



Meeting Yourself and Others in VR

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www.event-lab.org







www.guestxr.eu



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BBC <u>https://www.youtube.com/watch?v=sgJ24hknbHs</u> Invading Personal Space in Public | Social Experiment

Reality built for two: a virtual reality tool



I3D '90: Proceedings of the 1990 symposium on Interactive 3D graphics • February 1990 • Pages 35-36 • https://doi.org/10.1145/91385.91409



My first encounter with shared VR (199?) An engineer from Division Ltd

entered me into a shared VR

I was shocked at how uncomfortable I felt when his avatar invaded my personal space





https://www.virtual-reality-shop.co.uk/provision-100-vr-turnkey-system/

Proxemics theory – Edward Hall Figure from Informing the Design of Proxemic Interactions Nicolai Marquardt, S. Greenberg (2012) IEEE Pervasive Computing.

Proxemics in VR

- Bailenson et al (2003)
 Interpersonal Distance in
 Immersive Virtual Environments,
 Personality and Social Psychology
 Bulletin 29, 1-15.
 - People maintained greater distance from virtual humans when approaching from front compared to back
 - Distance greater when the virtual humans engaged in mutual gaze.





Proxemics in VR

- Llobera, J., Spanlang, B., Ruffini, G., and Slater, M. (2010). Proxemics with Multiple Dynamic Characters in an Immersive Virtual Environment. *ACM Transactions on Applied Perception* 8, Article 3.
 - When virtual human characters approach people proxemics effects hold
 - Skin conductance responses increase the closer the approach
 - Some effect also caused by the approach of cylinders



Why proxemics?

- Proxemics behaviour in VR is similar to proxemics behaviour in reality.
- My thesis is that this applies to everything not just proxemics.
- Social behaviour in VR is equivalent to social behaviour in reality.



MNG

Persuading People in a Remote Destination to Sing by Beaming There

A real-time multimodal interaction (visual, auditory and tactile) between 3 different persons located at 3 different places acting in the same virtual world.

> Pierre Bourdin Josep Maria Tomas Sanahuja Carlota Crusafon Moya Patrick Haggard Mel Slater (PI)





Why do people act as if they are with others?

- "Goffman made clear that copresence involved two moments: (1) when individuals sense that they are able to perceive others, and (2) when others are able to perceive them."
 - Biocca, F., and Harms, C. (2002). Defining and measuring social presence: Contribution to the networked minds theory and measure. *Proceedings of PRESENCE* 2002, 1-36.
- Social presence "the sense of being with others"
 - Heeter, C. (1992). Being there: The subjective experience of presence. *Presence: Teleoperators and Virtual Environments* 1, 262-271.





A sample of what we know about virtual meetings – social relationships in the red, green, blue studies

Tromp, et al. (1998). Small group behaviour experiments in the Coven project. IEEE Computer Graphics and Applications 18, 53-63.

Steed, A. et al. (1999). Leadership and collaboration in shared virtual environments. Virtual Reality, 1999. Proceedings., IEEE, 112-115.

Slater, M. et al. (2000). Small-group behavior in a virtual and real environment: A comparative study. *Presence: Teleoperators &* Virtual Environments 9, 37-51.







Collaborative task to identify a common phrase amongst individual words pinned to walls around the room.

Leadership conferred by computational advantage

Paranoid thoughts caused by being 'stared at'

Feelings of embarrassment, being excluded

Questionnaire measure of copresence correlated with presence

Strong attachment to their virtual bodies, it was 'rude' to intersect with another.

People obeyed social norms – apologised for collisions

Failure of expectation where avatar appearance did not match avatar behaviour.

The importance of eye gaze

Steptoe, et al. (2008). "Eye-tracking for avatar eye-gaze and interactional analysis in immersive collaborative virtual environments", in: *Proceedings of the 2008 ACM conference on Computer supported cooperative work*), 197-200.

Steptoe, W. et al. (2009). Eye tracking for avatar eye gaze control during object-focused multiparty interaction in immersive collaborative virtual environments. *2009 IEEE Virtual Reality Conference*, 83-90.

Steptoe, W et al.(2010). "Lie tracking: social presence, truth and deception in avatar-mediated telecommunication", in: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*: ACM), 1039-1048.

