

Visual Awareness Positivity: a Novel Neural Correlate of Consciousness

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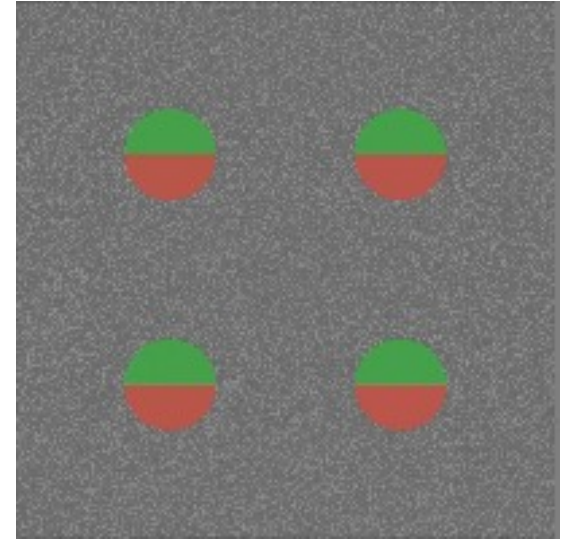
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Dr. Schurger Lab, Brain Institute

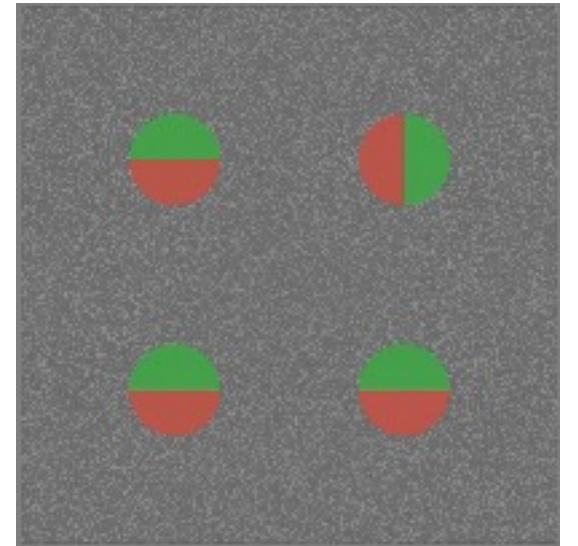
Let's do an experiment!

- Your task is to focus on the screen
- There will be 4 cut-circles flashing (A)
- One of them may be different (B)
- If you see a different circle, raise your right hand
- If you see all the same, raise your left hand

A



B



In the following phase you will see **four** circles bisected in the middle, half green and half red.

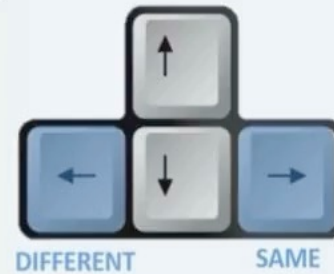
The bisecting line can be either horizontal or vertical.

Sometimes all of the circles will be in the **same direction**, while sometimes one of the circles will be in a **different direction** from the rest. For example, three horizontals and one vertical.

Respond using the arrow keys as indicated in the diagram below.

Caution! Response time is limited, so please answer quickly.

If you're not sure, please guess.

