PhD Apéro

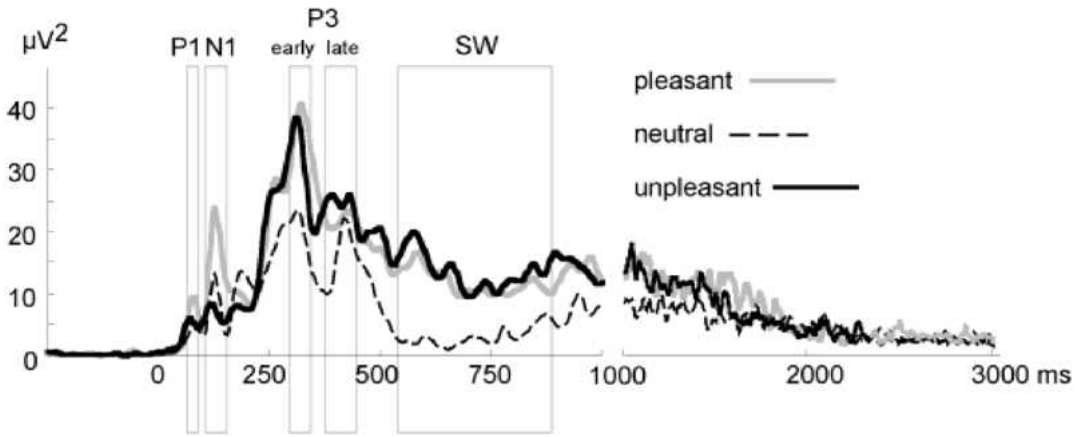
«EEG Signatures of Oculomotor Control»

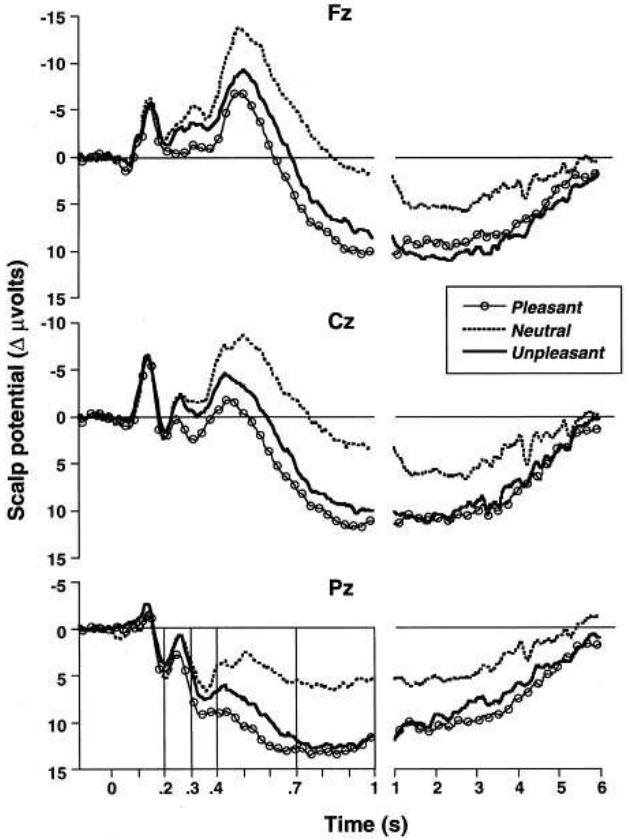
EEG Signatures of... What?

«Late positive wave indicates selective processing of emotional stimuli, reflecting the **activation of motivational systems** in the brain»

(Cuthbert et al., 2000)

— Biomarker for higher brain functions, specifically motivational system



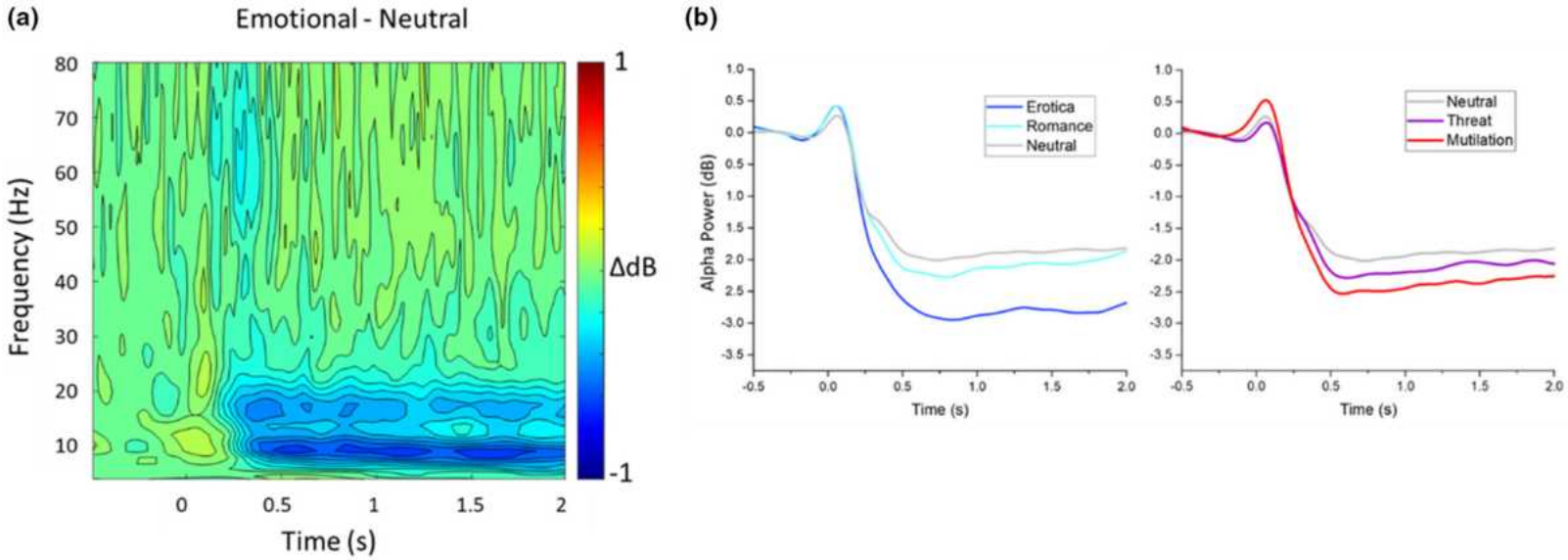


Cuthbert et al. (2000), Keil et al. (2002)

EEG Signatures of... What?

«[..] alpha ERD reflects cortical excitability associated with the **engagement of the motivational systems**» (Codispoti et al., 2023)

— Again: Association of alpha power modulation with motivational systems (here: emotional processing)



Codispoti et al. (2023) & Ferrari et al. (2020)

EEG Signatures of... What?

Misinterpreting electrophysiology in human cognitive neuroscience

Tzvetan Popov[1,2]

→ Also topoplots Lara

EEG Signatures of... What?

Overarching question: **What do we measure with EEG?**

- Direct reflexion of **cognitive contructs** (e.g. emotional processing of images or cognitive effort in WM tasks)?

  OR

- Behavioral control (e.g. **oculomotor engagement** in a task)?

EEG Signatures of Oculomotor Control

Alpha Oculomotor Control (AOC)

Co-variation of posterior alpha power modulations and gaze deviation with increasing WM load

Gamma Contrast Perception (GCP)

Increase of gamma frequency and reduction of microsaccades with higher stimulus contrast

International Affective Picture System (IAPS)

Co-variation of LPP modulation and gaze metrics over sustained time with complex visual images

Projects

Alpha Oculomotor Control (AOC)

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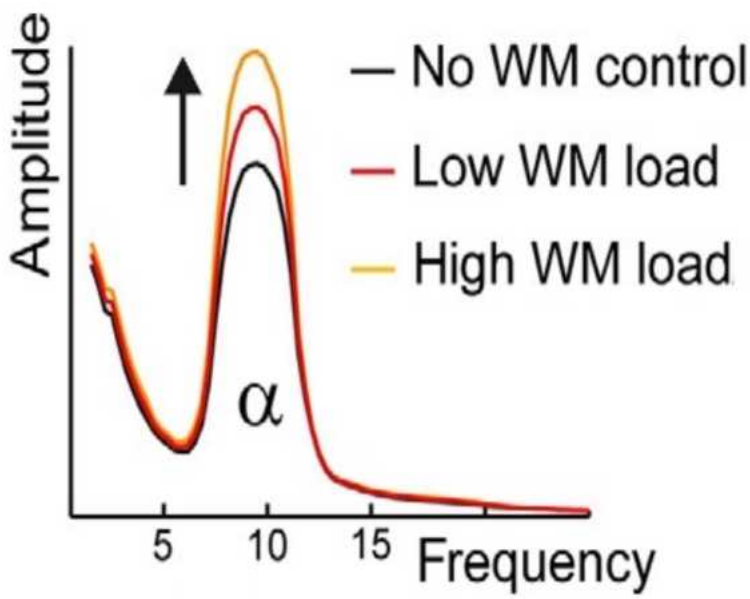
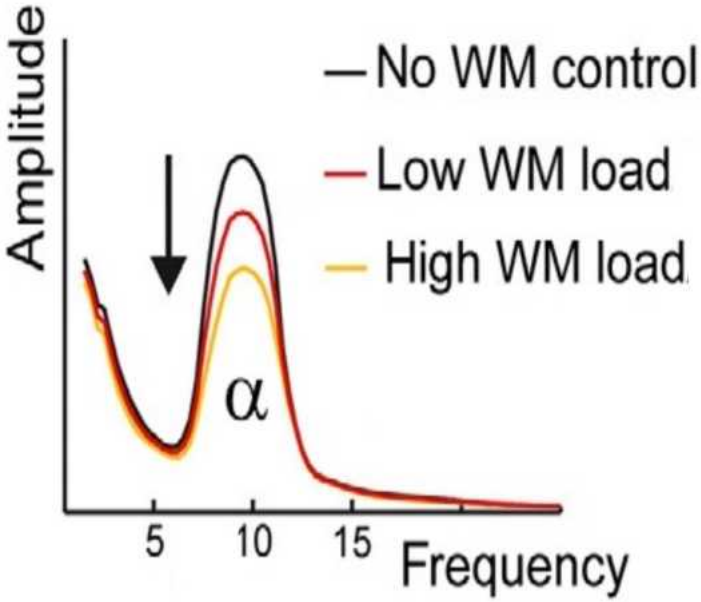
Background

