



Paradoxical effects of virtual reality

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Objectives

1. Characterize the singularity of a Virtual Reality experience

Focus on the use of “Avatars”

2. Describe the specific effects produced

Little-known, powerful, sometimes extreme or even paradoxical

3. Show “good” vs. “bad” uses

All futures are possible but none is certain..

4. Discussion and questions

Dimensions of the VR user experience ?

1 General notions

- 1 Presence (VR) : feeling of « being there » in the virtual world.
- 2 Co-presence : feeling of « being together » with others in the virtual world

2 The « 3 key illusions »

- 1 Place Illusion (Pi) : illusion of being in the place depicted by the VR
- 2 Plausibility Illusion (Psi) : illusion that virtual situations and events are really happening
- 3 Virtual Body Ownership Illusion (BOi) : illusion of ownership over the virtual body that self-represents the participant

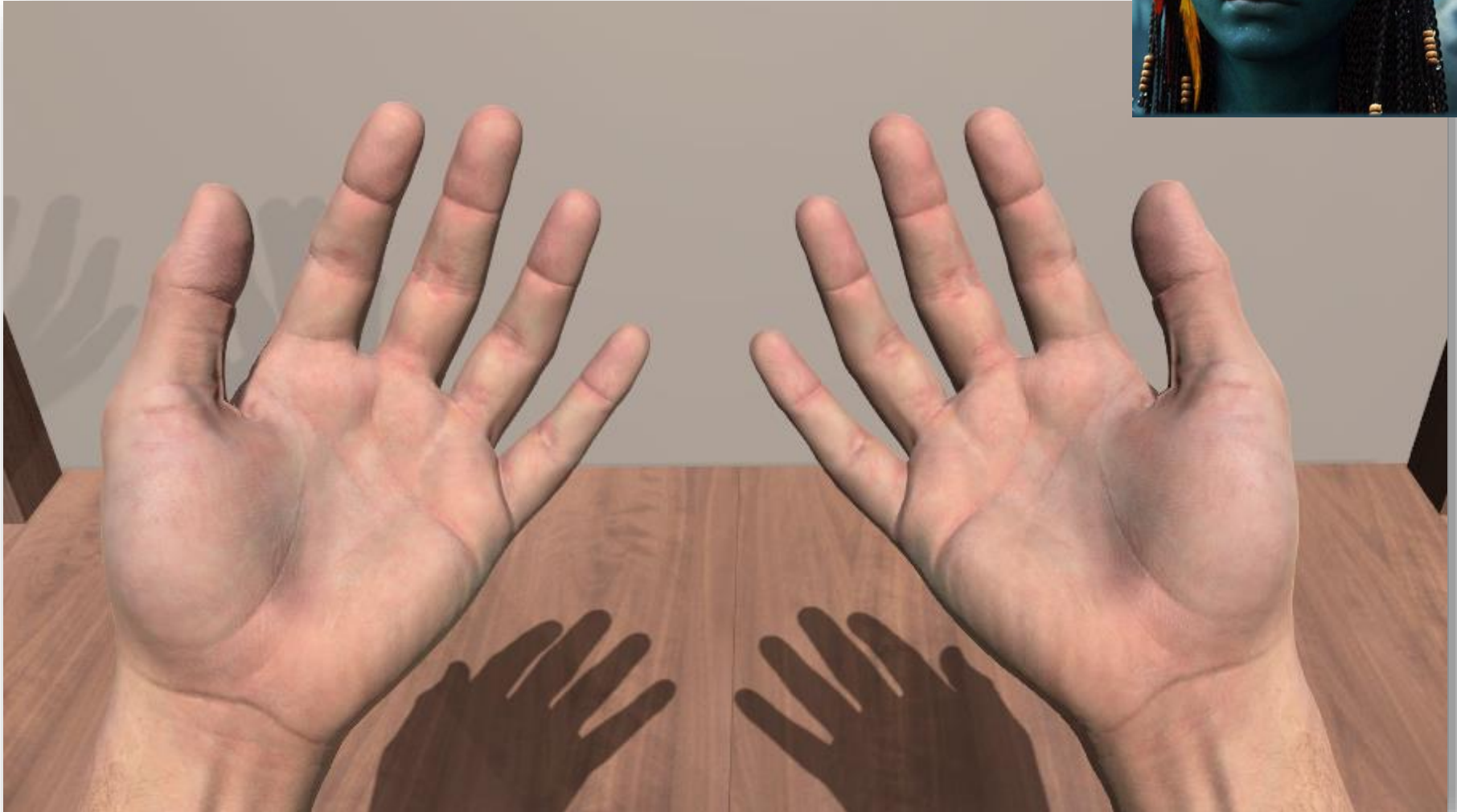
3 Sense of (virtual) embodiment

- 1 Ownership : owning the body
- 2 Agency : controlling the body
- 3 Self-Location : being located inside the body

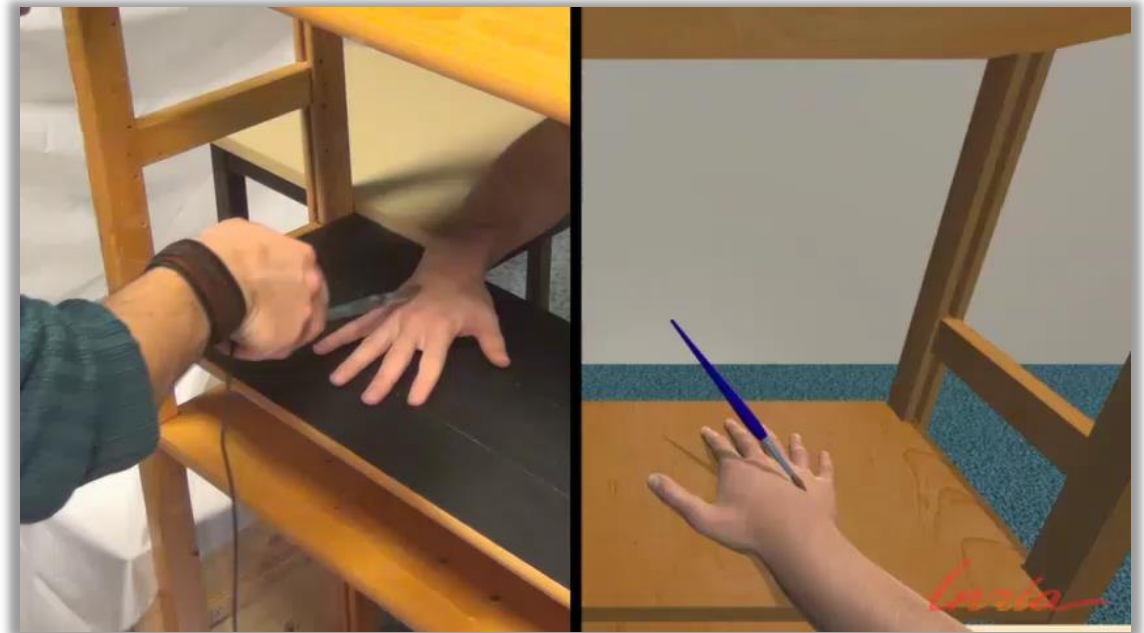
4 « Proteus » effect : stereotype behavioral effect

