Lisbon Addictions 2022: Immersive Virtual Reality in the Assessment and Treatment of Addictive Disorders – Current status and future directions

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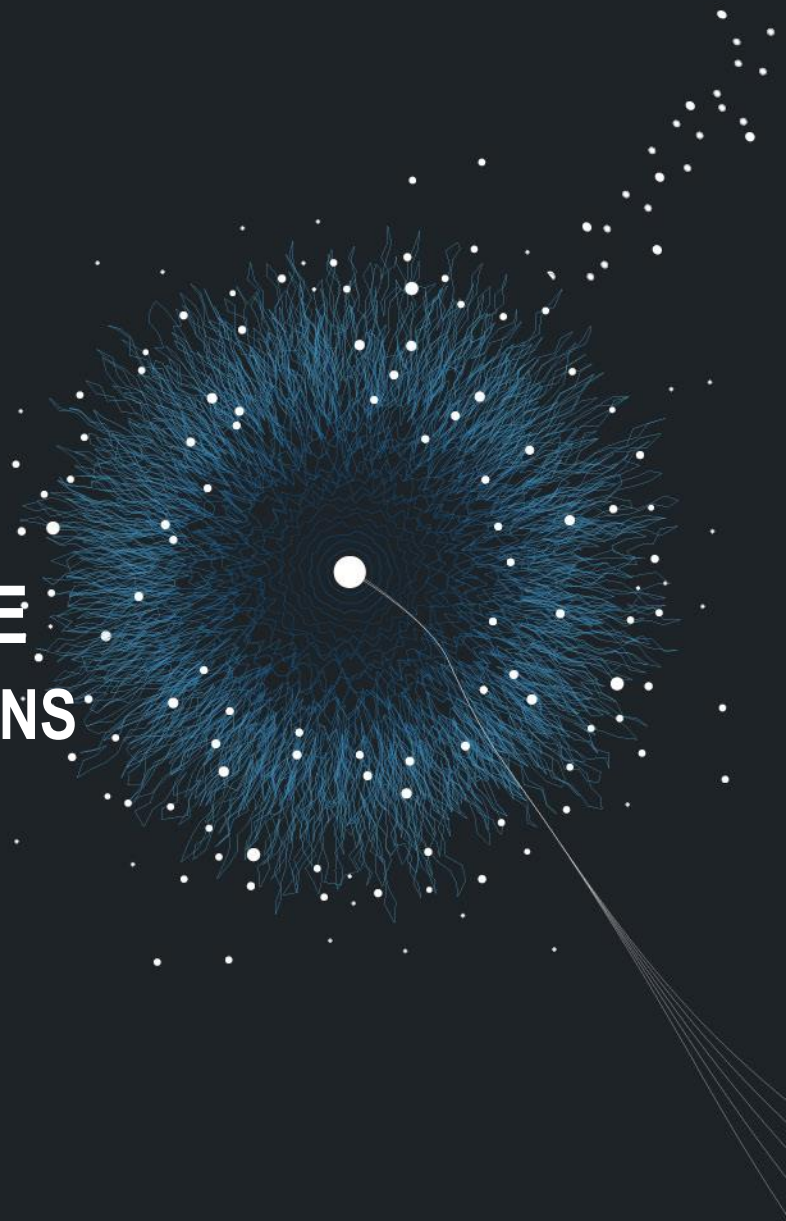

IMMERSIVE VIRTUAL REALITY
IN THE ASSESSMENT & TREATMENT OF ADDICTIVE DISORDERS: CURRENT STATUS AND FUTURE DIRECTIONS

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ABOUT ME

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I work on **Behaviour Change Support Systems** for vulnerable groups, such as people with an intellectual disability.

I research **embodied learning** strategies in **virtual reality** focusing on the treatment of substance abuse.

I **develop and evaluate** the **interaction design** to make XR-technology accessible.

I combine **psychology** with **technology** to design playful learning experiences.

I teach about the importance of **accessible XR** for vulnerable groups + supervise bachelor & master projects.