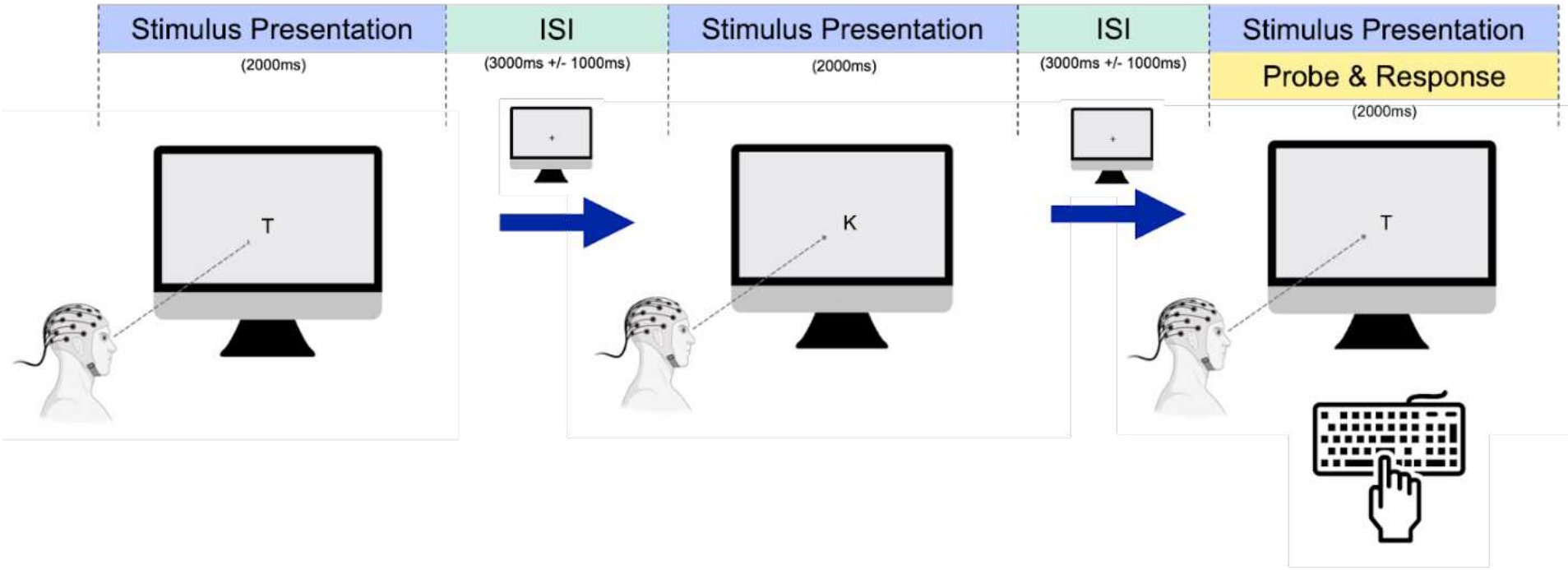


A | Alpha Power increase with increasing WM load

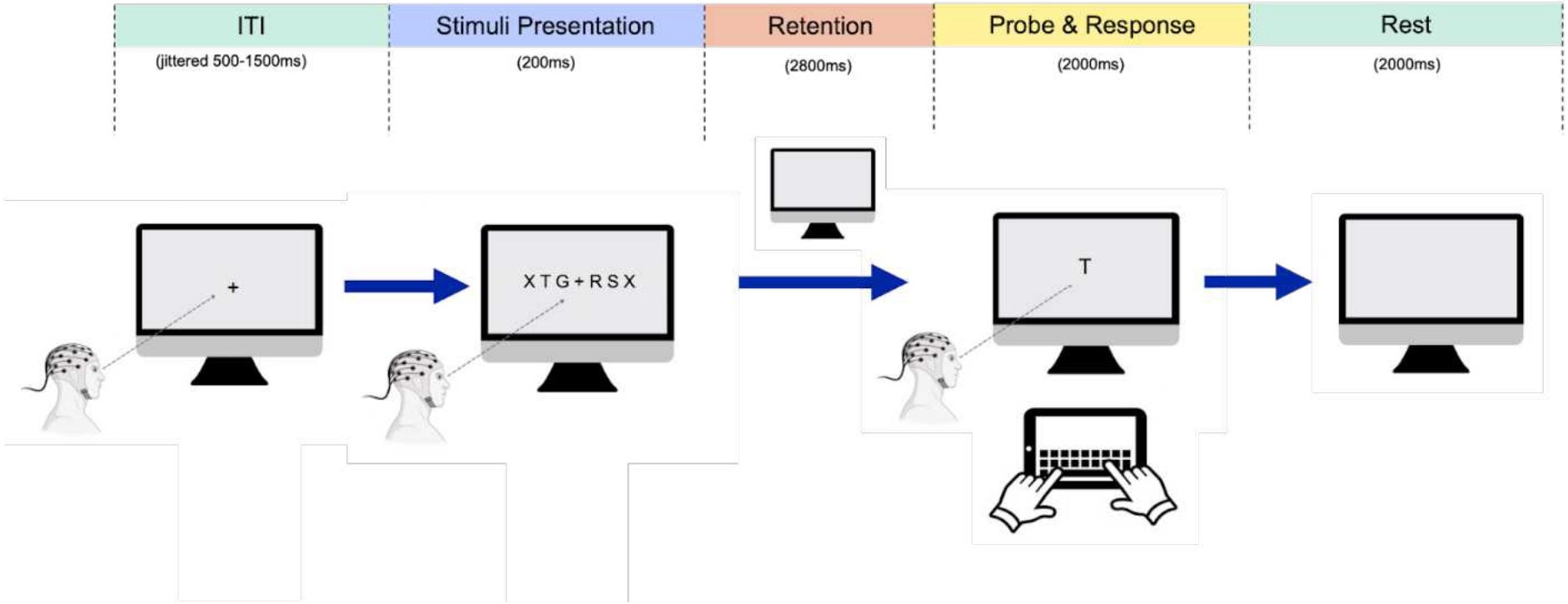


B | Alpha Power decrease with increasing WM load

Paradigm: N-back



Paradigm: Sternberg



Hypotheses

- **[H1] Reaction times increase with increasing WM load in both tasks.**

  [Accuracy, Reaction Time] ~ Condition + (1|Subject)

- **[H2] Accuracy decreases with increasing WM load in both tasks.**

  [Accuracy, Reaction Time] ~ Condition + (1|Subject)

- **[H3] Posterior alpha power decreases with increasing WM load in the N-back task and increases with increasing WM load in the Sternberg task.**

  [Alpha] ~ Condition + (1|Subject)

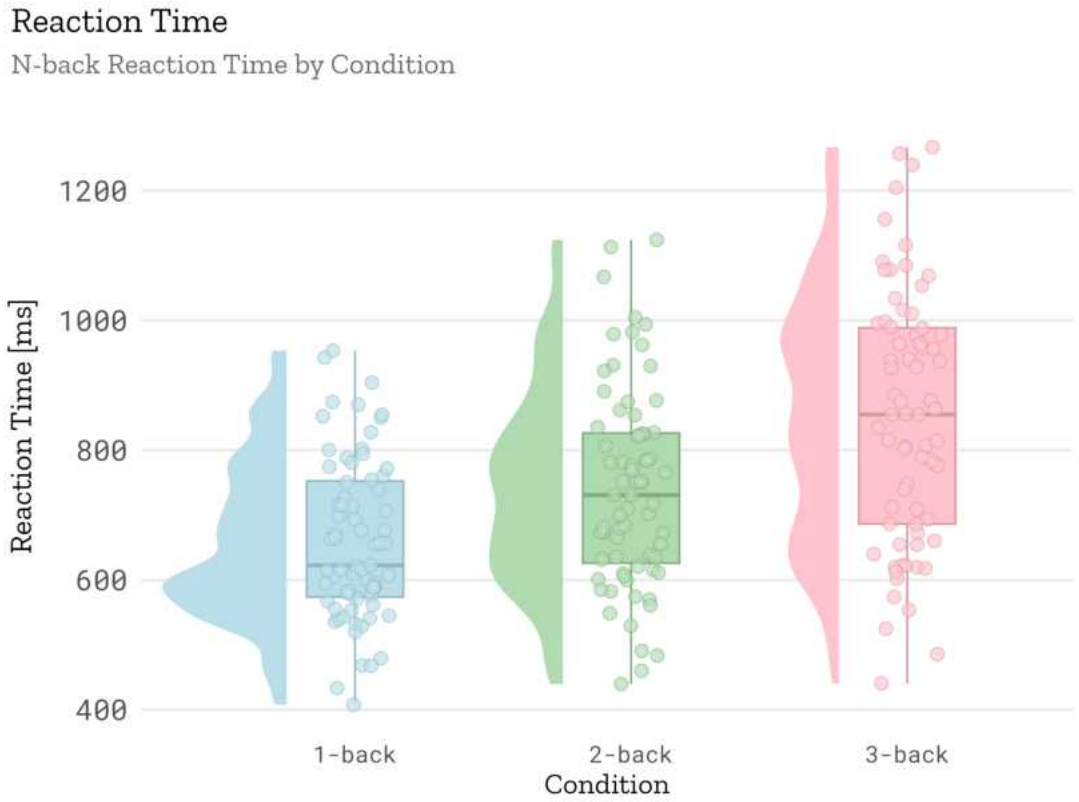
- **[H4] Variability of oculomotor action (operationalized as gaze deviation) increases with increasing WM load in the N-back task and decreases with increasing WM load in the Sternberg task.**