>> *To be continued..*

Avatars and virtual embodiment

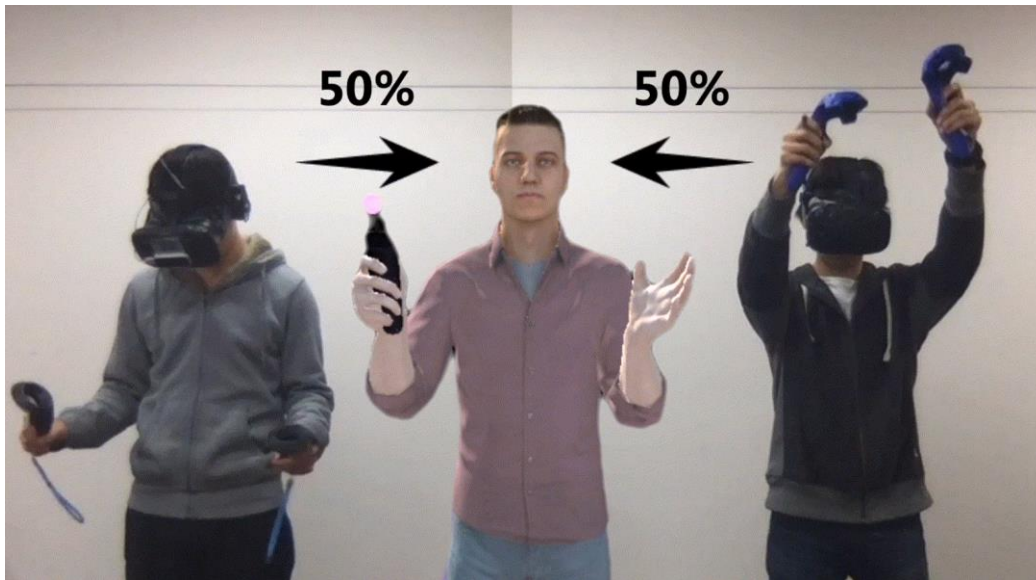
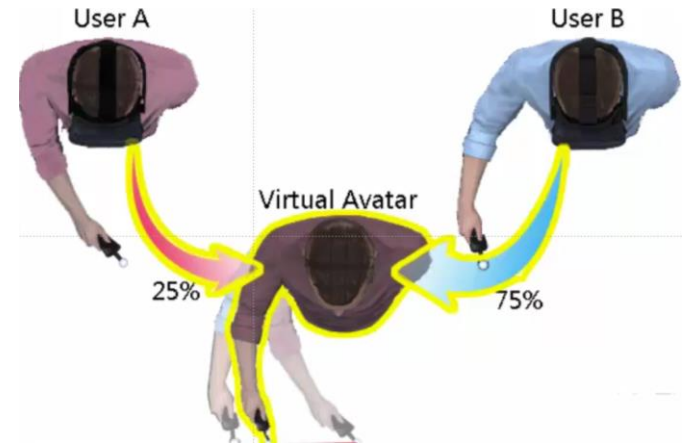


6th Finger illusion



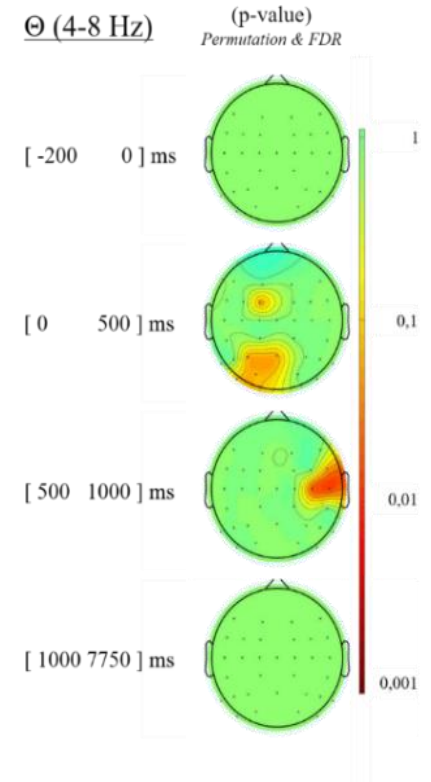
L Hoyet, F Argelaguet, C Nicole, A Lécuyer, “Wow! I have six Fingers!”: Would You accept structural changes of Your hand in VR?”, *Frontiers in Robotics and AI* 3, 27, 2016