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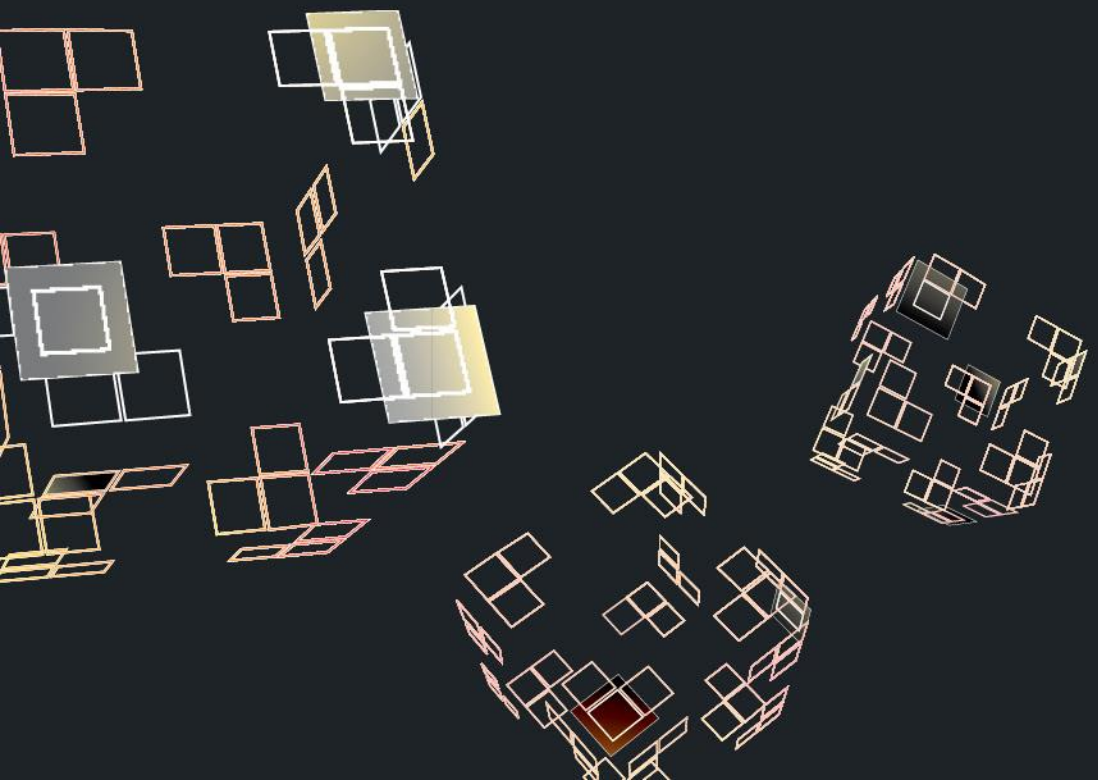
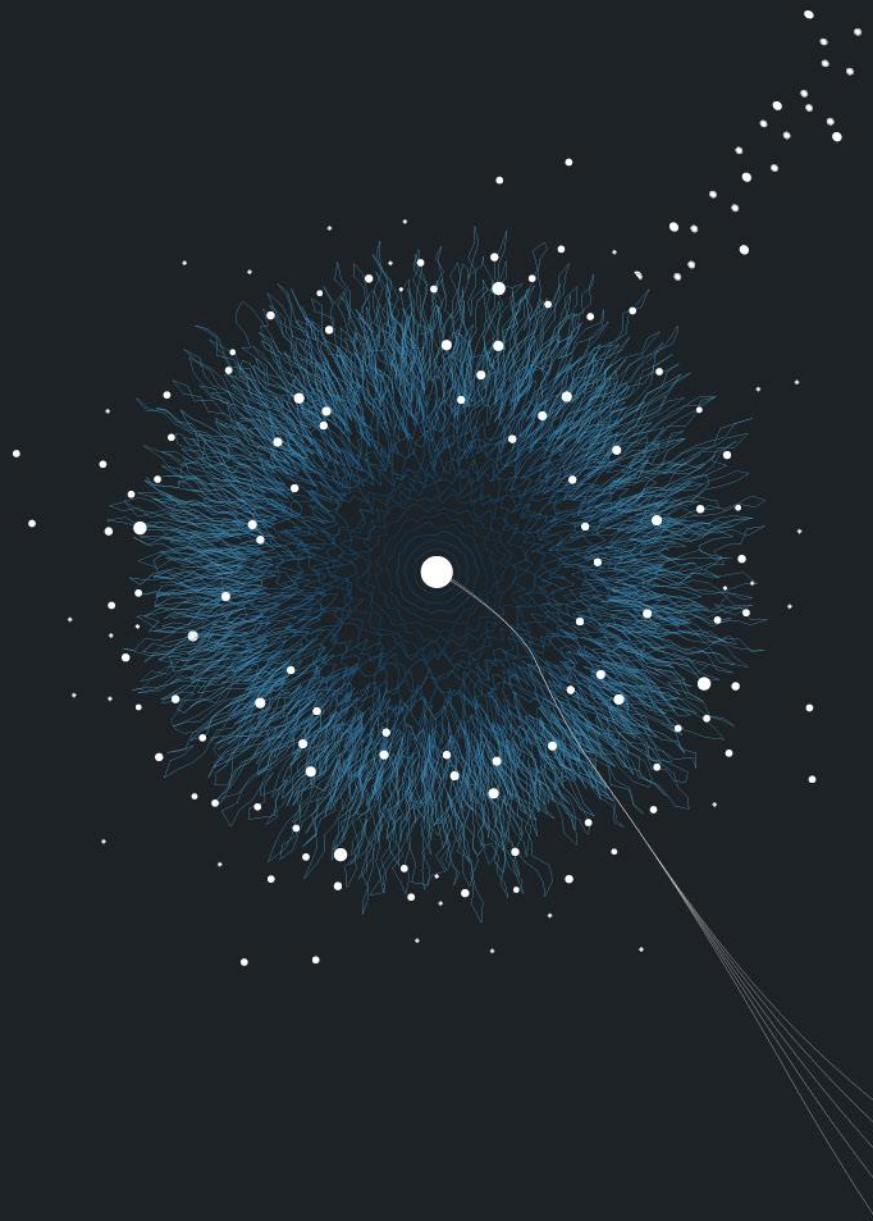