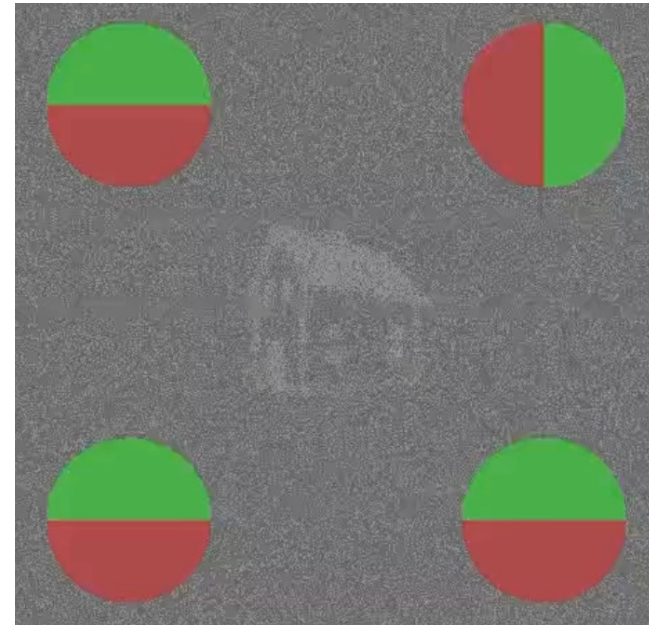
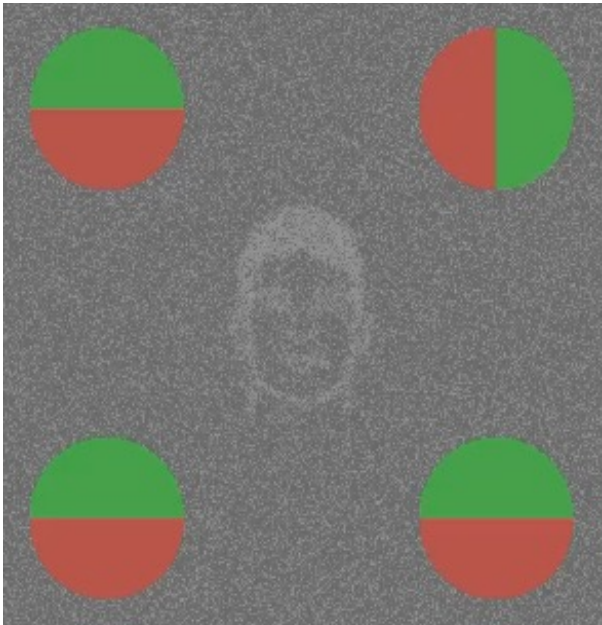


How many of you noticed faces and houses?

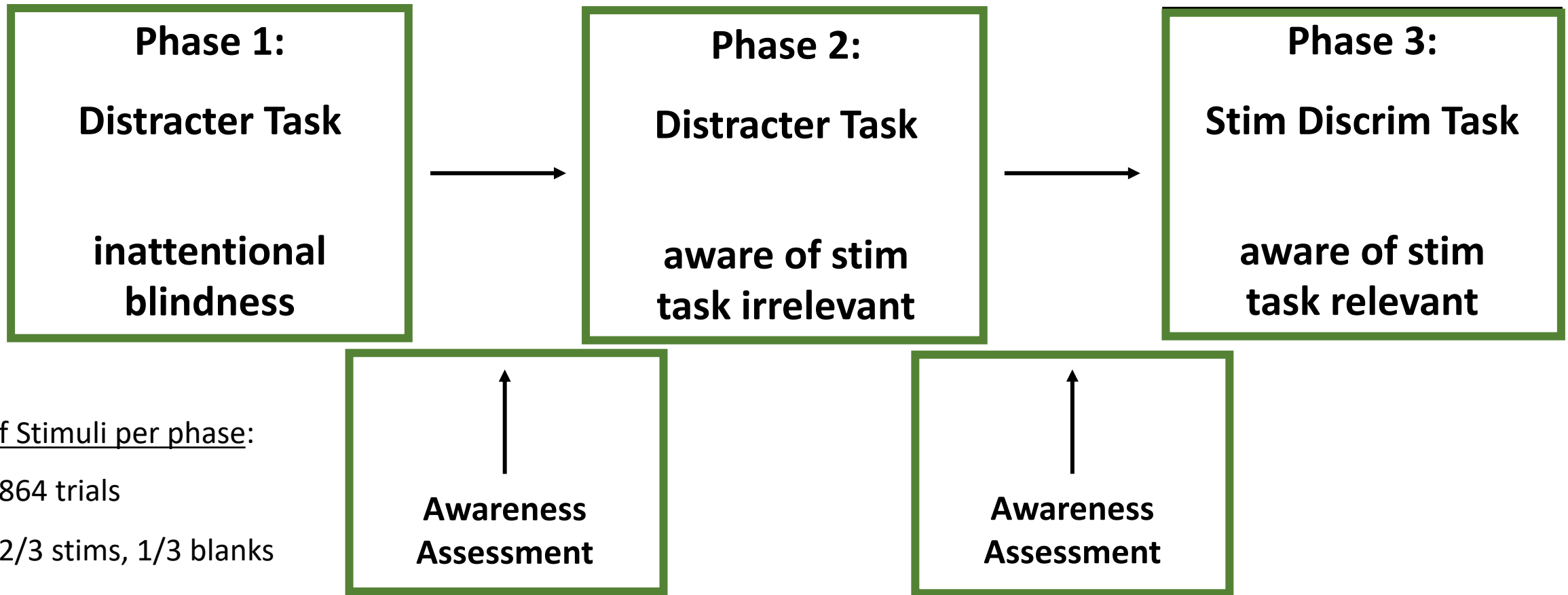
- What % of subjects do you think can stay “blinded” for 700+ trials?
- In the lab we get ~50% of participants not seeing the faces or houses after hundreds of trial