Plopski, A., et al. (2022). The Eye in Extended Reality: A Survey on Gaze Interaction and Eye Tracking in Headworn Extended Reality. *ACM Computing Surveys (CSUR)* 55, 1-39. 215 papers 1985-2020



Steptoe et al., 3 CAVES

Gaze associated with conversational attention

• Mutual awareness of gaze

• Appropriate flow of conversation

Task performance superior to video

 Tracked gaze rated as superior to static gaze (and model based gaze)

• Eye gaze becomes a general social resource.

• Eye gaze leads to better detection of lying.

Self avatars and trust

- Pan, Y., and Steed, A. (2017). The Impact of Self-Avatars on Trust and Collaboration in Shared Virtual Environments. *PLoS ONE* 12
- Collingwoode-Williams, T. et al. (2021). The Impact of Self-Representation and Consistency in Collaborative Virtual Environments. Frontiers in Virtual Reality 2, 45.



(A) Site A





(B) Site B





 Greater presence, task performance and trust in consistent avatar condition.

Avatar appearance and behaviour

- Garau, M. et al. (2003). "The Impact of Avatar Realism and Eye Gaze Control on the Perceived Quality of Communication in a Shared Immersive Virtual Environment", in: *Proceedings* of SIGCHI.).
- Zibrek, K. et al. (2019). "Social presence and place illusion are affected by photorealism in embodied VR," in *Motion, interaction and games.*), 1-7.
- Herrera, F. et al. (2020). Effect of behavioral realism on social interactions inside collaborative virtual environments. *Presence* 27, 163-182.







- Consistency: Interaction between gaze and realism of avatar – gaze behaviour more important for the more realistic avatar.
- Realistic virtual human led to greater social presence and Place Illusion.
- Conditions with hand tracking – in particular floating head and hands – resulted in greater social presence, self presence, and interpersonal attraction- though some differences were weak.

Recent Overviews

Oh, C.S., Bailenson, J.N., and Welch, G.F. (2018). A systematic review of social presence: Definition, antecedents, and implications. *Frontiers in Robotics and AI*, 114.

152 studies reviewed

Williamson, J.R., O'hagan, J., Guerra-Gomez, J.A., Williamson, J.H., Cesar, P., and Shamma, D.A. (2022). "Digital Proxemics: Designing Social and Collaborative Interaction in Virtual Environments", in: *CHI Conference on Human Factors in Computing Systems*), 1-12.

• Reviews also aspects that can go beyond reality



The Immortality Project

A complex shared VR – illusory death

- virtual environment (copresence).
- Island over 6 days.
- and died
- Then had a Near Death Experience
- memorial to them.
- attitudes?

Barberia I, et al. (2018) Virtual mortality and near-death experience after a prolonged exposure in a shared virtual reality may lead to positive life-attitude changes. PLoS ONE 13(11): e0203358.

• This work brings together PI, Psi and body ownership, in a shared multiple exposure

• Groups of 3 participants met in a beautiful

• Started as child-like, gradually matured, grew old,

• Then saw from the outside their partners build a

• Does an extended experience of life, death, near-death-experience impact attitudes life

Presence - I had the sensation to be in the virtual world



Plausibility - I had the sensation that the events were really happening



Copresence the sensation to be in the same place shared with others



Body ownership the sensation that it was my body...



Cybersick being uncomfortabl e or dizzy



Lessons for shared VR

- Strong presence, copresence, plausibility
- Body ownership in spite of alien bodies
- Strong social bonds formed (without any speaking)
- Knowledge was passed down the generations
- Sadness on leaving the environment for the last time
- Emotional interactions when all participants met some weeks later
- Life review changes occurred as a result of this extended virtual meeting in a surreal world

VR United



- A shared VR where avatars look like the corresponding person.
- Developed by Ramon Oliva, Alejandro Beacco, Jaime Gallego.
- Here Ramon explains the idea to others...



FINANCIAL TIMES

HOME WORLD US COMPANIES TECH MARKETS CLIMATE OPINION WORK & CAREERS LIFE & ARTS HOW TO SPEND IT

David Chalmers (NYU) and John Thornhill (FT) used VR United for a 2 hour interview in a restaurant setting.