INTRODUCTION
TO VIRTUAL IMMERSIVE REALITY (IVR)



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IMMERSIVE VIRTUAL REALITY

AN INTRODUCTION

- The user's **senses are substituted** by using special electronic equipment [1]
- Typically, a **Head-Mounted Display (HMD)** is used
- Induces a feeling of **immersion** in the virtual world [2]
- **IVR therapy:** VR Exposure Therapy (**VRET**) proven effective in anxiety disorders [3]

Figure 1. Head-Mounted Display (HMD).

Figure 2. Immersive Virtual Environment (IVE).

IMMERSIVE VIRTUAL REALITY

CONCEPTS

- **Place illusion** [4]
- **Plausibility illusion** [4]
- **Interactivity** [5]
- **Cybersickness**

Universal in VR

Further reading: Slater, M. (2009). Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1535), 3549-3557.

IMMERSIVE VIRTUAL REALITY

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- **Place illusion** [4]
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- **Interactivity** [5]
- **Cybersickness**

→ Universal in VR

- **Cravings**
- **Psychophysiology**

→ Cue reactivity [6,7]

Figure 3. Grabbing beer in fridge.

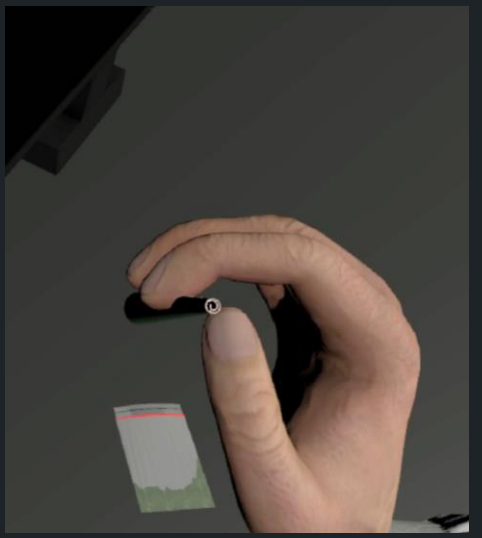

Figure 4. Joint in VR.

Figure 5. Vendor selling cigarettes in cafe.

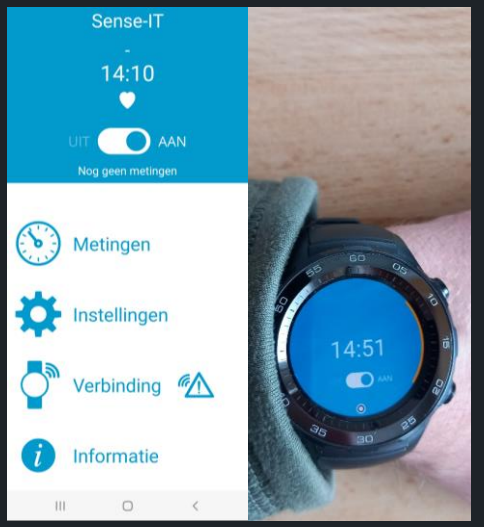

Figure 6. Sense-IT biocueing app to measure heart rates

Further reading: Slater, M. (2009). Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1535), 3549-3557.