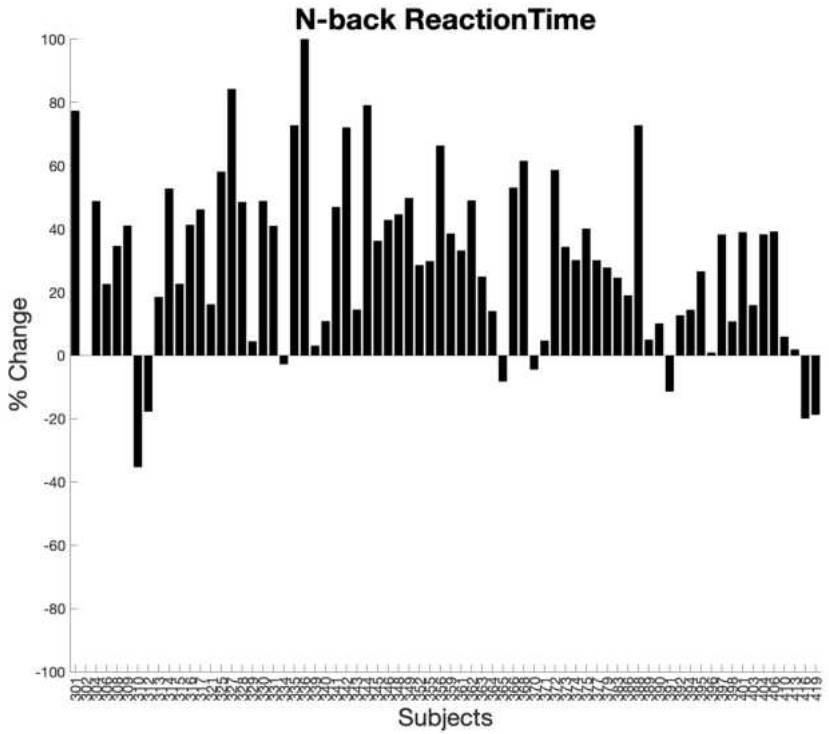
  [Gaze] ~ Condition + (1|Subject)

- **[H5] Variability of oculomotor action is associated with modulation of posterior alpha activity and accounts for the distinct relationships between alpha power and WM depending on the specific WM task.**

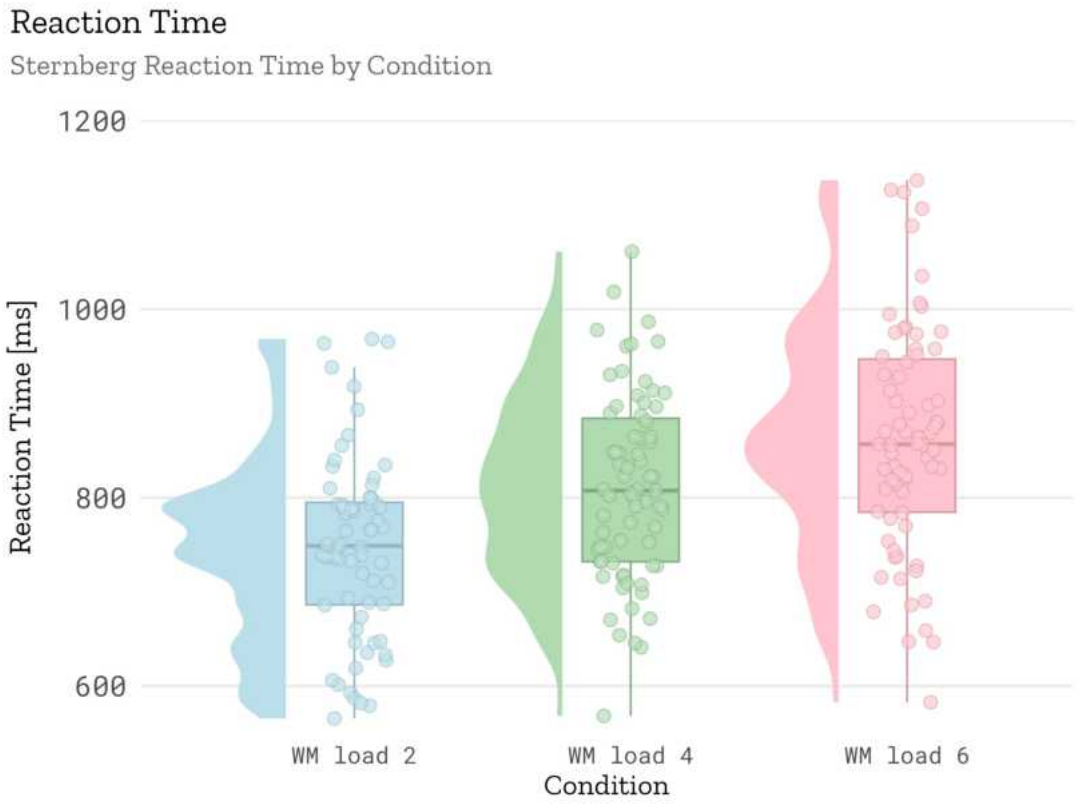
  *[Alpha] ~ Gaze * Condition + (1|Subject)*

