Modulation of visual contrast sensitivity with individualized tRNS is time-dependent and specific for the primary visual cortex.

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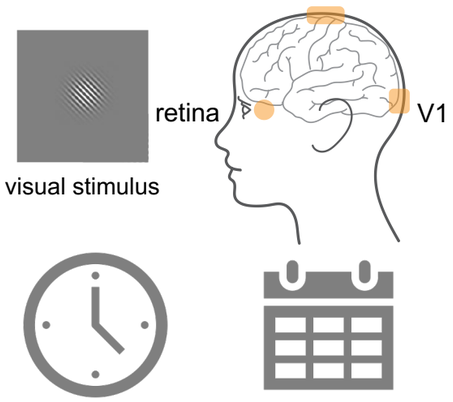
Background

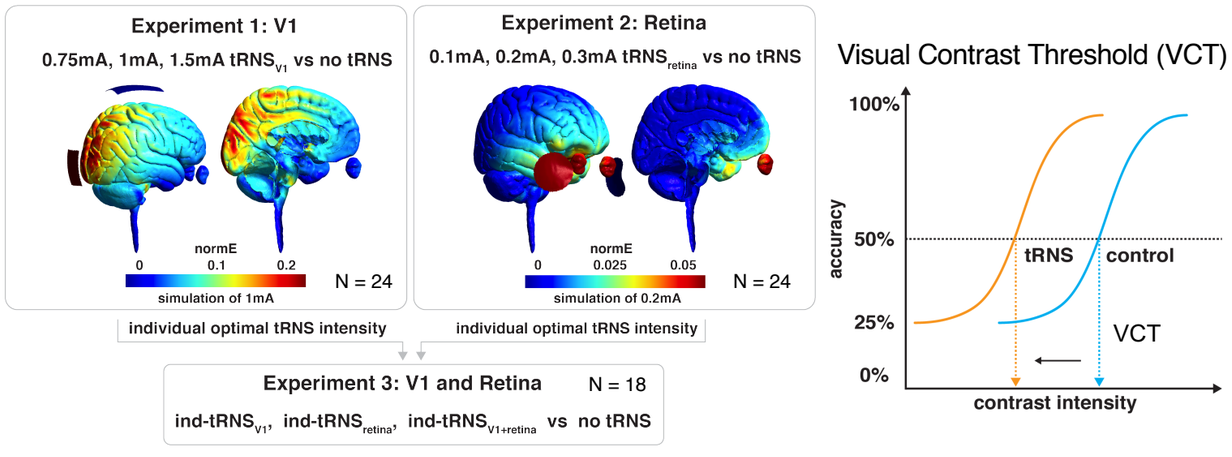
Transcranial random noise stimulation (**tRNS**) has been shown to significantly **improve visual perception**[1,2]. Previous studies demonstrated that tRNS delivered over cortical areas acutely enhances visual contrast detection of stimuli when tRNS **intensity is optimized for the individual**[1,3].

However, it is currently unknown whether:

1. tRNS-induced signal enhancement could be achieved within different neural substrates along the retino-cortical pathway
2. the beneficial effect of optimal tRNS intensities can be reproduced within and between sessions.