Inattentional Blindness (IB)

- (IB) = the failure to perceive a fully visible, unexpected stimulus when attention is focused elsewhere (Mack & Rock, 1998).

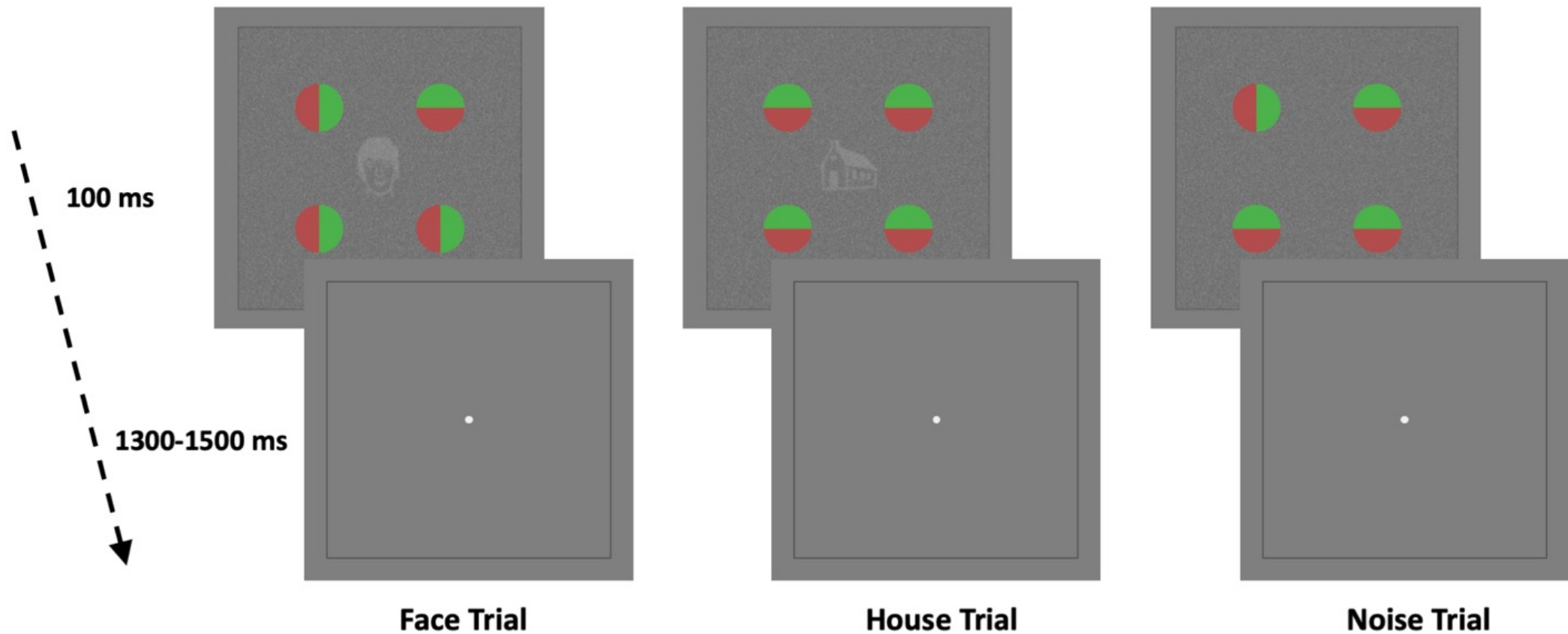


3-Phase Inattention Paradigm



of Stimuli per phase:

- 864 trials
- 2/3 stims, 1/3 blanks
- 288 trials each
- Identical Stims in each phase



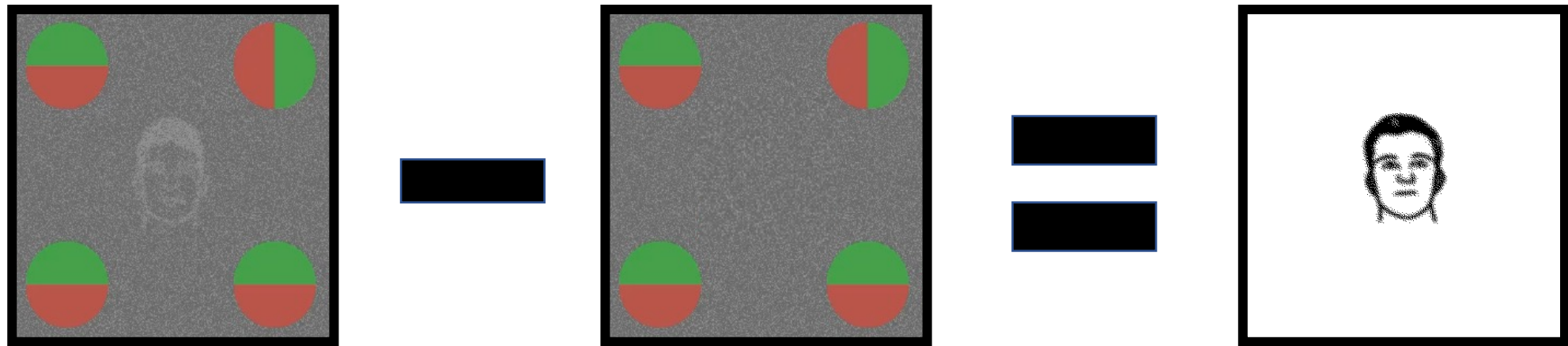
- Phase 1 & 2 task: identify whether the circles are same or not
- In the center, a face , house, or nothing is shown
- Divided in 3 phases
 - Phase 1: Inattentionally Blind, Phase 2: Aware, Phase 3: Task-relevant

Analyses

- What are the differences in the brain between noticing and not noticing faces and houses?
 - ERP
 - Time-frequency
 - Decoding
 - Stability