Lunch with the FT

Lunch with the FT Life & Arts (+ Add to myFT)

David Chalmers: 'We are the gods of the virtual worlds we create'

The techno-philosopher on meaningful life in the metaverse, building virtual utopias and why the 'corporatocracies' are becoming part of our brains





Sign In

Subscribe

Presence

Realistic Avatar

Copresence

Interplay with the real world

Things can go wrong



Interaction with virtual objects leads to violations of physics

Real world interferes

In a real place

Social norms

Interaction with Celebrities

- A VR United conference panel in "XR for the people"
 - David Chalmers (Australia), Prof. New York University
 - Doron Friedman (Israel), Prof. Reichman University
 - Myself (Spain)
 - A special celebrity guest
 - Moderator Jeremy Fogel, Prof., Tel Aviv University
 - Live audience watching the VR Panel on a large screen

Research with Prof. Doron Friedman







Meeting Yourself

Solomon's paradox

we can see solutions to other people's problems more clearly than to our own

- "People often reason more wisely about other people's social problems than about their own."
 - Exploring Solomon's Paradox: Self-Distancing Eliminates the Self-Other Asymmetry in Wise Reasoning About Close Relationships in Younger and Older Adults, Igor Grossmann, Ethan Kross, Psychological Science (2014)

ConVRSelf

Self-councelling through immersive virtual reality



- Conversations with yourself in virtual reality You become the friend
- You have a conversation with your look-alike self

CONVRSELE



We can scan and embody someone as themselves



We can embody people as anyone: 1PP + real-time motion capture.

For example, Dr Sigmund



Embodied as pourselflyouttalkttoDyoErrself





Results

- The first study (Osimo et al., 2015) showed with respect to personal problem solving:
 - All participants improved
 - They improved more if:
 - The Freud body moved synchrously with their own body movements compared to asynchornous high body ownership over the Freud body
 - The counsellor was Freud rather than another copy of themselves
- The second study (Slater et al., 2019) showed that:
 - All participants improved
 - They improved more if:
 - They did the body swapping with the Freud body compared with a pre-animated Freud talking to them about their problem.
- Overall synchronous embodiment in the Freud body as counsellor was important to help to address the personal problem.

FINDINGS

• Slater et al (2019) Sci. Rep.



General Method

- Can talk about anything with anyone
 - Not just psychological problems
 - Not just with Freud
- Has been used by a multinational to stimulate creativity
 - self conversation with Steve Jobs
- By the World Bank to foster work-life balance
 - Self conversation with Barack or Michelle Obama.





Using ConVRSelf to Foster Physical Exercise

- Participants first watched a video by Lebron James or Serena Williams promoting exercise
- Experimental Group: spoke with Lebron James or Serena Williams about how they could enhance their physical exercise routine.
- Control Group: only saw the video
- Results over the subsequent week:
 - Exercise in Experimental Group > Control Group
- Daniel Levy, Doron Friedman, Elena Álvarez de la Campa Crespo, Bernhard Spanlang, Mel Slater (2024, in review) Self-Conversation with a Sporting Celebrity Enhances Later Physical Exercise









Self-Conversation with a Sporting Celebrity Enhances Later Physical Exercise

Daniel Levy, Doron Friedman, Elena Álvarez de la Campa Crespo, Bernhard Spanlang, Mel Slater



Self Conversation in Virtual Reality Embodiment to Enhance Healthier Lifestyles Among Obese People (SOCRATES)



Talking to yourself about Obesity

- Obesity is a major world health problem
- 23% of women, 20% of men
- 69B€ per year cost in Europe
 - "The whole of Europe spends between 1.9% and 4.7% of the total annual health care costs and 2.8% of the annual hospital costs in dealing with overweight or obese patients."
- Multiple adverse health effects
 - Diabetes, coronary arterial, mental health
- Current treatments have limited effectiveness
 - Initial success with patients eventually returning to prior weight



SOCRATES Focus

- A review of the literature led to our focus on three major issues:
 - Self awareness
 - Patients to recognise that they have a medical condition.
 - Self-stigmatisation
 - improve their self-worth
 - Self-determination

• Patients can overcome their self-stigmatisation and

• Patients are empowered and learn to take action.