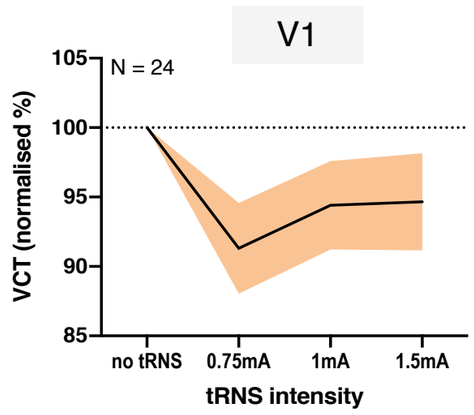


Methods

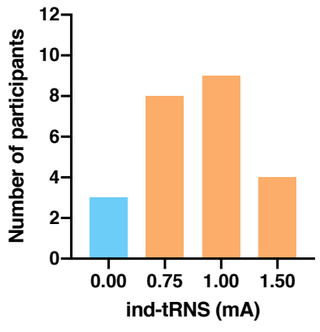


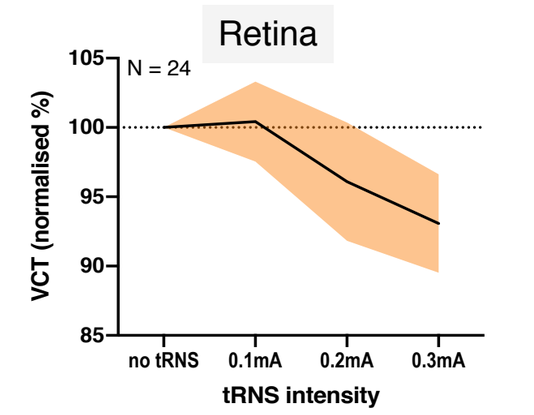
We tested whether tRNS applied to the primary **visual cortex (V1)** and to the **retina** improves visual contrast detection measured with **visual contrast threshold (VCT)**. We determined the **optimal tRNS intensities** for each individual (**ind-tRNS**) and retested the effects of ind-tRNS (i) within and (ii) between the sessions, as well as (iii) simultaneous effects of tRNS of V1 and the retina.

Results

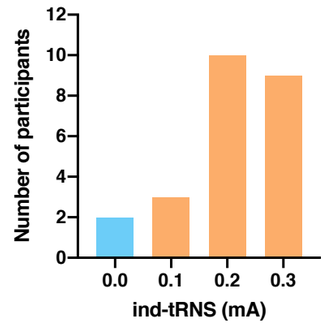


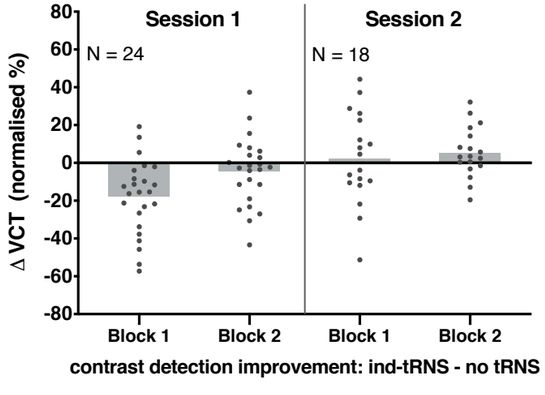
tRNS decreased VCT when delivered to the V1 ($F_{(3, 69)}$=4.54, p=0.006). Beneficial effects of ind-tRNS could be replicated when retested within the same experimental session [$t_{(23)}$=1.72, p=0.049] but not when retested in a separate session [$t_{(17)}$=-0.17, p=0.43].

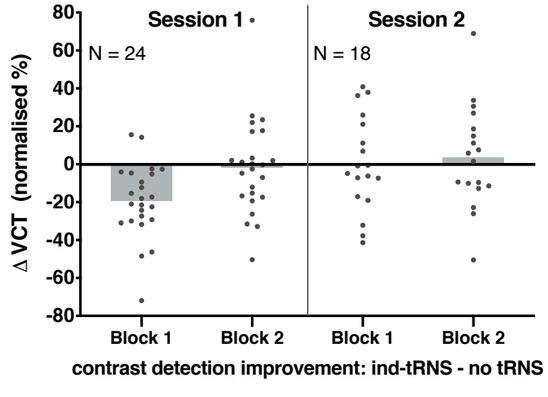




tRNS of the retina did not cause a systematic reduction of VCT irrespective of whether the individually optimized intensity was considered [within $t_{(23)}$=1.05, p=0.15 and between sessions $t_{(17)}$=0.2, p=0.42] or not [$F_{(3, 69)}$=1.69, p=0.18].







We also did not observe consistent additive effects of V1 and retina stimulation [$t_{(17)}$=0.8, p=0.22].

Conclusions

- V1 seems to be more sensitive than retina to tRNS-induced modulation of visual contrast processing
- The individual optimal tRNS intensity appears to vary across sessions

1. van der Groen, O., & Wenderoth, N. (2016) *The Journal of Neuroscience*
2. van der Groen, O., Tang, M. F., Wenderoth, N., & Mattingley, J. B. (2018) *PLoS Computational Biology*
3. Potok, W., et al. (2021) *The Journal of Neuroscience*

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