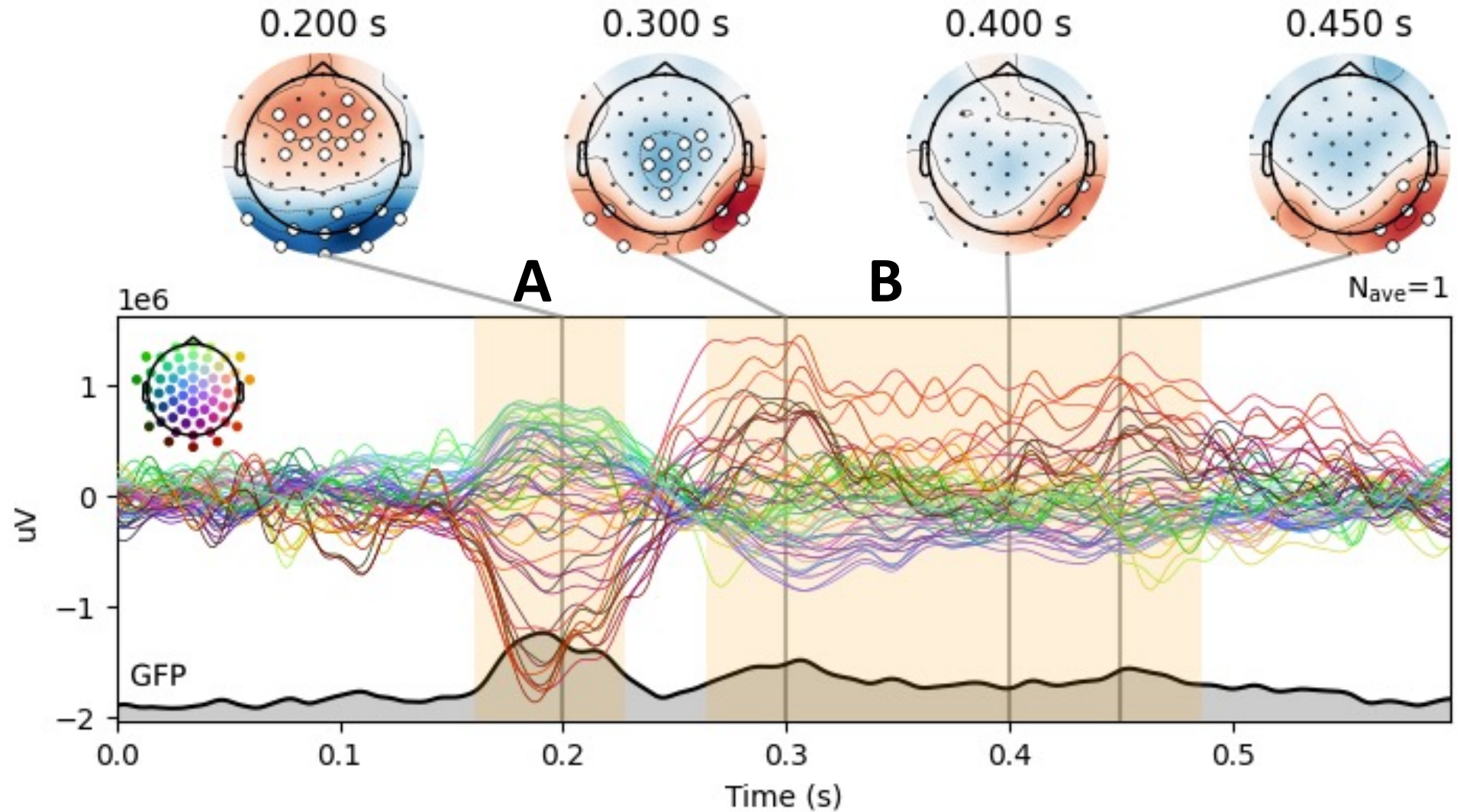
Isolating Stimulus Signal

- We averaged the “noise” ERP
- Then subtracted it from each stimulus average ERP (faces, houses) within each phase