Virtual co-embodiment



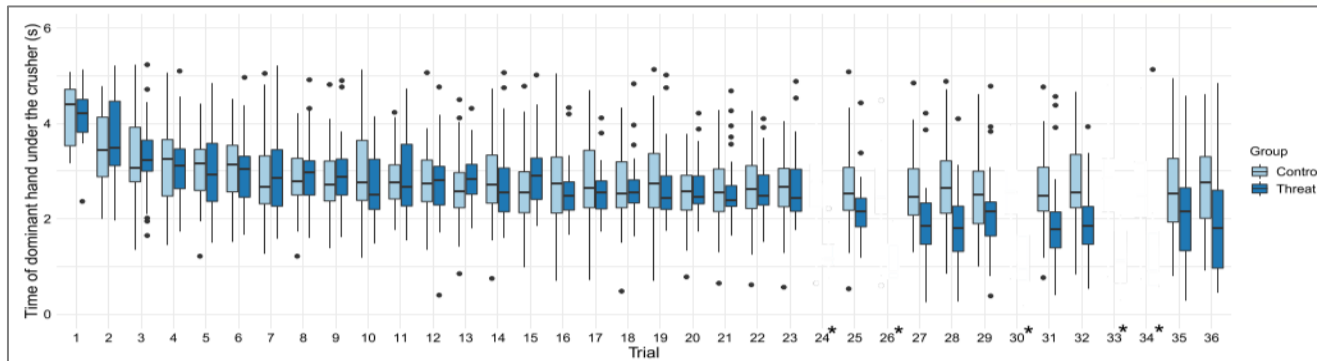
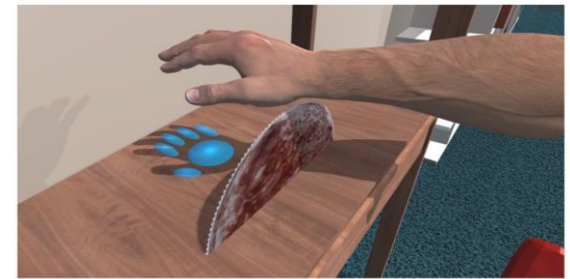
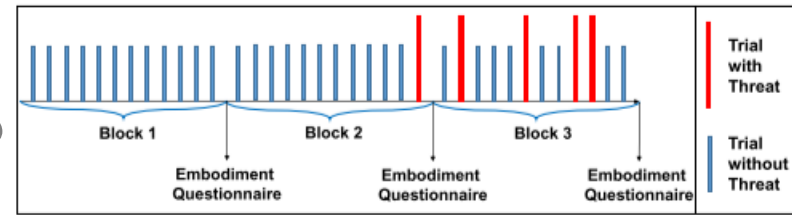
Rebecca Fribourg, Nami Ogawa, Ludovic Hoyet, Ferran Argelaguet Sanz, Takuji Narumi, et al.. Virtual Co-Embodiment: Evaluation of the Sense of Agency while Sharing the Control of a Virtual Body among Two Individuals. *IEEE Transactions on Visualization and Computer Graphics*, Institute of Electrical and Electronics Engineers, 2020

Neuromarkers in VR: Virtual Embodiment & Agency



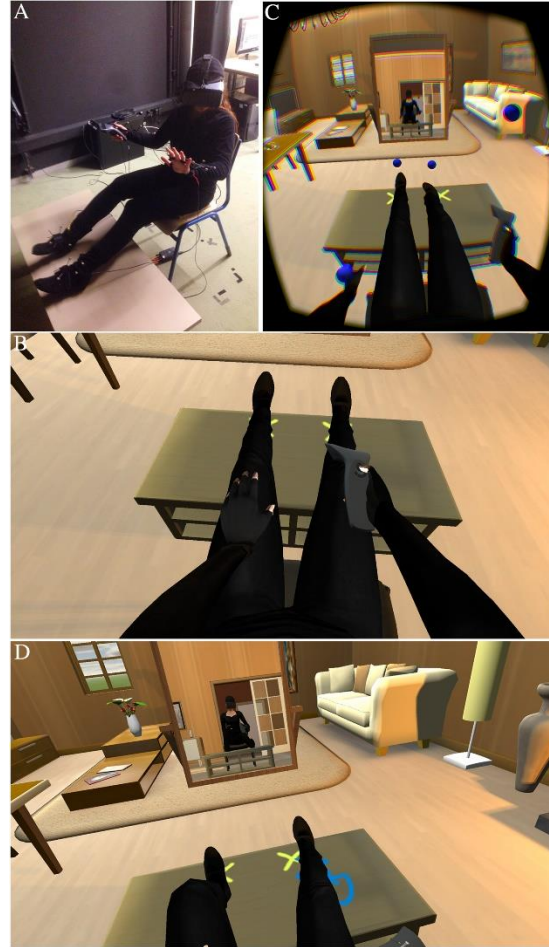
C. Jeunet, L. Albert, F. Argelaguet, A. Lécuyer, “Do you feel in control?: Towards Novel Approaches to Characterise, Manipulate and Measure the Sense of Agency in Virtual Environments”, IEEE Transactions in Visualization and Computer Graphics, vol 24, issue 4, pp. 1486-1495, 2018

Fear the virtual dangers?