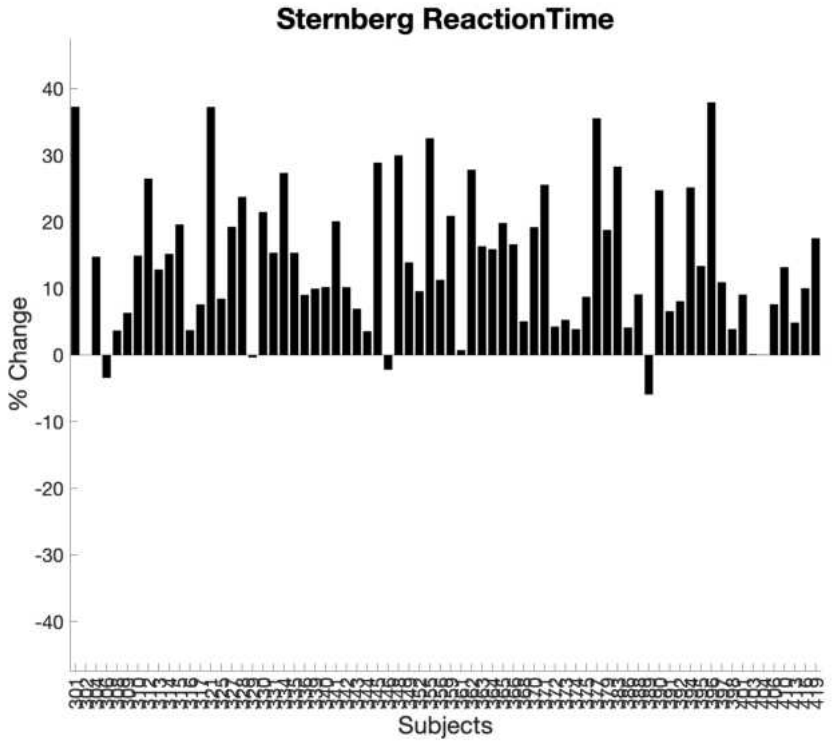
[H1] Reaction Times N-back



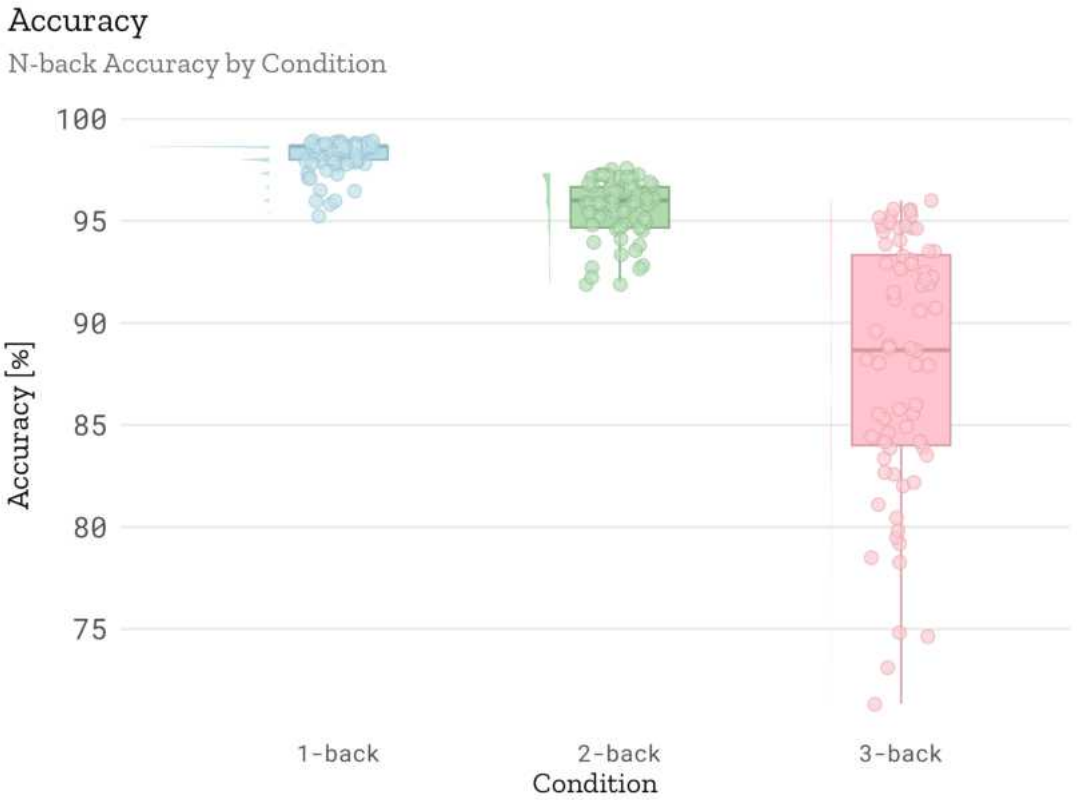


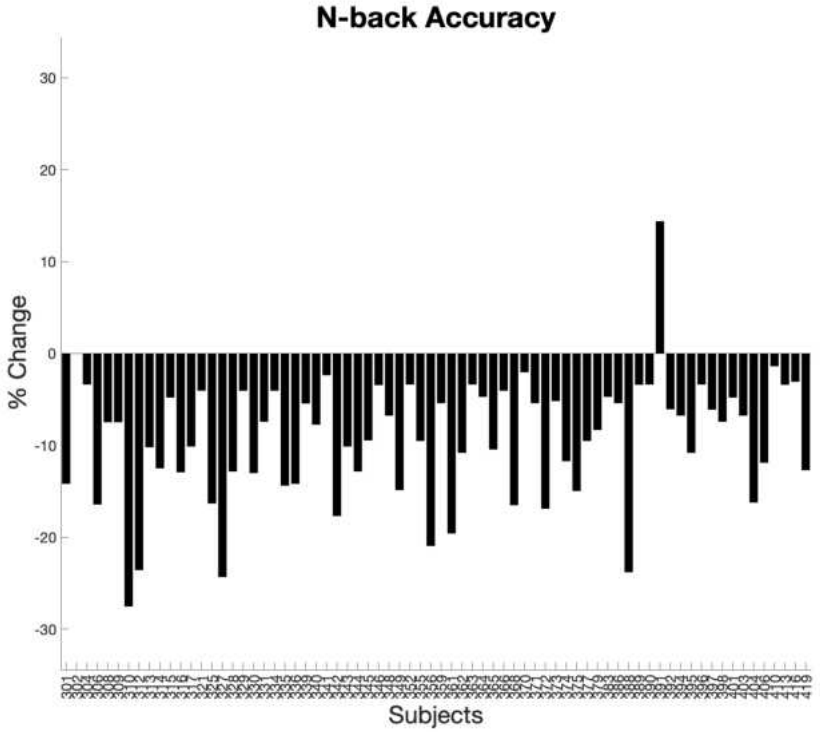
[H1] Reaction Times Sternberg



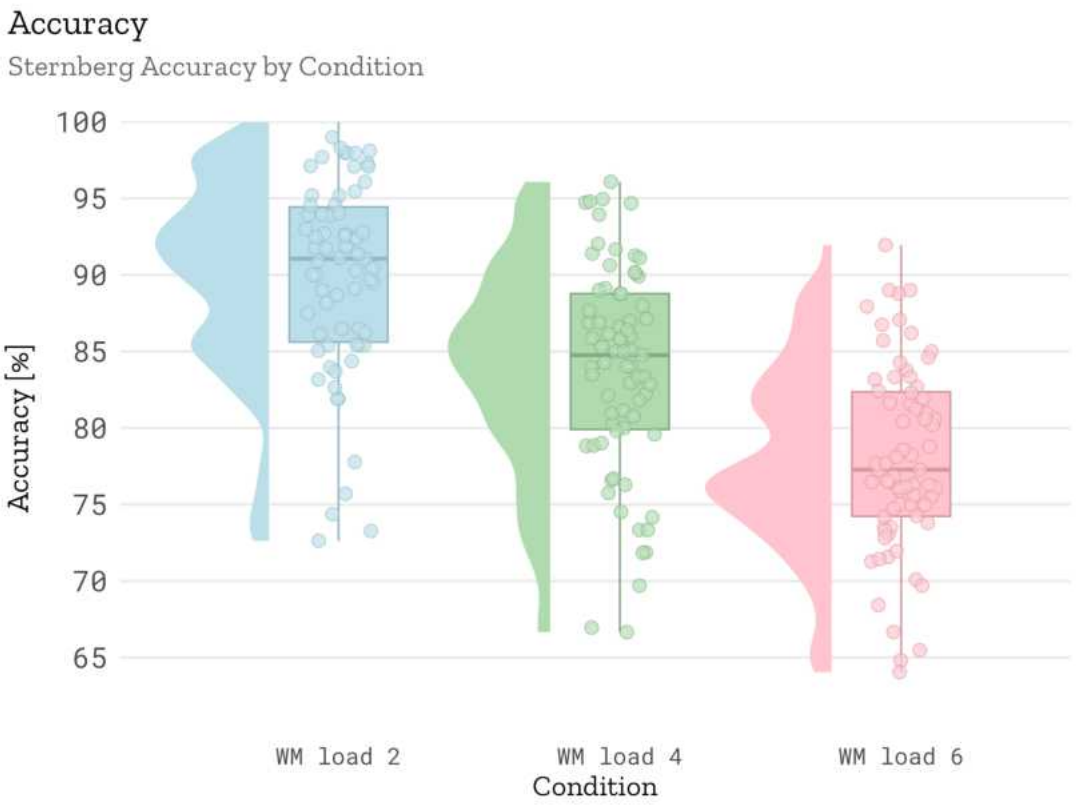


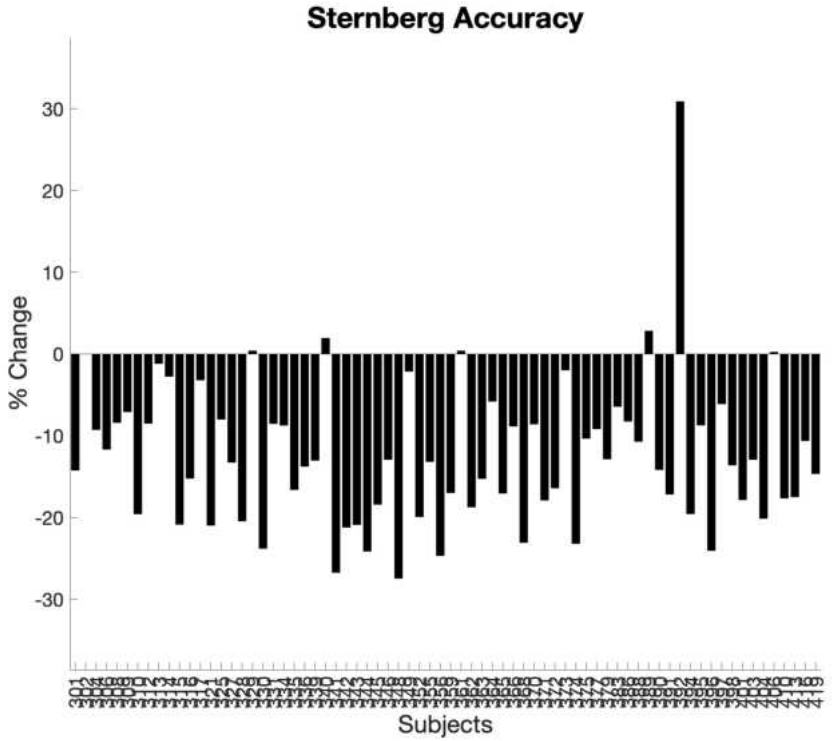
[H2] Accuracy N-back



