

1. Introduction

- There is an **inconsistency** in the literature regarding the **direction of the association between alpha power and WM load** (see Fig. 1).^[1]
- The present proposal suggests that **different gaze patterns during commonly used WM tasks** (i.e., Sternberg and N-back) can explain the task- and subject-specific **discrepancies between alpha power and WM load**.
- Previous studies postulated that differences in alpha power varied with the **variability in oculomotor activity**. The higher the gaze variability, the stronger the decrease in alpha power and vice versa.^[2]
- We hypothesize that although fluctuations in alpha power in relation to WM load appear to be associated with the cognitive demands of the task, these modulations likely evolved **primarily to facilitate/support oculomotor control**.

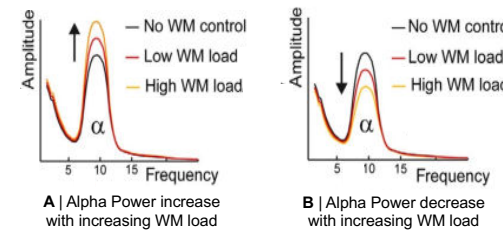


Fig. 1: WM load dependent increase (A) or decrease (B) of posterior alpha power, showcasing the inconsistency in the literature regarding the direction of the association between alpha power and WM load in different WM tasks. Adapted from van Ede, 2018.

2. Hypotheses

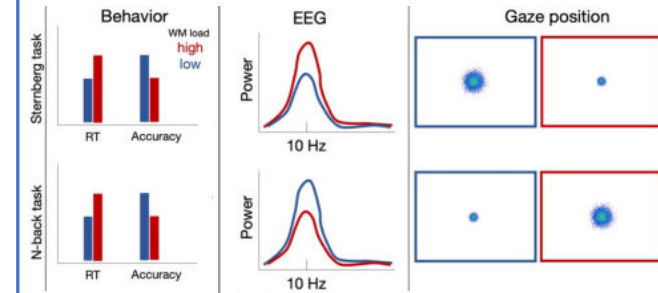


Fig. 2: Sternberg and N-back show similar behavioral data but the direction of the association between alpha power and WM load differs between the tasks. It is hypothesized that these differences are due to distinct variability of oculomotor action.

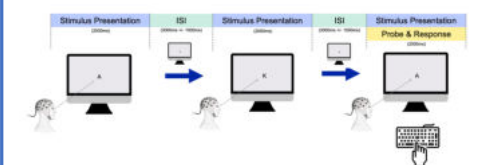
3. Methods

Datasets

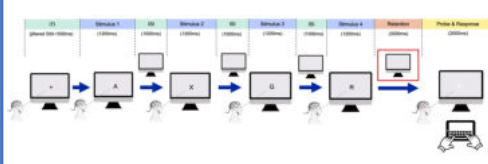
- N = 10 pilot participants (M = 23.0, SD = 2.35, 80% female)
- N = 10 pilot participants (M = 25.9, SD = 2.13, 50% female)

The first sample of ten pilot participants completed a sequential Sternberg task (SternbergSEQ). The second wave completed the N-back and a simultaneous variation of the Sternberg task (SternbergSIM).

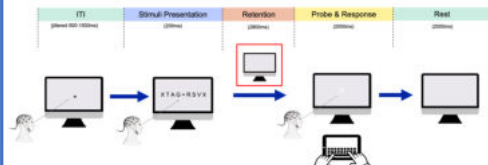
N-back Task



SternbergSEQ Task



SternbergSIM Task



EEG

- Load dependent posterior alpha power modulations during retention interval
- 128-channel ANT Neuro EEG system, sampling rate 500 Hz
- Preprocessing with Automagic^[3]: removal of noisy/outlier channels, high pass filter 0.10 Hz, ZapLine 50 Hz, artifact removal with ICLabel, ocular correction with OPTICAT

