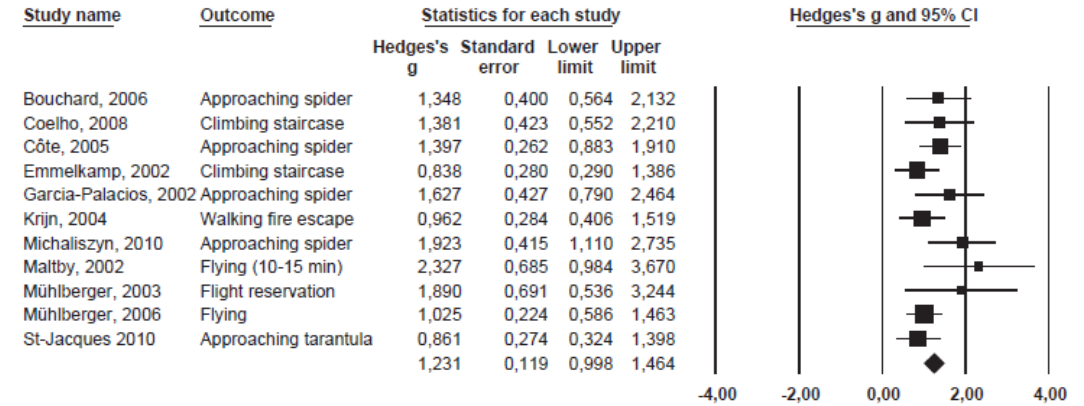| Study name	Outcome	Hedges's g	Standard error	Lower limit	Upper limit	Hedges's g and 95% CI
Bouchard, 2006	Approaching spider	1,348	0,400	0,564	2,132	
Coelho, 2008	Climbing staircase	1,381	0,423	0,552	2,210	
Côte, 2005	Approaching spider	1,397	0,262	0,883	1,910	
Emmelkamp, 2002	Climbing staircase	0,838	0,280	0,290	1,386	
Garcia-Palacios, 2002	Approaching spider	1,627	0,427	0,790	2,464	
Krijn, 2004	Walking fire escape	0,962	0,284	0,406	1,519	
Michaliszyn, 2010	Approaching spider	1,923	0,415	1,110	2,735	
Maltby, 2002	Flying (10-15 min)	2,327	0,685	0,984	3,670	
Mühlberger, 2003	Flight reservation	1,890	0,691	0,536	3,244	
Mühlberger, 2006	Flying	1,025	0,224	0,586	1,463	
St-Jacques 2010	Approaching tarantula	0,861	0,274	0,324	1,398	
		1,231	0,119	0,998	1,464	

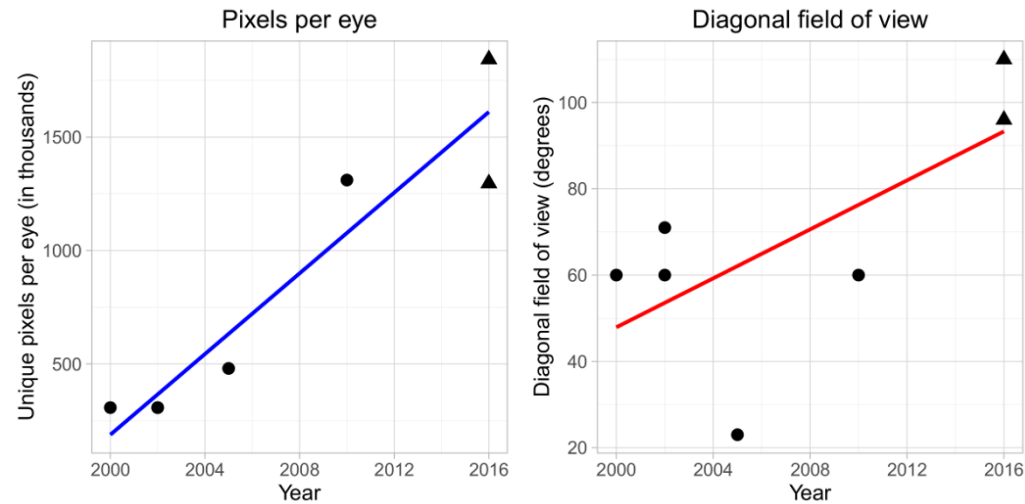Fig. 2. Uncontrolled effect size estimates (pre-vs. post-treatment) for the efficacy of VRET on behavioral assessments.