IMMERSIVE VIRTUAL REALITY

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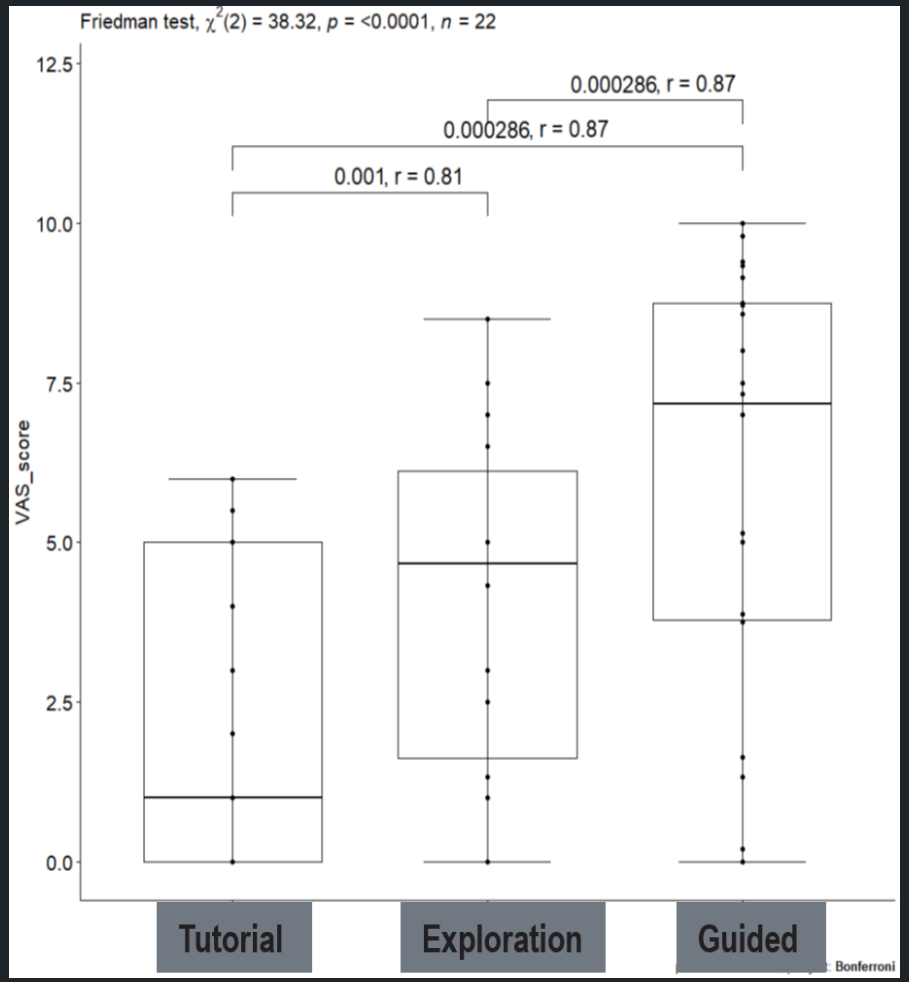

Figure 7. Friedman-test and pairwise comparison based on the Visual Analogue Scale scores [8].

Further reading: Langener, S., VanDerNagel, J., Klaassen, R., Van der Valk, P., & Heylen, D. (2021, August). "Go up in smoke": Feasibility and initial acceptance of a virtual environment to measure tobacco craving in vulnerable individuals. In *2021 IEEE 9th International Conference on Serious Games and Applications for Health (SeGAH)* (pp. 1-8). IEEE.

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VIRTUAL REALITY (VR)