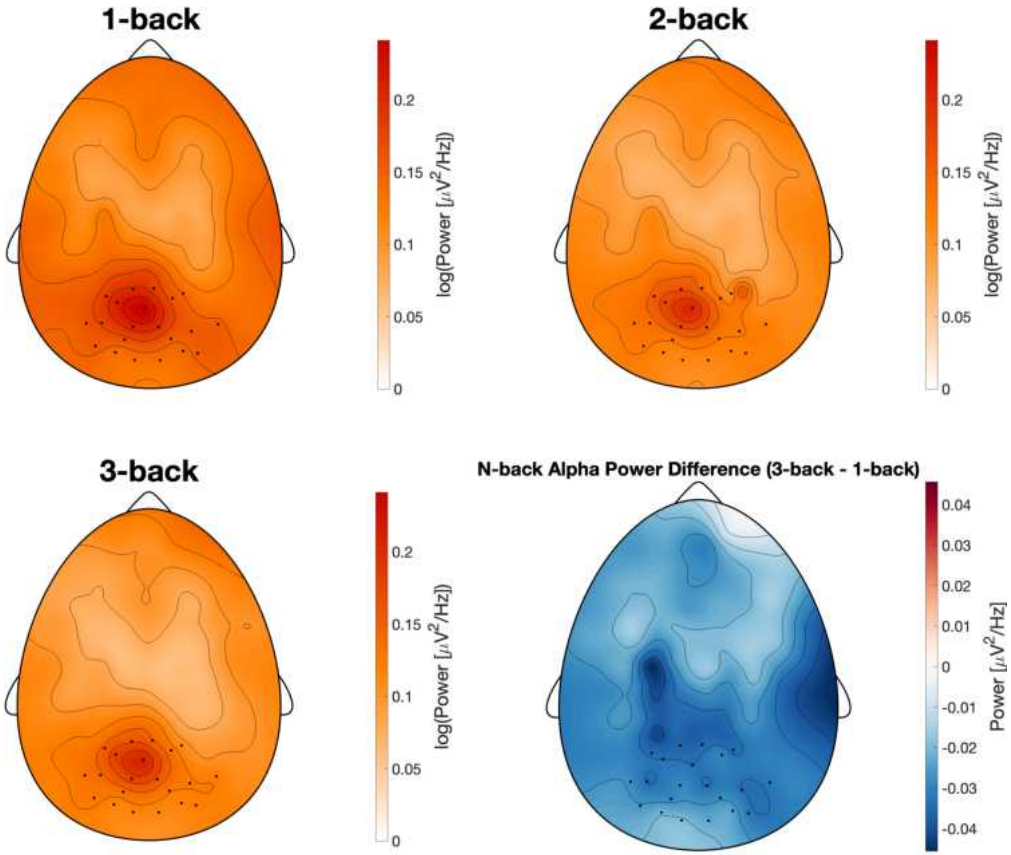


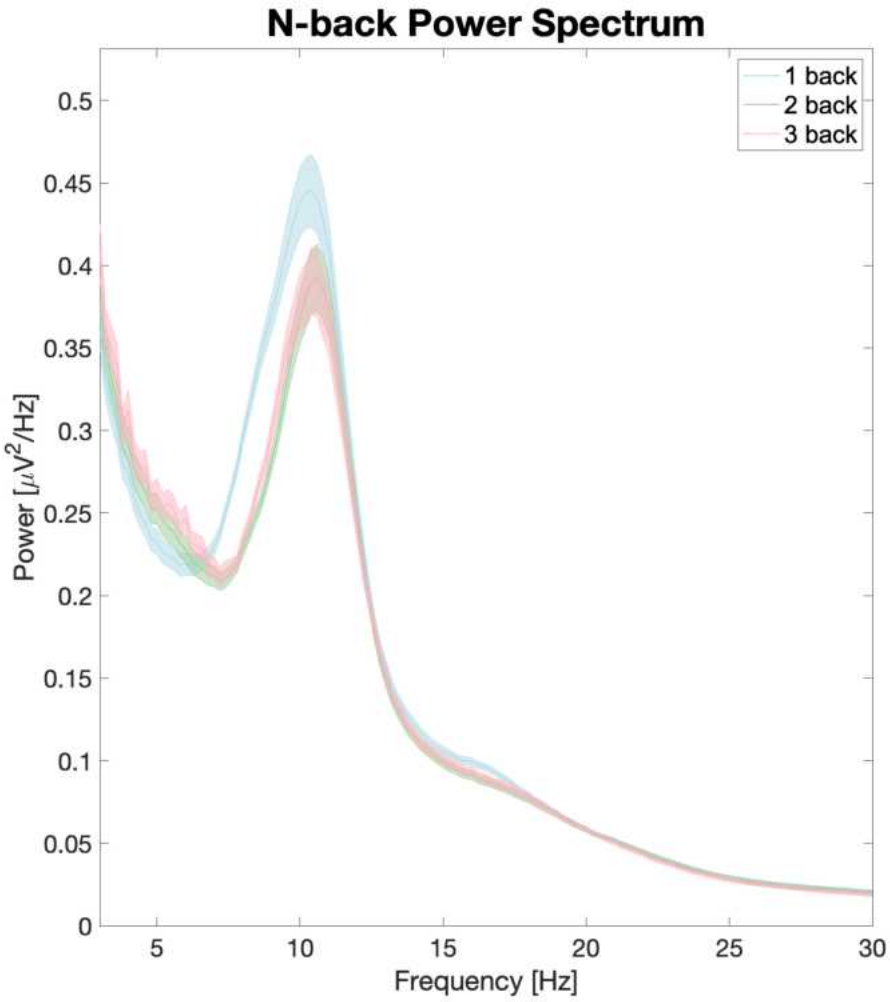
[H2] Accuracy Sternberg



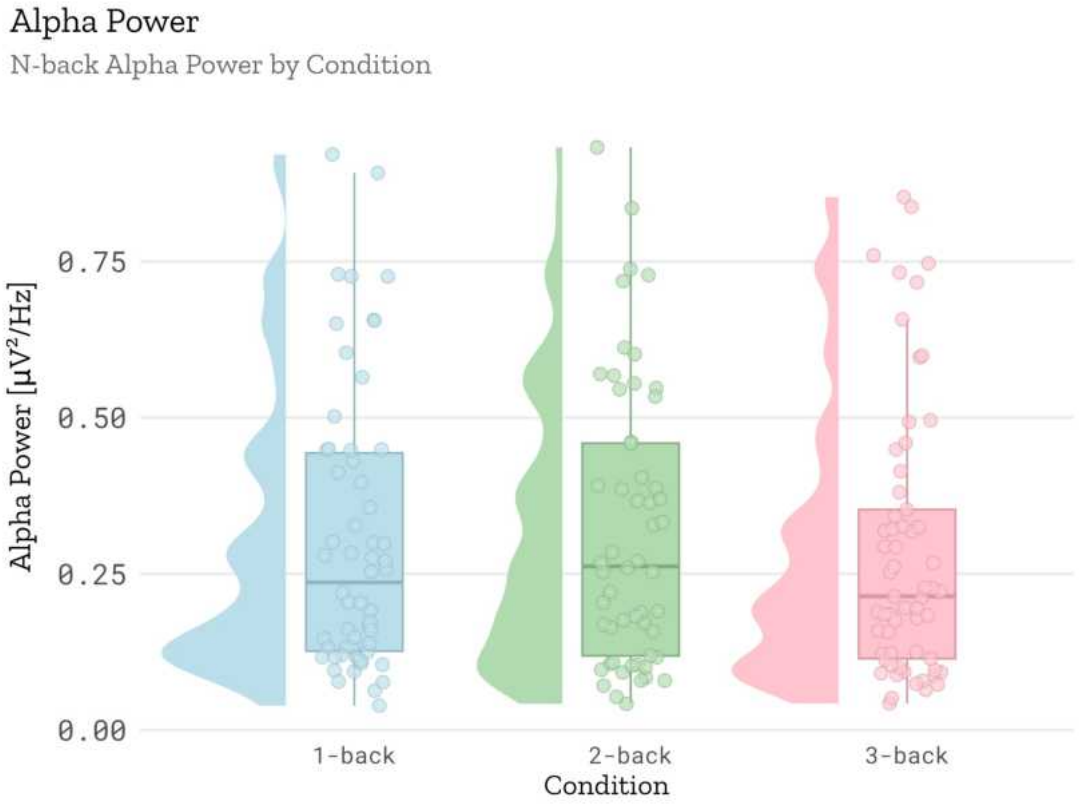


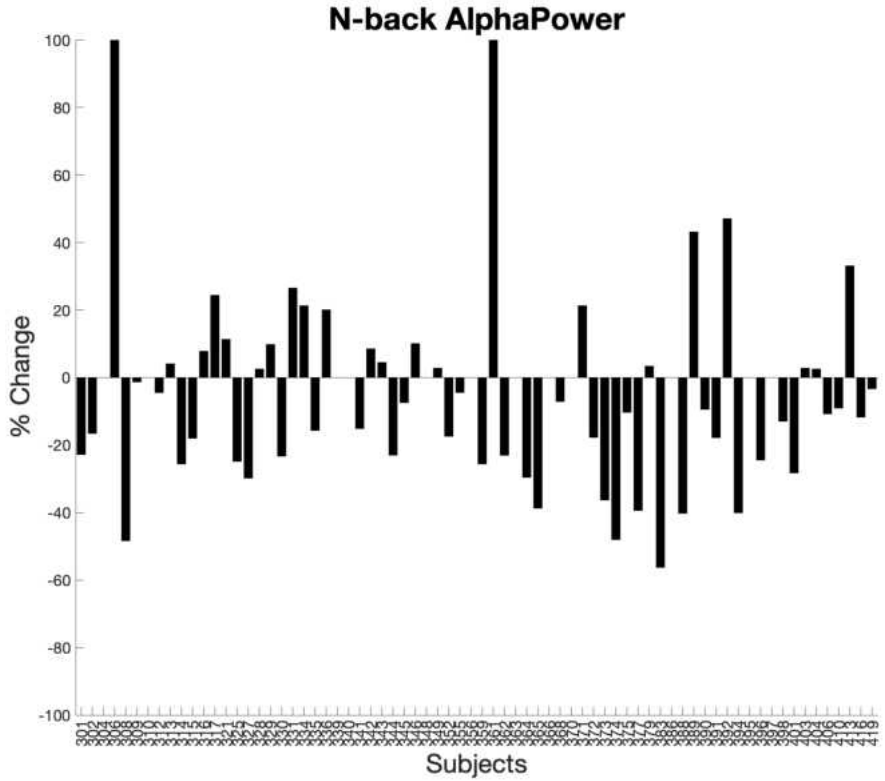
[H3] Alpha Power DECREASE N-back



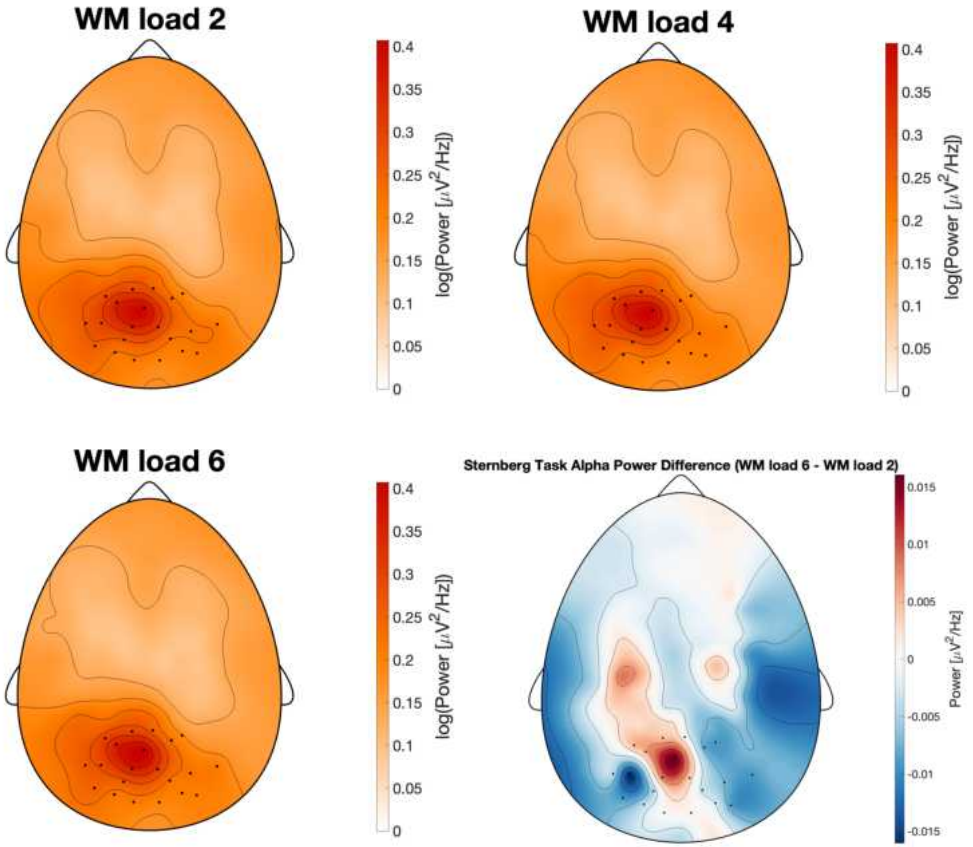


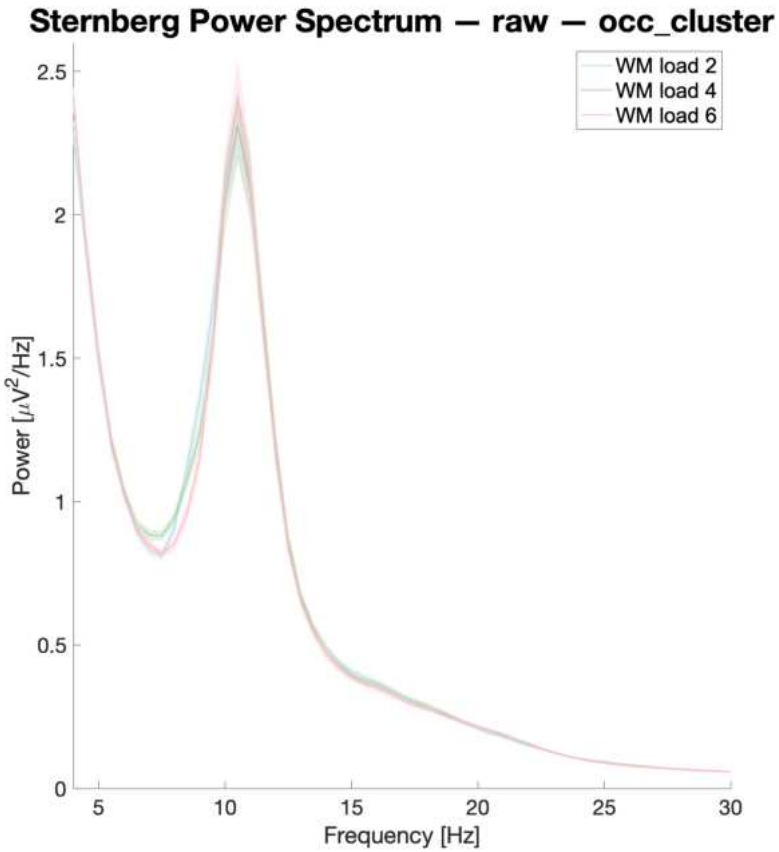