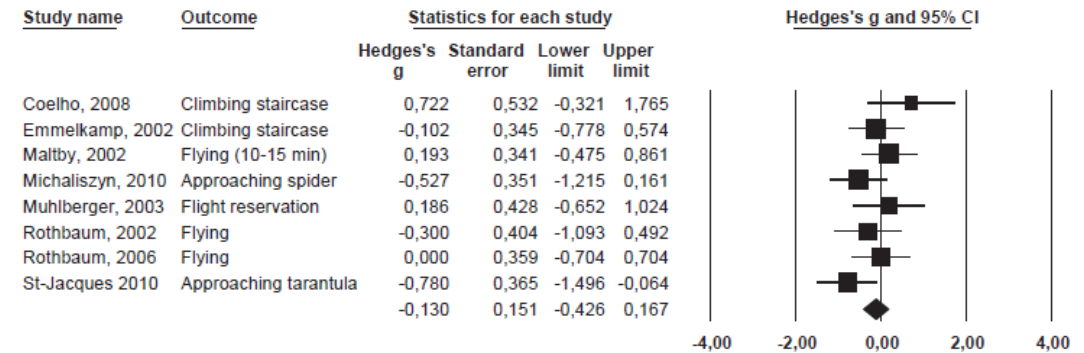| Study name	Outcome	Hedges's g	Standard error	Lower limit	Upper limit	Hedges's g and 95% CI
Coelho, 2008	Climbing staircase	0,722	0,532	-0,321	1,765	
Emmelkamp, 2002	Climbing staircase	-0,102	0,345	-0,778	0,574	
Maltby, 2002	Flying (10-15 min)	0,193	0,341	-0,475	0,861	
Michaliszyn, 2010	Approaching spider	-0,527	0,351	-1,215	0,161	
Muhlberger, 2003	Flight reservation	0,186	0,428	-0,652	1,024	
Rothbaum, 2002	Flying	-0,300	0,404	-1,093	0,492	
Rothbaum, 2006	Flying	0,000	0,359	-0,704	0,704	
St-Jacques 2010	Approaching tarantula	-0,780	0,365	-1,496	-0,064	
		-0,130	0,151	-0,426	0,167	

Fig. 3. Controlled effect size estimates for the efficacy of VRET compared to active control conditions on behavioral assessments.

Morina et al (2015)