SOCRATES Focus and ConVRSelf

- Self awareness
 - When we look in a mirror we see what we expect to see.
 - We never see ourselves from the perspective of another.
 - Here patients see and interact with a 3D representation of themselves.
- Self-stigmatisation
 - Patients maintain a conversation with a representation of themselves while the body shape changes. Yet they are still always the same person. Demonstrates we are not just a size and a shape.
- Self-determination
 - Patients talk with a fit and healthy of their future self who has learned how to overcome their condition, and maintain a healthy body size. They learn from their future self how this was accomplished.

ConVRSelf with Obesity

- Patients attend an intensive motivational interviewing course
- A look-alike virtual body representation is constructed
- They converse with themselves over a series of meetings
 - With a general counsellor
 - With a representation of a fit and healthy future self







Randomised Control Trial - Excellent Results

- D. Anastasiadou, M. Slater, B. Spanlang, D. C. Porras, M. Comas, A. Ciudin, G. P. Puig, J. Vázquez-De Sebastián, J. A. Ramos-Quiroga, P. Lusilla-Palacios (2022) Clinical efficacy of a virtual reality tool for the treatment of obesity: study protocol of a randomised controlled trial. BMJ open 12
- D. Anastasiadou, D., P. Herrero Castillo, J. Vázquez-De Sebastián, B. Spanlang, E. Álvarez De La Campa, M. Slater, J. Ramos-Quiroga and P. Lusilla Palacios (2023) Virtual Self-Conversation Using Motivational Interviewing Techniques To Promote Healthy Eating And Physical Activity: A Usability Study.
- Dimitra Anastasiadou, et al. (2024) Clinical Efficacy of a Virtual Reality Tool for the Treatment of Obesity: Randomized Controlled Trial (accepted).

Meeting the Police: The Golden Rule



• "What is hateful to you, do not do to your fellow"

• "Treat others as you would want them treat you"

The Golden Rule Embodiment Paradigm (GREP)

In VR the Golden Rule becomes a paradigm for intervention. You can directly experience what it is like to experience what you might do to others.

You take on the body and perspective of another and experience how you have treated that other. This is accomplished through embodied perspective taking

GREP

Mel Slater & Domna Banakou (2021) The Golden Rule for Fostering Prosocial Behavior with Virtual Reality, Current Directions in Psychological Science

You are involved in an action that causes harm to another (the victim).

• This may be active involvement or acquiescence

You then experience the scenario again from the standpoint of the victim.

The test – some time later you are involved in another scenario that causes harm to another

• How do you respond?

In experimental settings there is normally a control group who experience the scenario but not from the embodied perspective of the victim.



US Police Racial Aggression

Inner city US police department

37 patrol officers

Interrogation of a male black robbery suspect

Partner – violently aggressive and racially abusive

21 re-experienced the scene as the victim

16 as an observer through a window outside the interrogation room



The other officer conducts an aggressive and racially abusive interrogation (see mirror reflection which shows the self)



From the embodied perspective of the victim.



Seeing the interrogation through a window. **Control** – Observer condition.

The Test

3 weeks later the participants were in a virtual cafe talking with the abusive officer

A black male entered the cafe

Immediately the abusive officer to steal a white woman's handbag.

harassed him, accusing him of wanting



The customer says he has done nothing

The customer standing by the counter

The aggressive officer accuses the customer

Results

Observer condition 0.23

Probability that positive helping behaviour > 80%

Victim condition 0.79

Resume

- Proxemics illustrates realistic behaviour in VR
- VR can go beyond realistic scenarios and people still respond as if it were real – the NDE study
- Current work on shared VR with applications (journalism, conference,...)
- As well as meeting others you can meet yourself in a unique way (ConVRSelf) – with several applications
- The others you meet (police) may be entirely virtual can lead to behavioural change
 - Example of the Golden Rule Embodiment paradigm



People



Domna Banakou



Tania Johnston



Alejandro Beacco



Gizem Şenel



Ramon Oliva



Jaime Gallego



Brenda Ryan (IDIBAPS)



Esen Küçüktütüncü



Raul Gallego Abellan



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