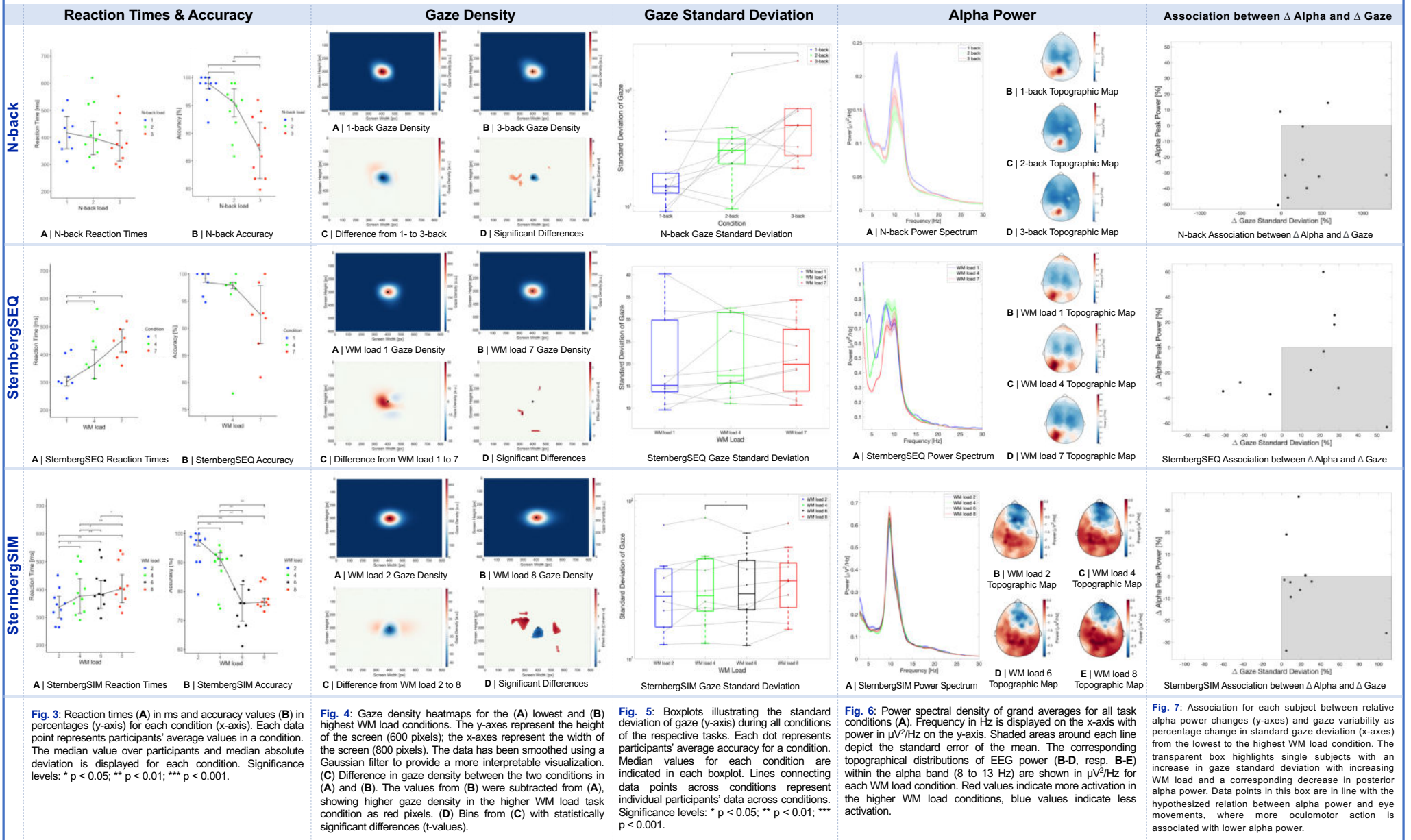
Eye Tracking

- Load dependent changes in gaze density & gaze standard deviation during retention interval
- Eye tracker EyeLink 1000 Plus

Behavioral Data

- Reaction time
- Accuracy

4. Results



References

- van Ede, F. (2018). Mnemonic and attentional roles for states of attenuated alpha oscillations in perceptual working memory: A review. *European Journal of Neuroscience*, 48(7), 2509–2515.
- Popov, T., Miller, G. A., Rockstroh, B., Jensen, O., & Langer, N. (2021). Alpha oscillations link action to cognition: An oculomotor account of the brain's dominant rhythm. *Neuroscience*.
- Pedroni, A., Bahreini, A., and Langer, N. (2019). Automagic: Standardized preprocessing of big EEG data. *Neuroimage*, 200:460–473.

5. Conclusion (preliminary)

- Different gaze patterns depending on the WM task
- N-Back: High WM load is associated with stronger alpha power reduction and higher gaze variability
- SternbergSEQ: High WM load is associated with no alpha power modulation and lower gaze variability

- SternbergSIM: High WM load is associated with no alpha power modulation and higher gaze variability
- Lack of sufficient statistical power prohibits conclusions regarding the presence or absence of a clear relationship between alpha power and gaze variability
- This pilot study lays the groundwork for a future registered report with an adequately powered sample size

Contact

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