VR psychotherapy – today

- Modern VR exposure therapy (for public speaking anxiety)
  - Automated serious game (no therapist required), including sandbox mode
  - Interactive to user behavior
  - Includes alternative embodiment, used for theraputic purposes
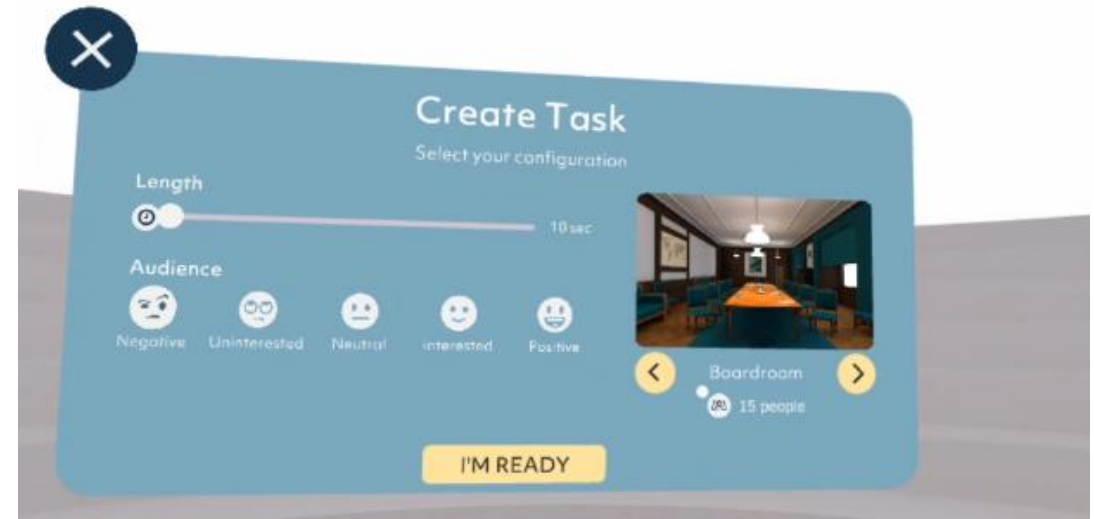
VR psychotherapy – today

- VR relaxation
  - The most commercially successful VR mental health applications thus far
  - Typically involves virtual nature environment

VR psychotherapy – today

- VR pain distraction
  - Serious game that acts distracting
  - Requires cognitive, attention and motoric resources, but just enough to keep you distracted

VR psychotherapy – let there be games!

Gamification element	Description
Dual-purpose game mechanics	All games designed to be both enjoyable and therapeutic, requiring the user to keep their gaze on a moving spider, with or without additional game mechanics. No included first-person movement, to both evoke common fear of invasion of private space by spider, and avoid cybersickness.
Speed	Used moving spider stimuli to evoke a greater fear response and prevent VR-specific safety behavior of closing one's eyes.
Goals	Clear goals for completion of each sublevel, conveyed verbally and/or visually.
Performance feedback	Scores displayed at all times and users could replay levels to achieve a higher score.
Badges and achievements	Visual summary of levels completed.
Dual-purpose narrative	Many sublevel games presented with short narrative on task background and goal.
Points	Scoring key to game mechanic in gaze task and "boss" type sublevels, requiring a certain score to complete.
Levels	Familiar level design with levels and sublevels.
Increasing difficulty	Increasing spider realism with each level.
Onboarding/psychoeducation	First part of game features traditional CBT psychoeducation on phobia development and maintenance, and rationale for exposure.
Virtual helper	Voice-over virtual therapist, also presented as hologram avatar in the virtual therapist room, introduced at beginning of game and guided the user throughout, giving instructions, encouraging progress and achievements, and summarizing key therapeutic points.

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Privacy issues

- Since everything is tracked, everything can be logged, including non-verbal data

- Can be used to recreate e.g pseudo-gaze patterns

- Micro-movements associated with chest rising with breathing, can be picked up and used as proxy for pulse