TECHNOLOGICAL PROGRESS

2017

2019

2021

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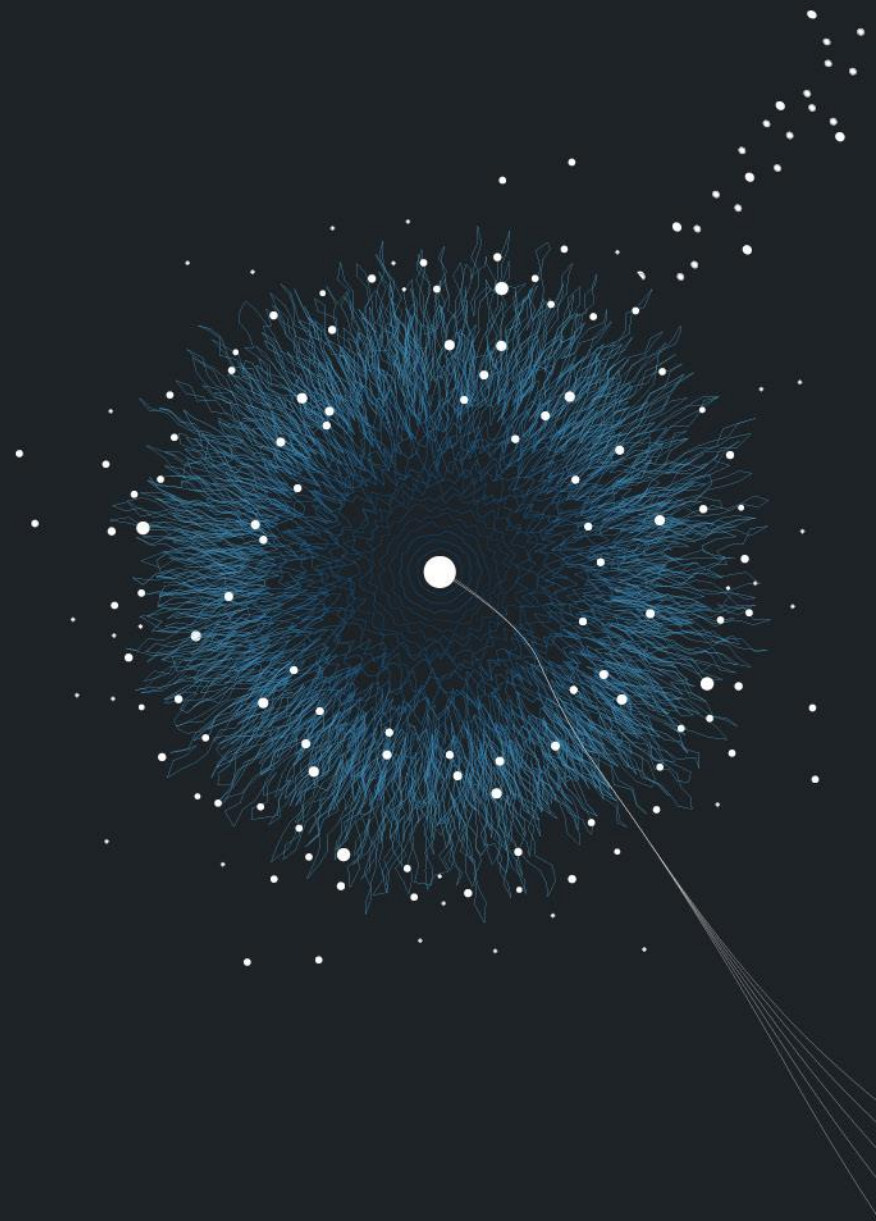
CURRENT STATUS
IVR IN ADDICTIVE DISORDERS



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IVR IN ADDICTIVE DISORDERS

CURRENT STATUS FOR CLINICAL PRACTICE

Systematic review [9]

- Searched PubMed & PsycINFO
- Until November 2020
- Using HMDs

Table 1. PICOS framework to identify eligibility criteria.

Population:	Adolescent or adult humans with addictive disorders (SUD or other addictive behaviors) or daily/heavy use	
Intervention*:	Immersive VR (using Head-Mounted Display) for the assessment or treatment of addictive disorders	
Comparators*:	No limitation	
Outcomes:	Assessment:	Diagnosis, disease severity, measure of treatment effect, or predictor of treatment outcome, related to VR-cue-reactivity (e.g., craving, psychophysiological response, and attention to cues)
	Treatment:	Cue-reactivity, motivation, dependence severity, substance use, abstinence
Study designs:	No limitation, except single case studies (n < 3)	
Timing:	No restriction	
Language:	English	

* Does not apply to the (1) research question focusing on assessment.