[H3] Alpha Power DECREASE N-back



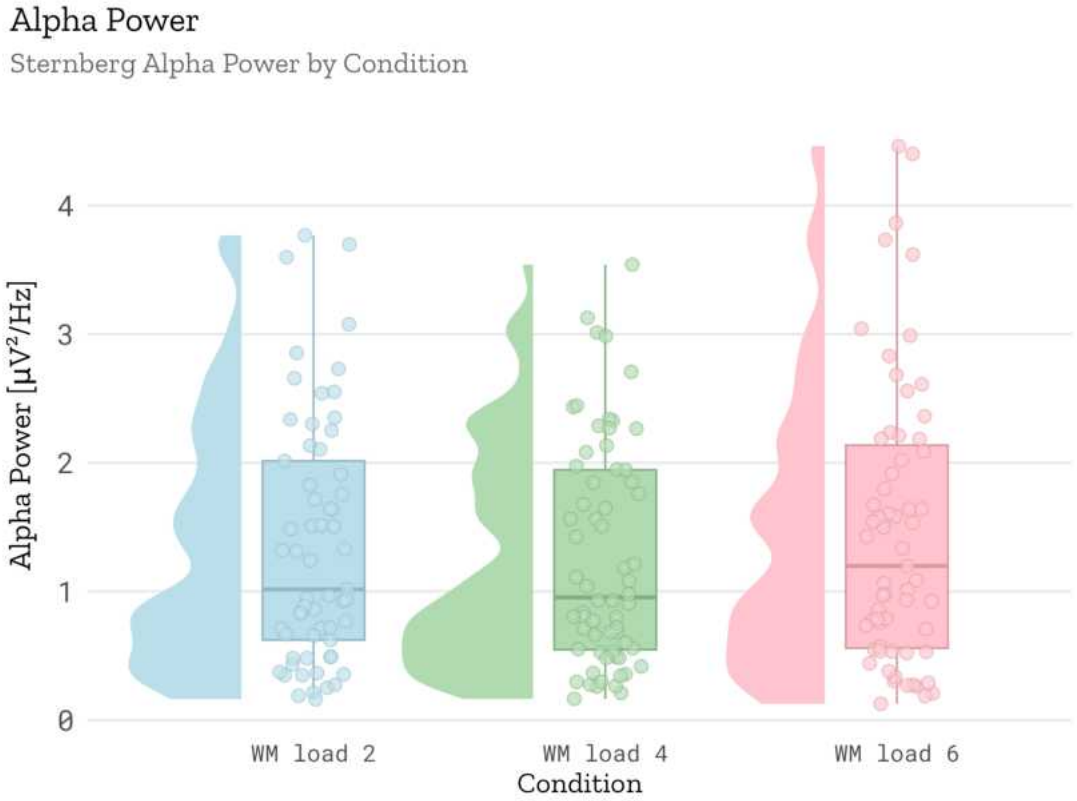


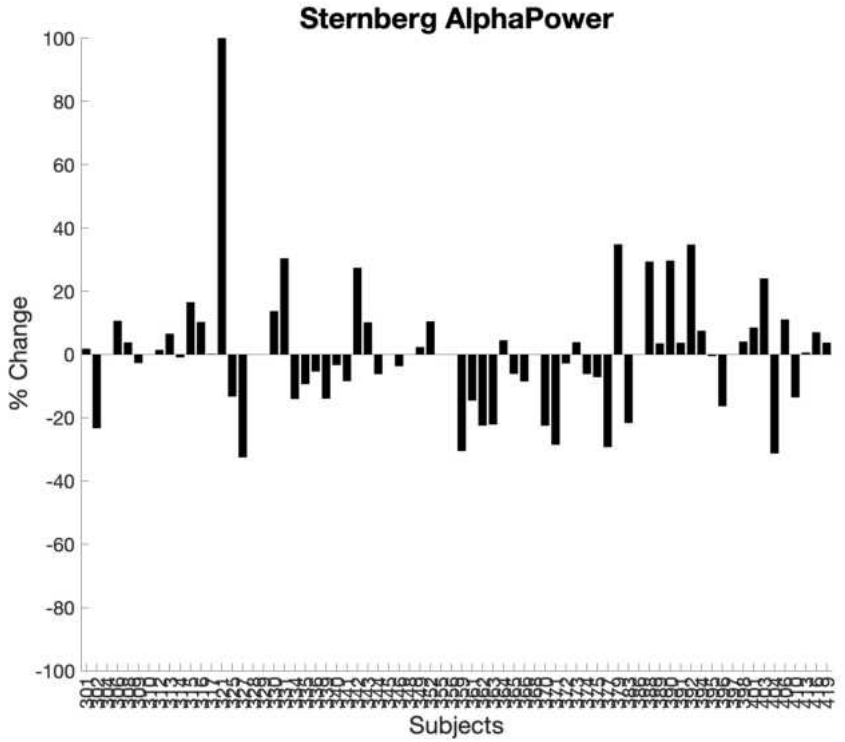
[H3] Alpha Power INCREASE Sternberg



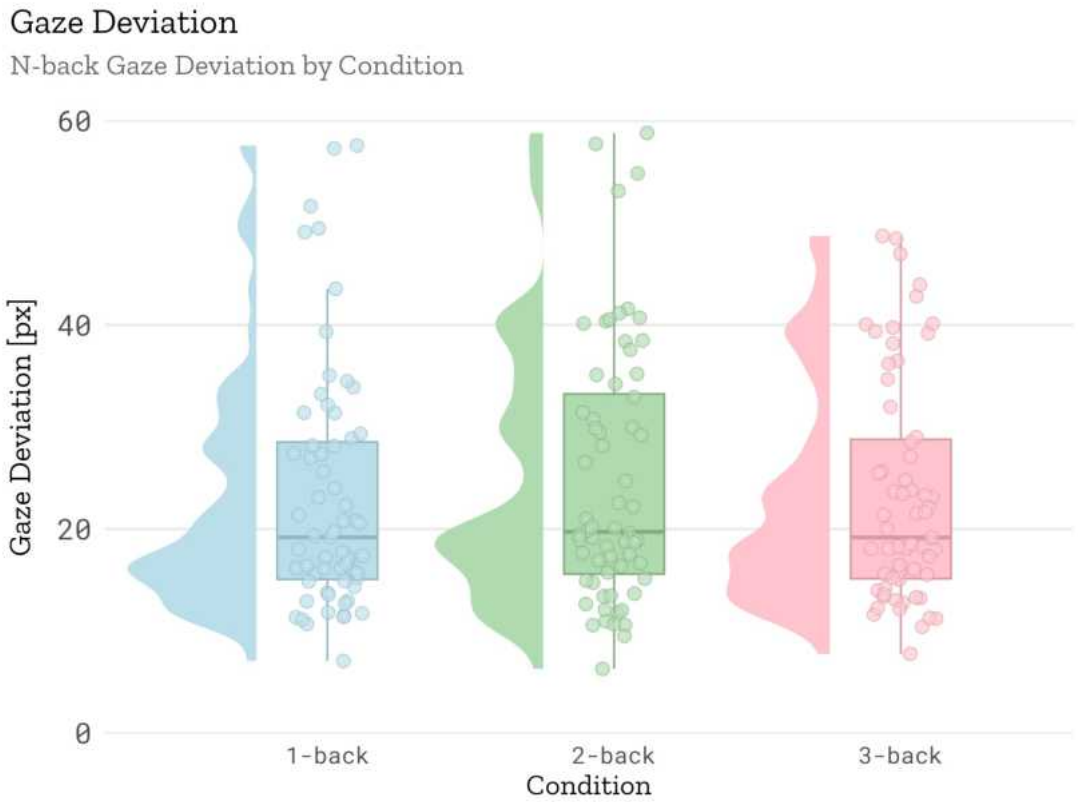


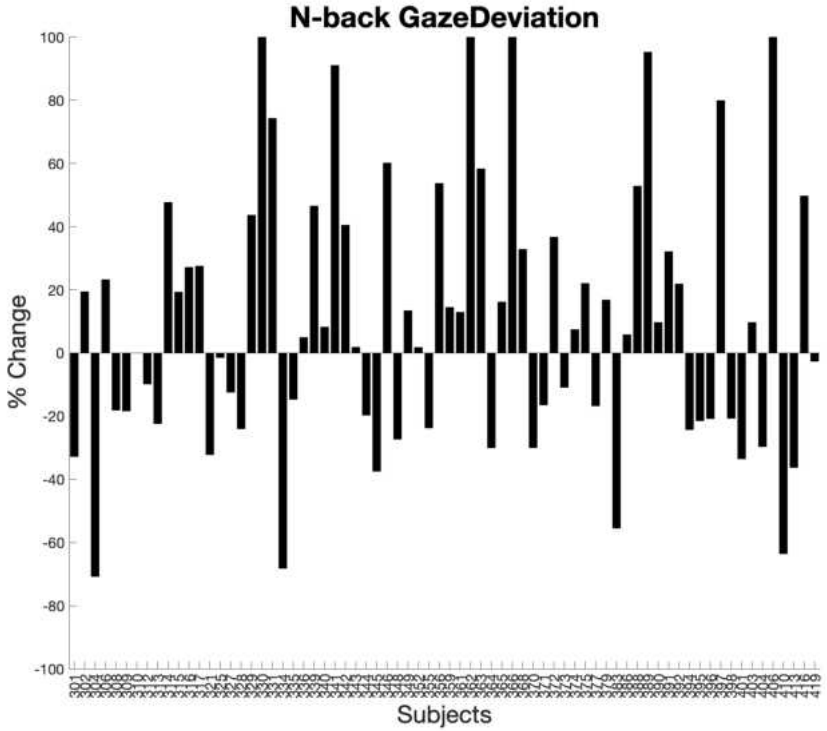
[H3] Alpha Power INCREASE Sternberg