- Gaze patterns can be used as digital fingerprint

- Hence, we can collect very sensitive data not possible with other technology

- This is especially significant in clinical VR applications

Review articles

Routledge
Taylor & Francis Group
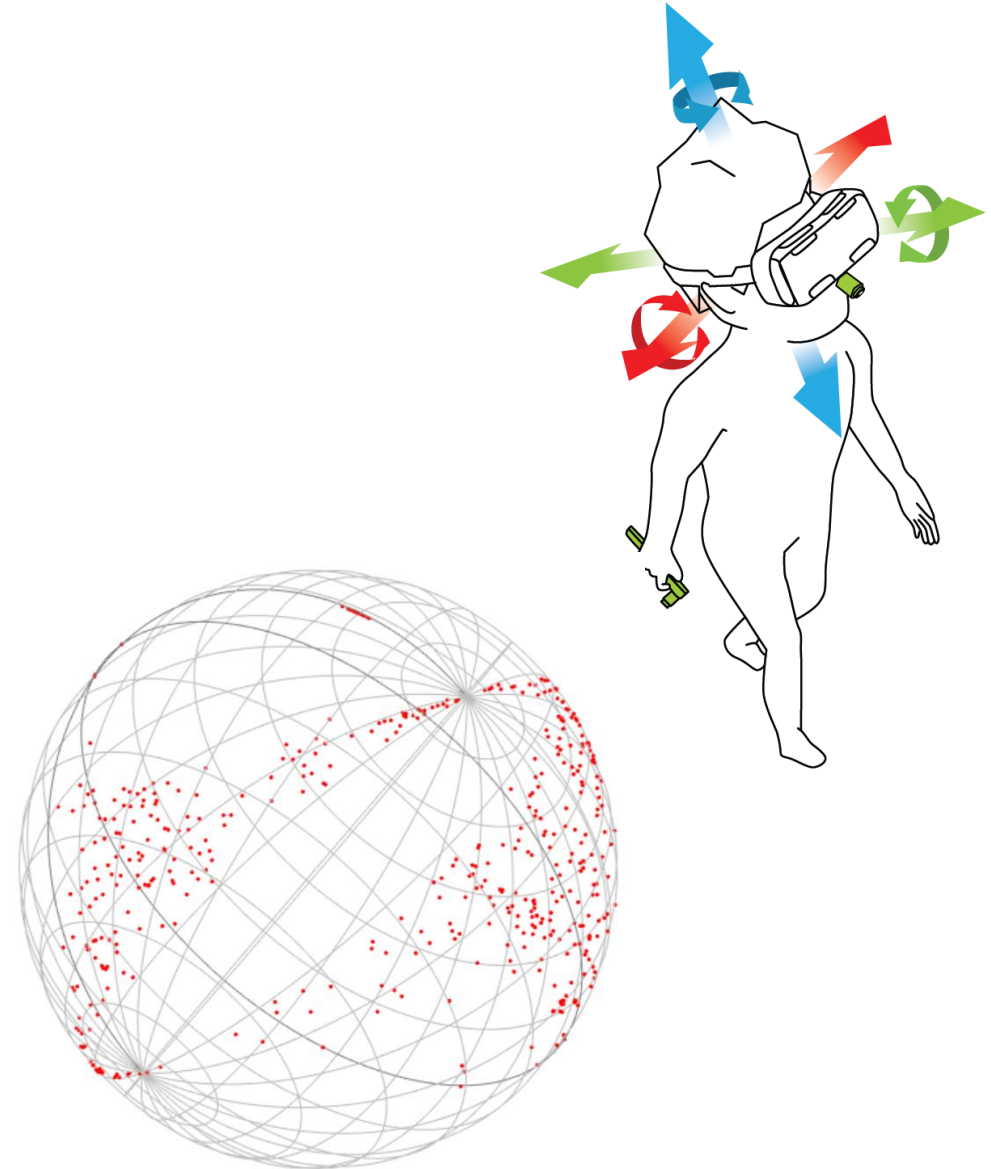
Creating state of the art, next-generation Virtual Reality exposure therapies for anxiety disorders using consumer hardware platforms: design considerations and future directions

Philip Lindner[a,b] [iD], Alexander Miloff[a] [iD], William Hamilton[a,c], Lena Reuterskiöld[a] [iD], Gerhard Andersson[b,d] [iD], Mark B. Powers[e,f] [iD] and Per Carlbring[a] [iD]

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frontiers in Psychiatry

How to Treat Depression With Low-Intensity Virtual Reality Interventions: Perspectives on Translating Cognitive Behavioral Techniques Into the Virtual Reality Modality and How to Make Anti-Depressive Use of Virtual Reality–Unique Experiences

Philip Lindner[1,2,3,4*], William Hamilton[5], Alexander Miloff[1] and Per Carlbring[1,6]

Thanks

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