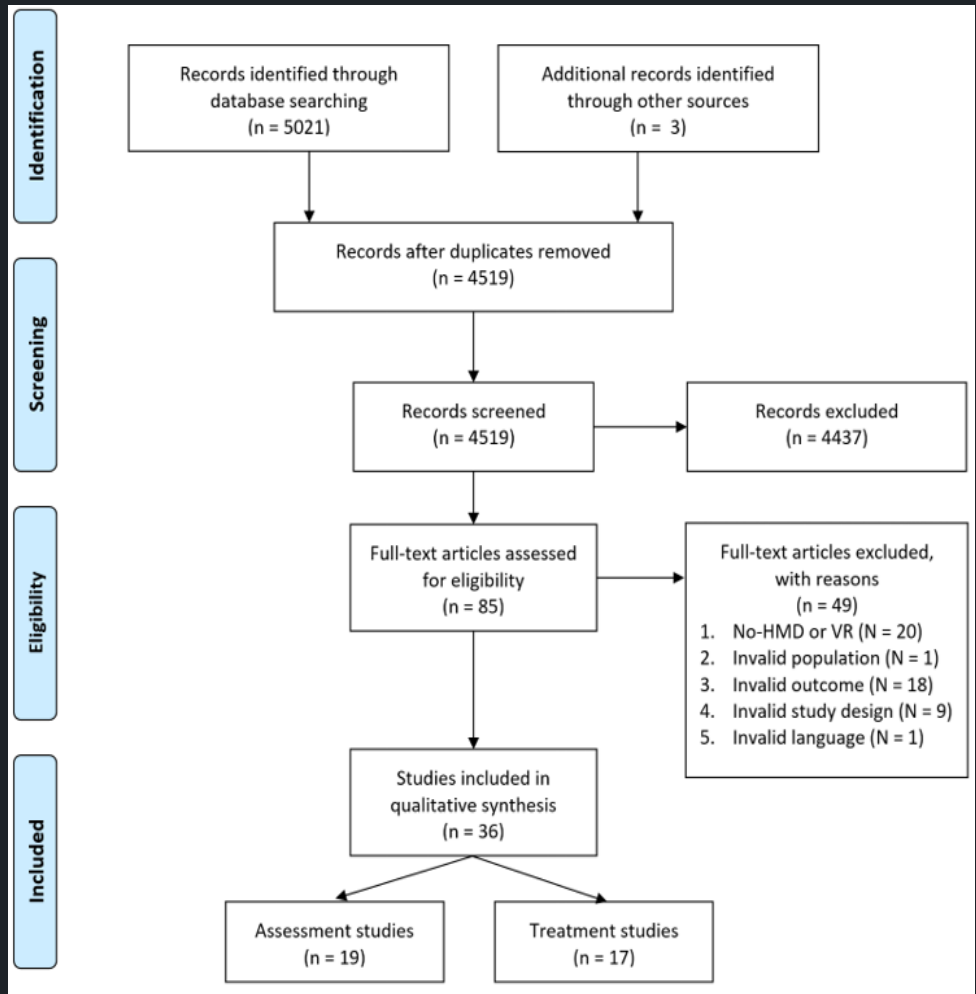

Figure 9. PRISMA flow diagram.

Further reading: Langener, S., Van Der Nagel, J., van Manen, J., Markus, W., Dijkstra, B., De Fuentes-Merillas, L., . . . Schellekens, A. (2021). Clinical relevance of immersive virtual reality in the assessment and treatment of addictive disorders: A systematic review and future perspective. *Journal of clinical medicine, 10*(16), 3658.

IVR IN ADDICTIVE DISORDERS

CURRENT STATUS FOR THE CLINICAL PRACTICE

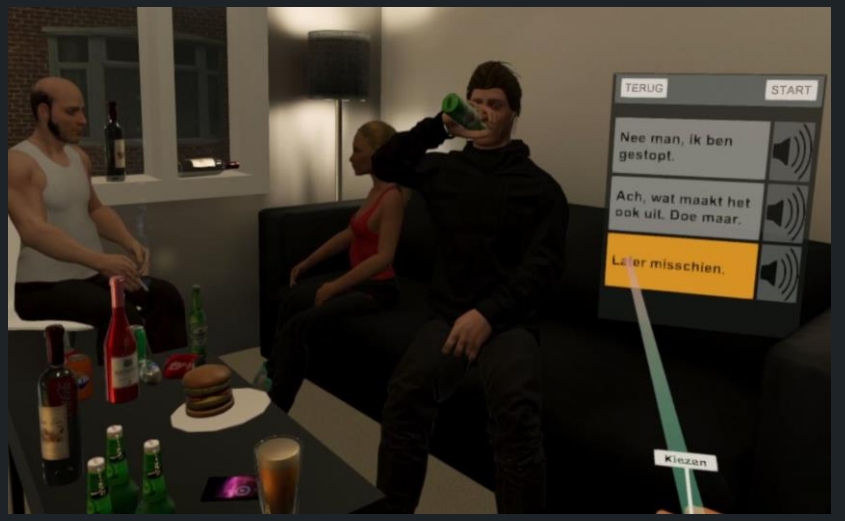

Figure 10. Virtual human (agent) drinking beer.

- Alcohol
- Cocaine
- Methamphetamine
- Cannabis
- Nicotine
- Gaming
- Gambling

→ Cue reactivity investigated

Further reading: Segawa, T., Baudry, T., Bourla, A., Blanc, J. V., Peretti, C. S., Mouchabac, S., & Ferreri, F. (2020). Virtual reality (VR) in assessment and treatment of addictive disorders: A systematic review. *Frontiers in neuroscience*, *13*, 1409.

IVR IN ADDICTIVE DISORDERS

CURRENT STATUS FOR THE CLINICAL PRACTICE

Assessment

- **Cue reactivity to diagnose** patients with AD
- Physiological measures to **discriminate** patients/healthy controls promising
- **No** work on prognostic value (e.g., abstinence)
- Most studies show **relationship between cue reactivity and clinical parameters**

Treatment

- **VRET** showed deflating effects, with one study reporting a negative effect compared to standard CBT
- Other interventions, such as **embodied learning, coping skills training, & aversive learning are promising**

BUT: Clinical studies using other interventions are absent!