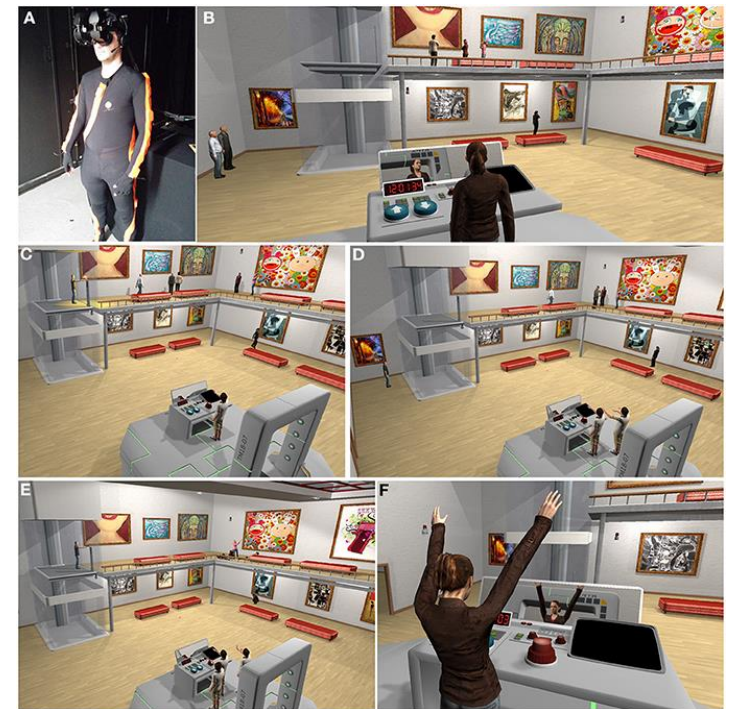
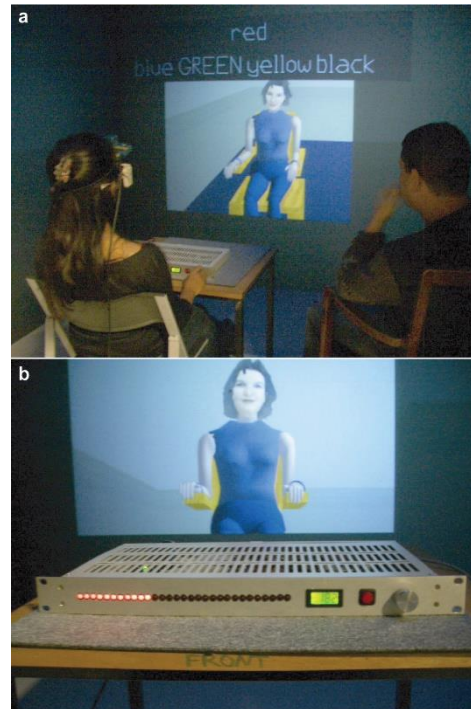


Rebecca Fribourg, Evan Blanpied, Ludovic Hoyet, Anatole Lécuyer, Ferran Argelaguet. Does virtual threat harm VR experience?: Impact of threat occurrence and repeatability on virtual embodiment and threat response. *Computers and Graphics*, 2021, 100, pp.125-136