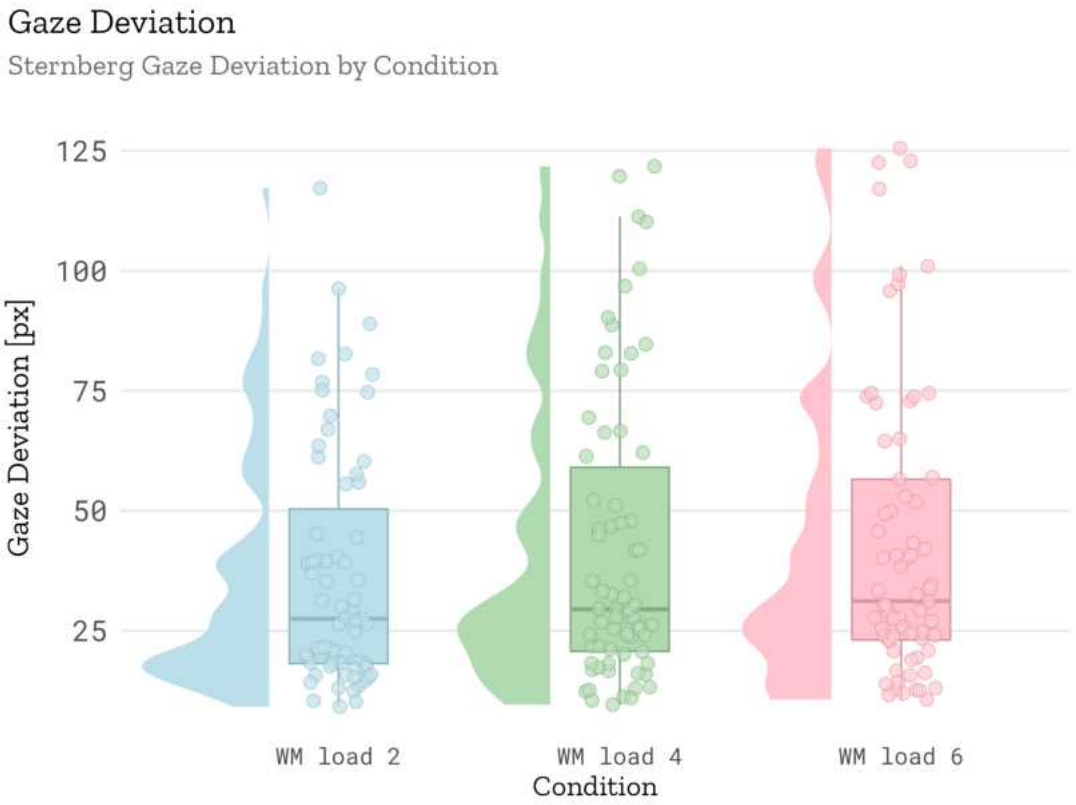


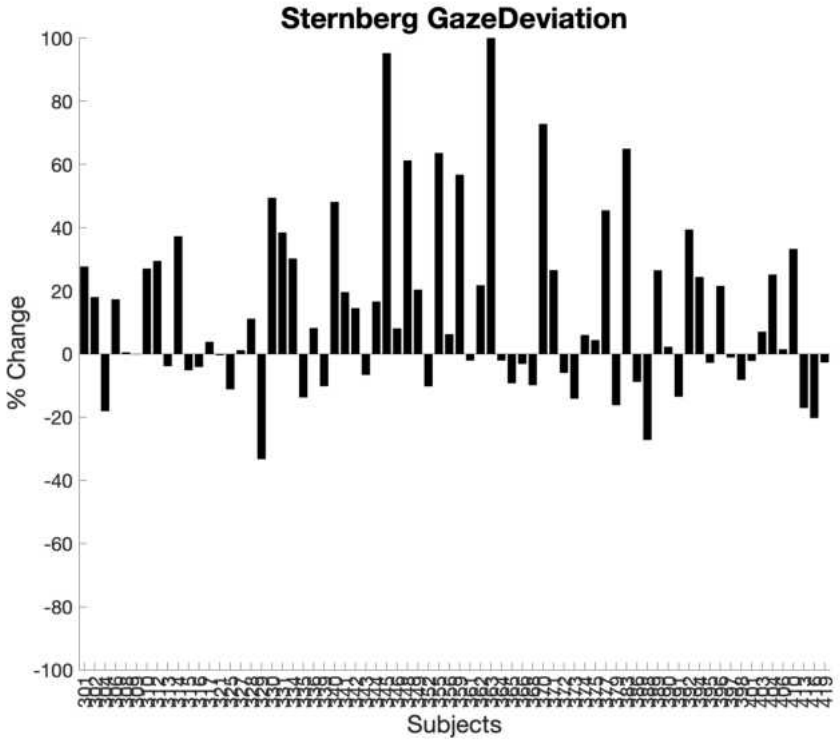
[H4] Gaze INCREASE N-back



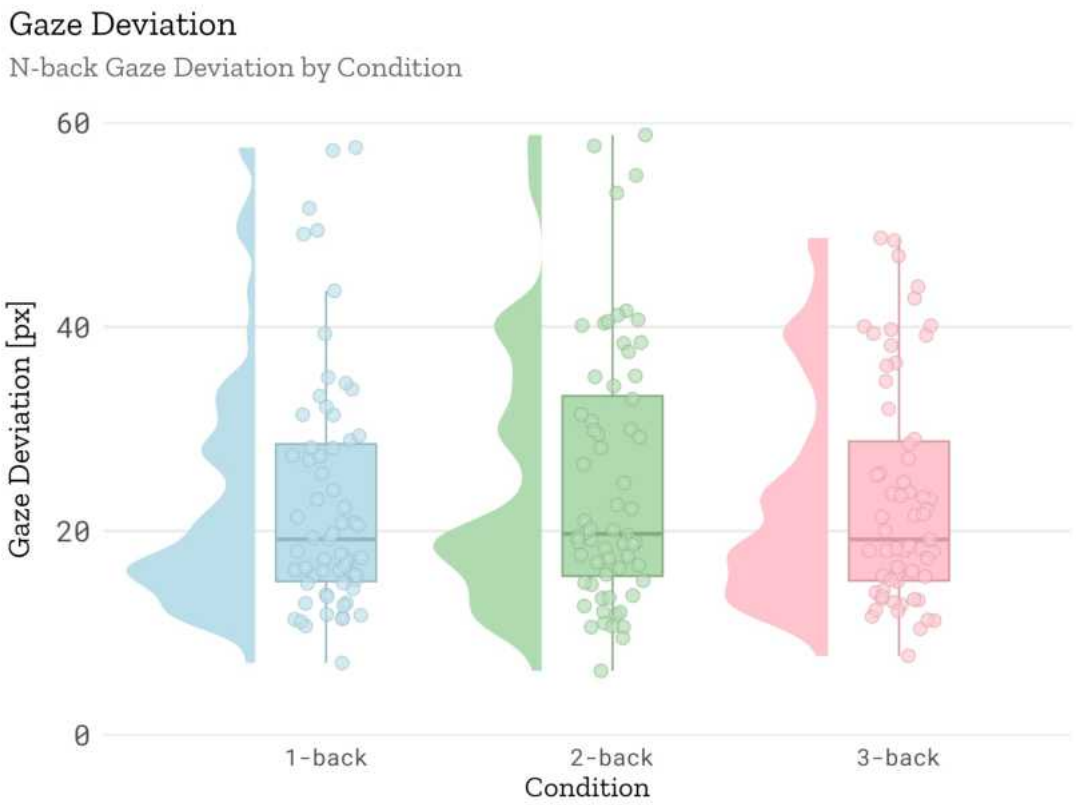


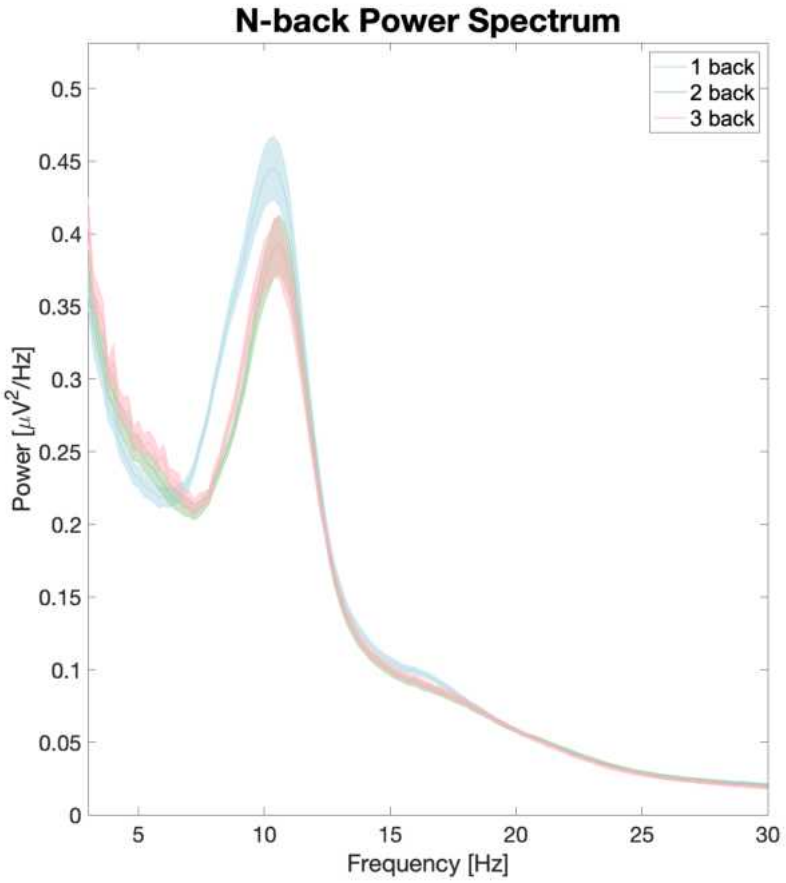
[H4] Gaze DECREASE Sternberg



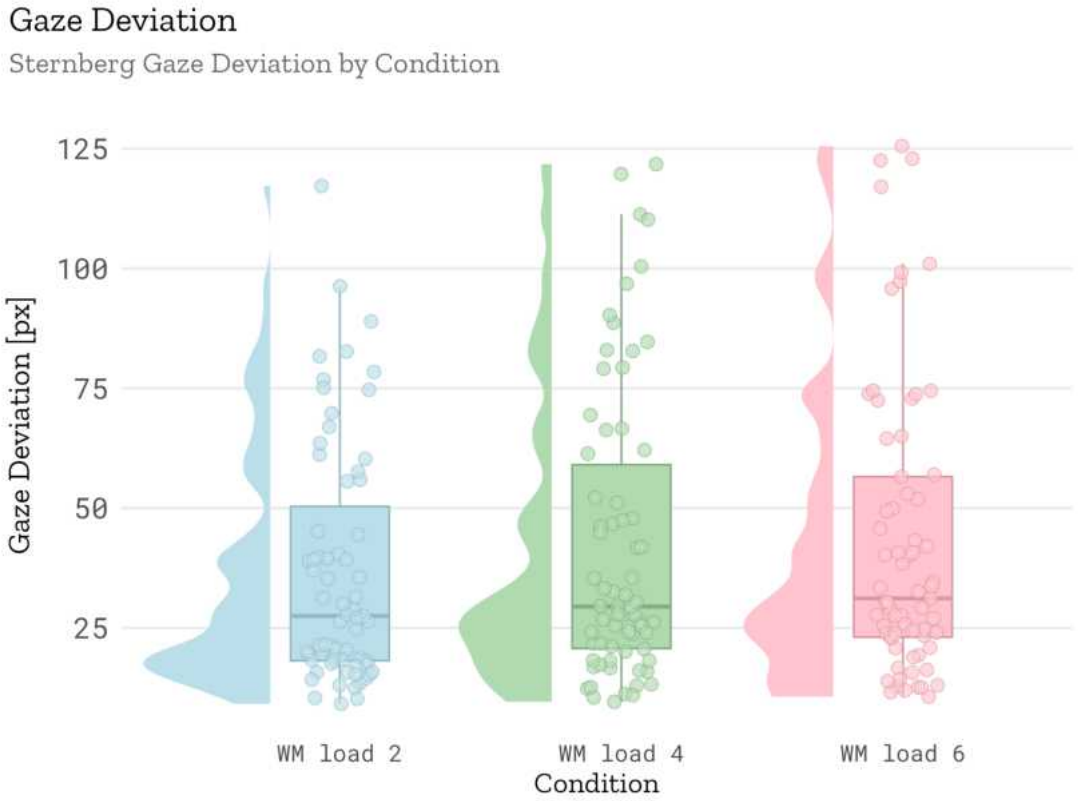


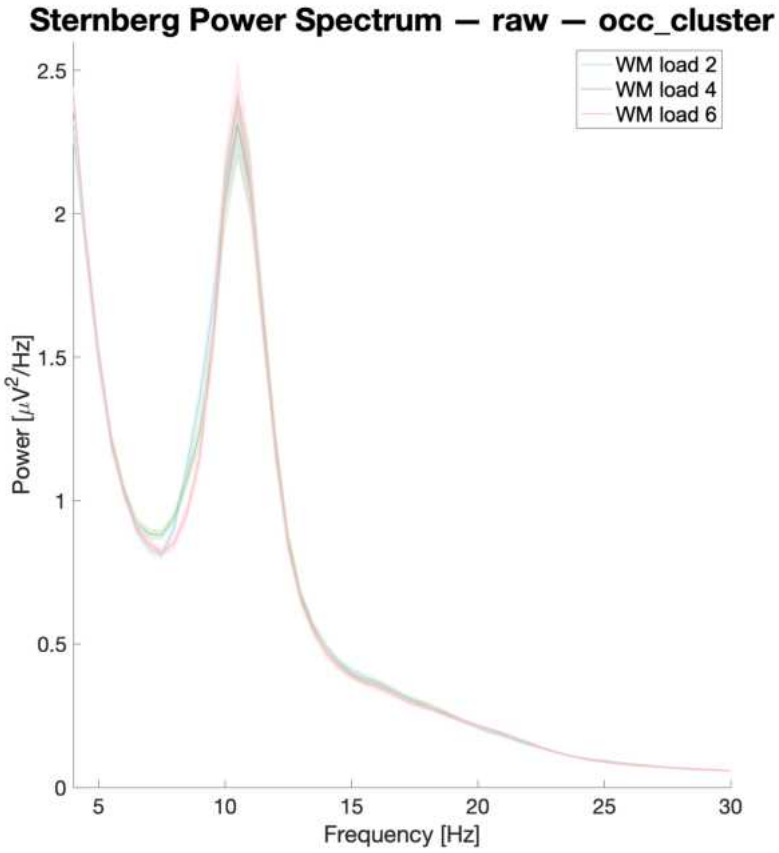