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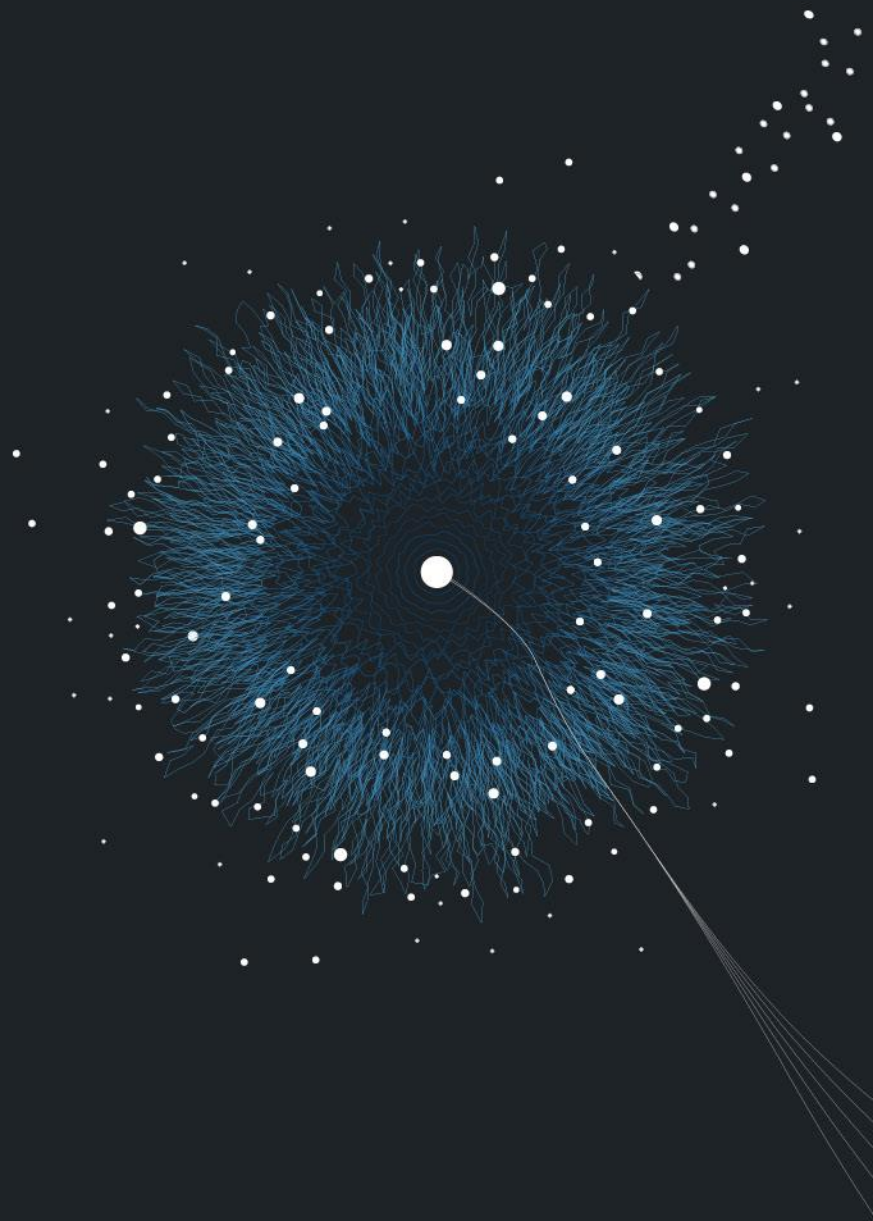
IVR IN ADDICTIVE DISORDERS

CURRENT STATUS FOR THE CLINICAL PRACTICE

Discussion

- IVR offers promising new paradigms to treat ADs
- **BUT:** Benefits and effectiveness need to be clarified
- We found a lack of methodological rigor and insufficient quality of reporting methods
- Studies with clear clinical endpoints and scientific quality are needed

FUTURE DIRECTIONS
IVR IN ADDICTIVE DISORDERS



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IVR IN ADDICTIVE DISORDERS

FUTURE DIRECTIONS

- From passive to **active learning**
  - Coping skills training (e.g., risk situations & coping)
  - Body-centered learning (e.g., crushing cigarettes, bodily signals, mindfulness)
- **Treatment protocols** are needed
  - Link goal to specific learning experience
- **Who can profit?**
  - People with lower literacy, developmental disabilities, & psychiatric comorbidities?

Figure 11. Coping skills implemented in IVR.

IVR IN ADDICTIVE DISORDERS

FUTURE DIRECTIONS

- **Persuasive virtual agents** for refusal skills training
  - Can virtual humans influence patients with AD?

- Embodiment illusions for **body swapping**
  - E.g., seeing drug use through eyes of one's child

- **Therapist involvement**
  - Asymmetric interaction (headset, computer)

Figure 12. Persuasive virtual agent for refusal skills trainings.