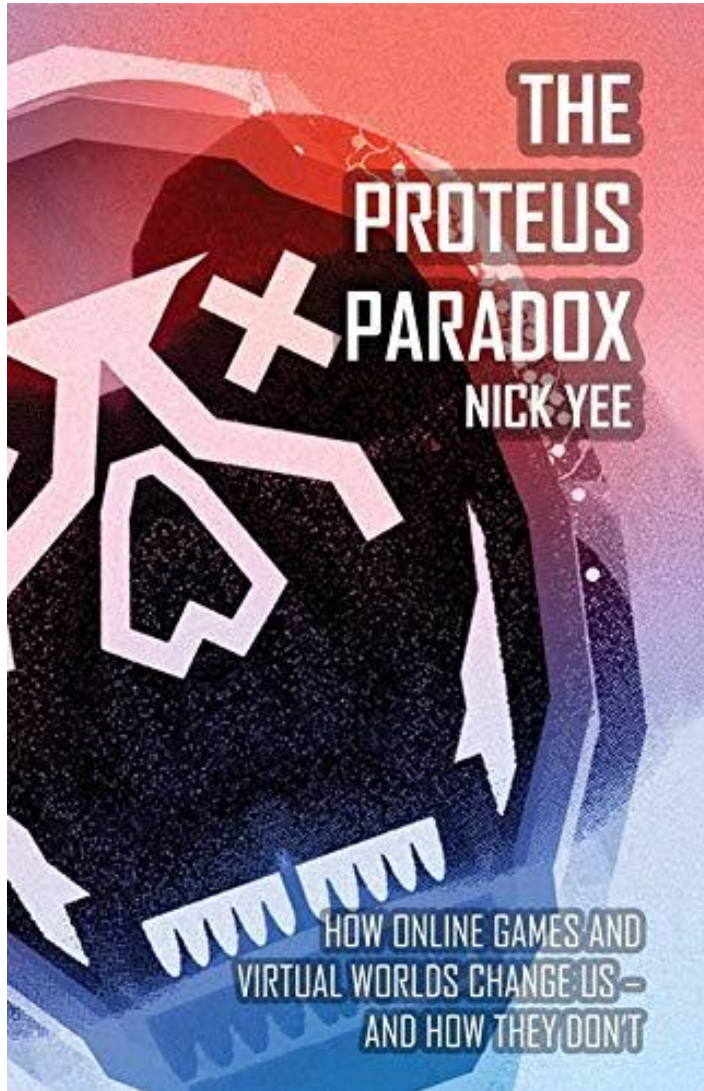
Extreme experiences



Out of body experience
Time-travel
Milgram experience
Near-death experience



The « Proteus » effect



(Banakou et al., 2018)

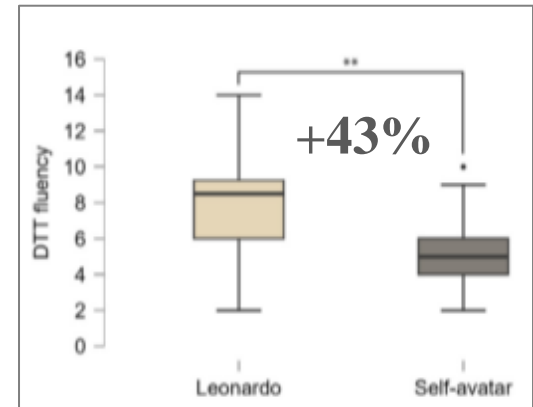
Being « Da Vinci »



(a) Lucan Portrait



(b) Virtual model



Geoffrey Gorisse, Simon Wellenreiter, Sylvain Fleury, Anatole Lécuyer, Simon Richir, et al. I am a Genius! Influence of Virtually Embodying Leonardo da Vinci on Creative Performance. IEEE Transactions on Visualization and Computer Graphics, 2023

Examples of « good » uses (SOA)

- 1 Personal capabilities: cognitive tests, creativity..
- 2 Cognitive biases: racist, age-related..
- 3 Violence reduction: domestic violence, maternal violence..
- 4 Therapies: psychotherapy, anorexia treatment..
- 5 Awareness: environmental impact, climate risks, animal causes..



