Virtual reality exposure therapy and non-invasive brain stimulation for fear of heights

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INTRODUCTION

- Recent studies have demonstrated that transcranial magnetic stimulation (TMS) combined with behavioral treatments augments therapy effects in anxiety disorders and post-traumatic stress disorders (Lantrip et al. 2022), however, the optimal stimulation localization for TMS is still unknown.
- **Objective:** transfer of the positive effects of intermittent theta-burst stimulation (iTBS) of the left dorsolateral prefrontal cortex (dlPFC) on the retention of fear extinction (Deng et al. 2021) to a therapeutic setting

METHODS

- **Sample:** *n* = 45 participants with a DSM-V diagnosed fear of heights (double blind randomized in *n* = 22 Verum and *n* = 23 Placebo)
- **rTMS:** 50 Hz iTBS (80% active motor threshold) was applied to the dlPFC (according to Deng et al. 2021). The stimulation target was determined by the F3 electrode location from the 10-20 EEG system using the BeamF3 method (Beam et al. 2009).

Figure 1: rTMS and blinding electrodes

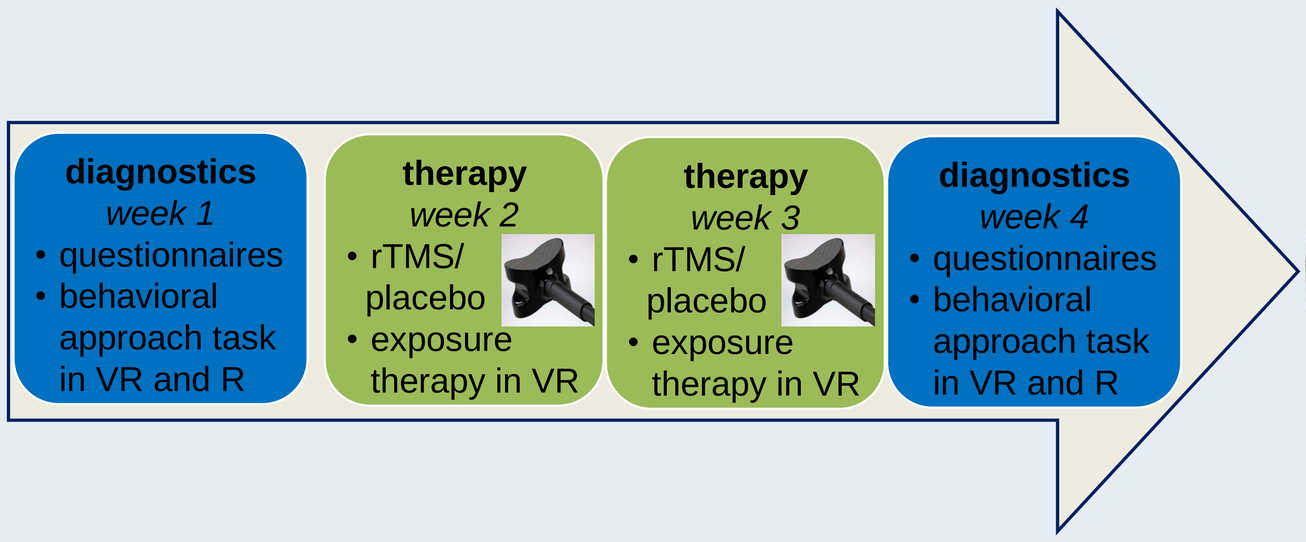

Figure 2: study process

Figure 3: behavioral approach task in VR

- **Primary outcome:** Acrophobia Questionnaire (AQ) with the subscales anxiety (ACRO) and avoidance (AVOI) (Cohen 1977)
- **Secondary outcome:** final approach to the height situations (VR-elevator range: 0-50, staircase range: 0-17) and max. anxiety (Subjective Units of Discomfort, range: 0-100)
- **Data analysis:** mixed ANOVAs and t-tests in SPSS

RESULTS

- **Virtual Reality Exposure Therapy (VRET):** Ø duration: 27.10 min (range: 16-45), Ø sense of presence 72.39% (range: 38.75-100); significant difference regarding presence (t_{42} = 2.25, p = .030), experimental group reports higher presence (78.16% vs. 66.63%); no differences regarding other process variables

Table 1: results of the mixed ANOVAs: there is a significant main effect of time, but no main effect of group and no group*time interaction.
*** p < .001,
** p < .01;
VR = virtual reality,
R = reality.

measures	**statistics** (*F*)		
	group	time	interaction
ACRO	0.08	42.75***	0.37
AVOI	0.64	63.70***	0.37
final approach (VR)	0.55	39.73***	0.42
max. anxiety (VR)	0.15	10.70**	0.14
final approach (R)	3.21	37.32***	1.88
max. anxiety (R)	0.12	25.76***	1.23