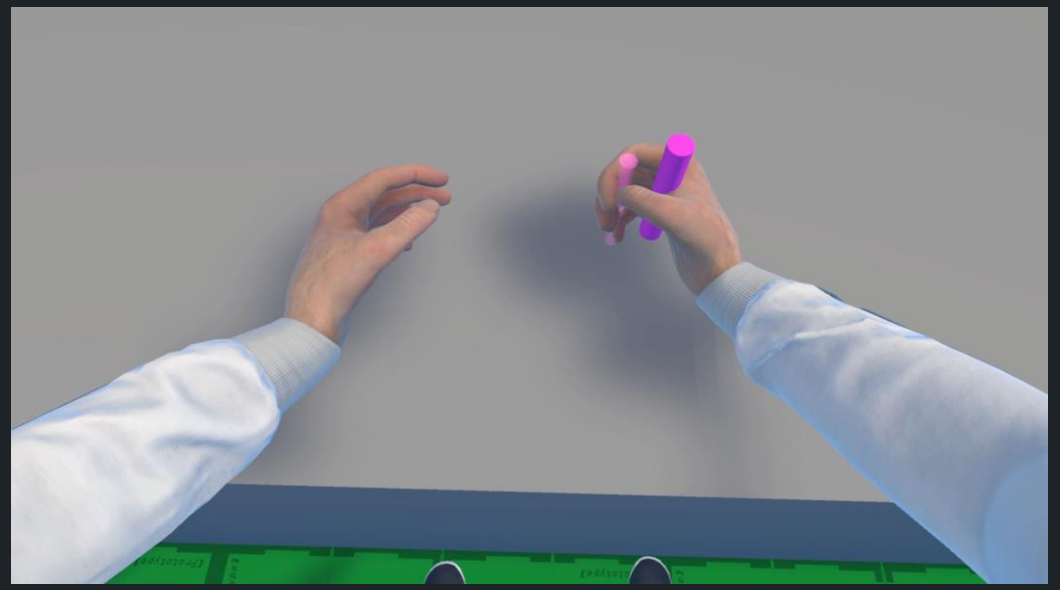

Figure 13. Embodiment illusions in IVR.

Further reading: Langener, S., Klaassen, R., VanDerNagel, J., & Heylen, D. (2022). Immersive Virtual Reality Avatars for Embodiment Illusions in People with Mild to Borderline Intellectual Disability: User-Centered Development and Feasibility Study. *JMIR Serious Games. IN PRESS.*

THANK YOU FOR YOUR ATTENTION!

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REFERENCES

1. Emmelkamp, P.M. and K. Meyerbröker, *Virtual reality therapy in mental health.* Annual Review of Clinical Psychology, 2021. **17**: p. 495-519.
2. Bown, J., E. White, and A. Boopalan, *Looking for the ultimate display: A brief history of virtual reality*, in *Boundaries of self and reality online*. 2017, Elsevier. p. 239-259.
3. Carl, E., et al., *Virtual reality exposure therapy for anxiety and related disorders: A meta-analysis of randomized controlled trials.* Journal of anxiety disorders, 2019. **61**: p. 27-36.
4. Slater, M., *Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments.* Philosophical Transactions of the Royal Society B: Biological Sciences, 2009. **364**(1535): p. 3549-3557.
5. Mütterlein, J. *The three pillars of virtual reality? Investigating the roles of immersion, presence, and interactivity*. in *Proceedings of the 51st Hawaii international conference on system sciences*. 2018.

REFERENCES

6. Carter, B.L. and S.T. Tiffany, *Meta-analysis of cue-reactivity in addiction research.* Addiction, 1999. **94**(3): p. 327-340. Bown, J., E. White, and A. Boopalan, *Looking for the ultimate display: A brief history of virtual reality*, in *Boundaries of self and reality online*. 2017, Elsevier. p. 239-259.
7. Segawa, T., et al., *Virtual reality (VR) in assessment and treatment of addictive disorders: A systematic review.* Frontiers in neuroscience, 2020. **13**: p. 1409.
8. Langener, S., et al. *"Go up in smoke": Feasibility and initial acceptance of a virtual environment to measure tobacco craving in vulnerable individuals*. in *2021 IEEE 9th International Conference on Serious Games and Applications for Health (SeGAH)*. 2021. IEEE.
9. Langener, S., et al., *Clinical relevance of immersive virtual reality in the assessment and treatment of addictive disorders: A systematic review and future perspective.* Journal of clinical medicine, 2021. **10**(16): p. 3658.
10. Langener, S., et al., *Immersive Virtual Reality Avatars for Embodiment Illusions in People with Mild to Borderline Intellectual Disability: User-Centered Development and Feasibility Study.* JMIR Serious Games, 2022.