VERARE Project

Inria
Mission Covid-19

CHU
Rennes



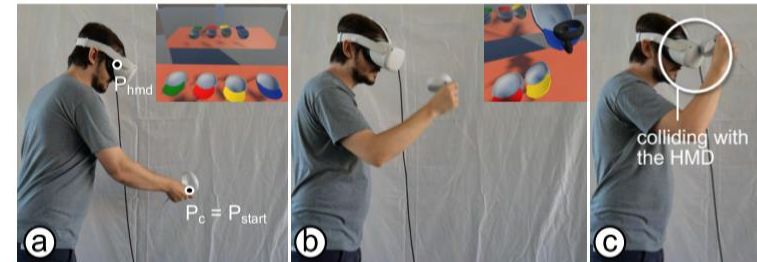
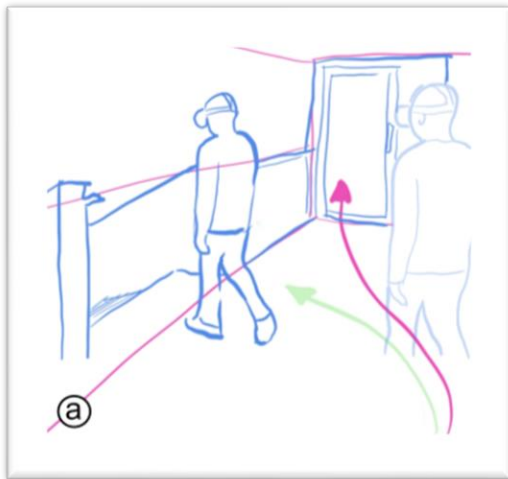
~60 patients (since 2022)

Examples of “bad” uses (prospective)

1. Virtual embodiment: powerful, multi-dimensional experience
 - ❖ “Ownership” manipulation: alteration of identity, risk of ‘liking oneself less’ in the real world
 - ❖ “Agency” manipulation: phantom actions, false memories, neurophysiological impacts
 - ❖ “Self-location” manipulation: de-corporalization, spatial manipulation
2. Proteus effect: psychological influence linked to stereotypes
 - 1 Influence on actions and behavior
 - 2 Influence on the experience or memory of an event
 - 3 Influence on opinion – possibly lasting
3. Potentially amplified effect of extreme experiences
 - 1 Violent or transgressive experiences: risk of trivialization, loss of reference points – limited knowledge today
 - 2 Increased vigilance for psychologically fragile people: psychiatric problems, children, traumatized people..
4. Spatial manipulation: physical risk by encouraging dangerous, unconscious actions or movements – see next slide

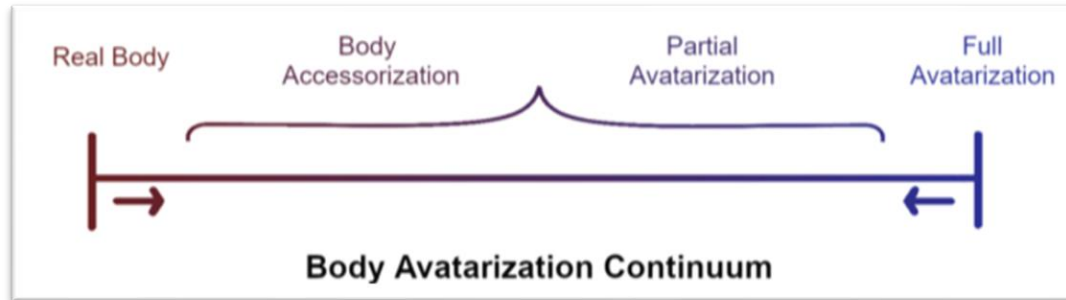
Perceptual Manipulations in VR

“The Dark Side of Perceptual Manipulations in Virtual Reality”
(Tseng et al., ACM CHI 2022)



- Raising awareness among academics ?
- Can we publish everything (not only in VR field) ?
- Impact on scientific practices (specific reflection, publications, etc.) ?

Self-Avatars in Augmented Reality



A Genay, A Lécuyer, M Hachet, « Being an Avatar "for Real": a Survey on Virtual Embodiment in Augmented Reality », IEEE Transactions on Visualization and Computer Graphics, 2021

A Genay, A Lécuyer, M Hachet, "Virtual, real or mixed: How surrounding objects influence the sense of embodiment in optical see-through experiences?", Frontiers in Virtual Reality, 2021

A Genay, A Lécuyer, M Hachet, "What Can I Do There? Controlling AR Self-Avatars to Better Perceive Affordances of the Real World", IEEE ISMAR 2022



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