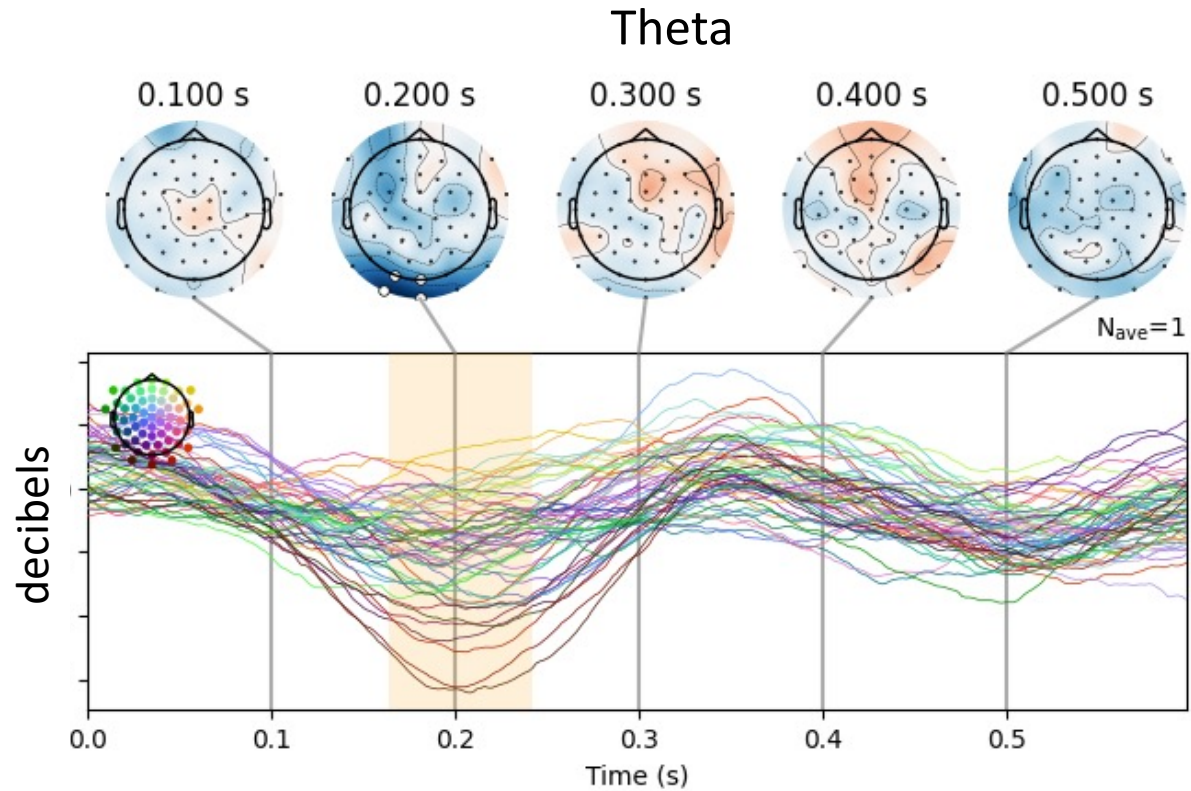


- Then, we will compare Phase 2 (aware) with Phase 1 (blind)

Faces: ERP (aware minus blind)

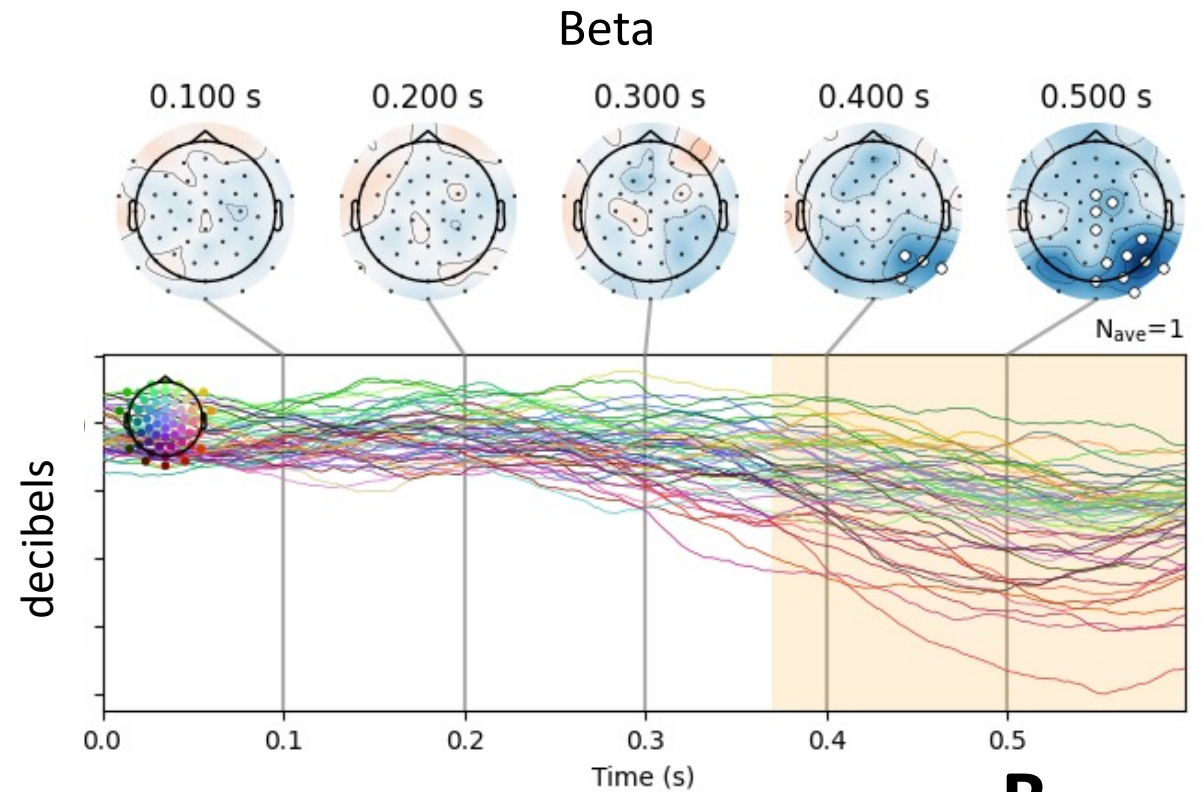


Faces: Time-Frequency (aware minus blind)