[H5] Alpha Power and Gaze Deviation Association: Nback





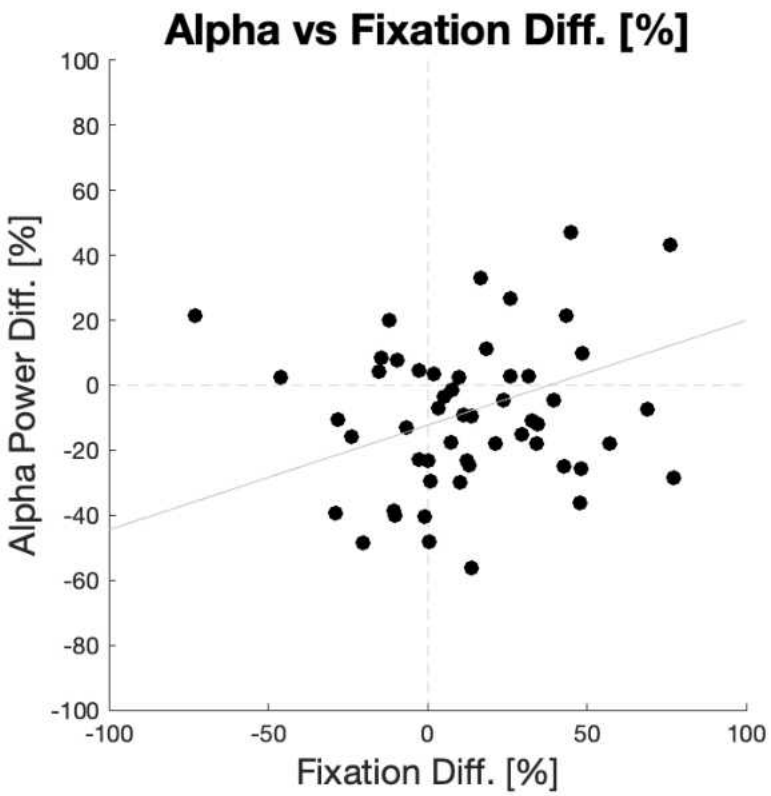
[H5] Alpha Power and Gaze Deviation Association: Sternberg



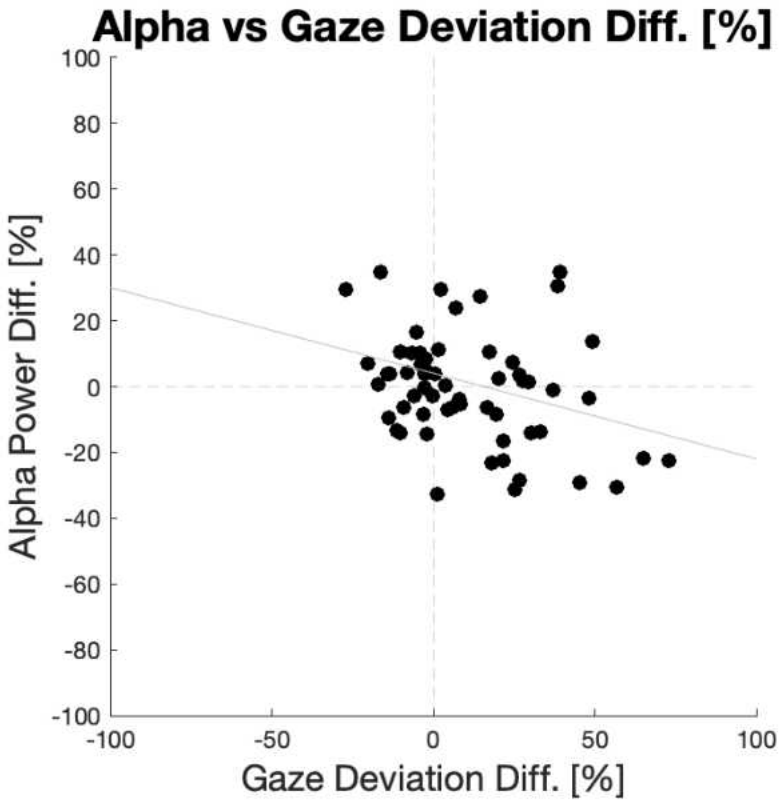


[H5] Alpha Power and Gaze Deviation Associations

N-back



Sternberg



Thank you for your attention!