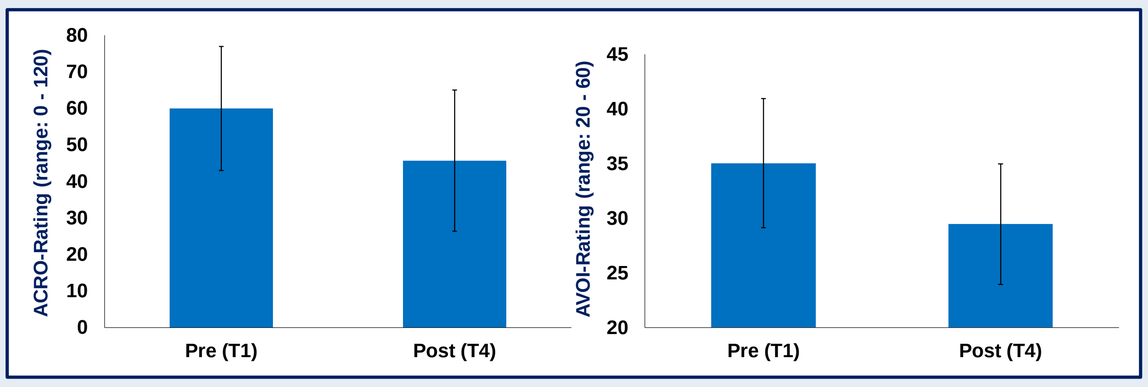

Figure 4: change in AQ (ACRO and AVOI) caused by the therapy for both groups (pre/post)

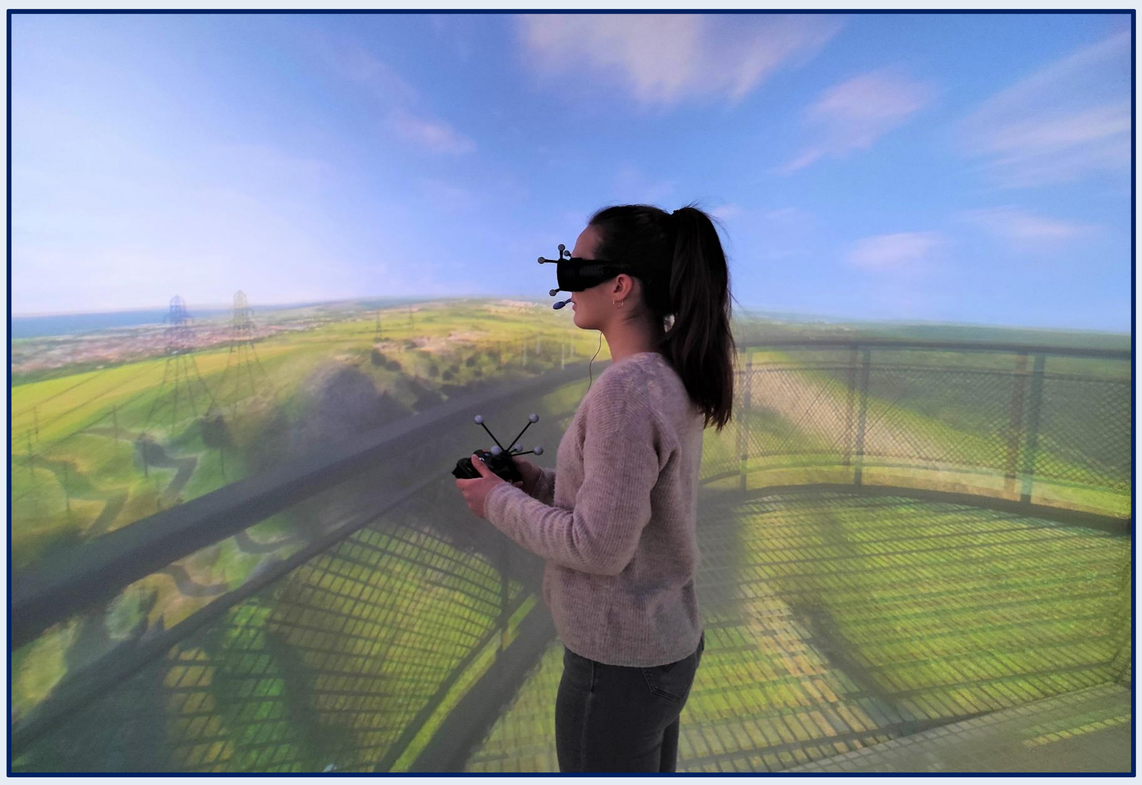

Figure 5: viewing platform from a tower in VR for VRET

DISCUSSION

- This study provides evidence that a combination of rTMS of the dlPFC and VRET is feasible in a therapeutic setting.
- Here, rTMS of the dlPFC reveals no additional effect to VRET on symptom reduction in subjects with fear of heights.
- As shown in previous studies, VRET is effective.
- Further research is required to determine the correct parameters for successful rTMS.

LITERATURE

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