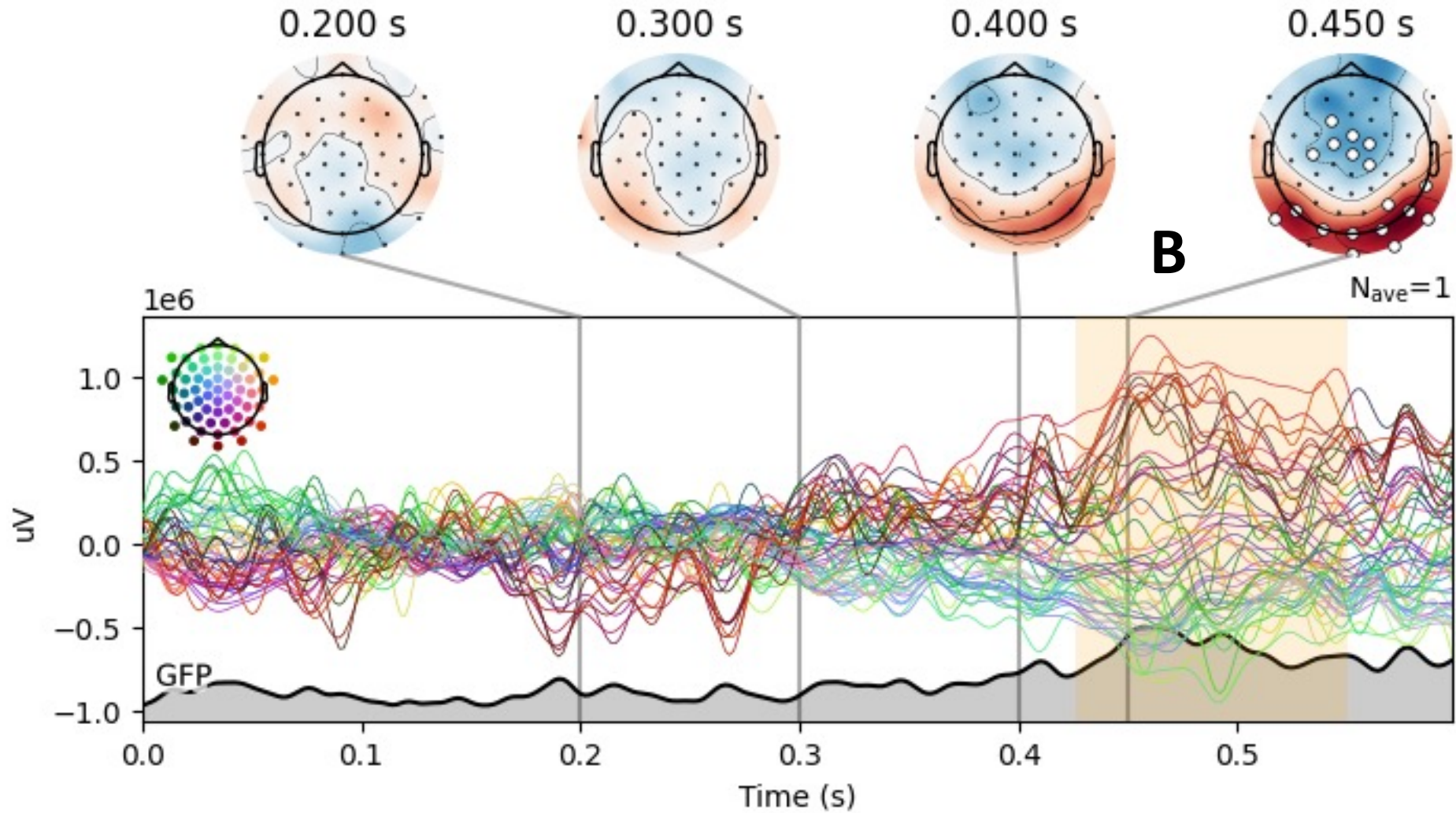
N = 42

A



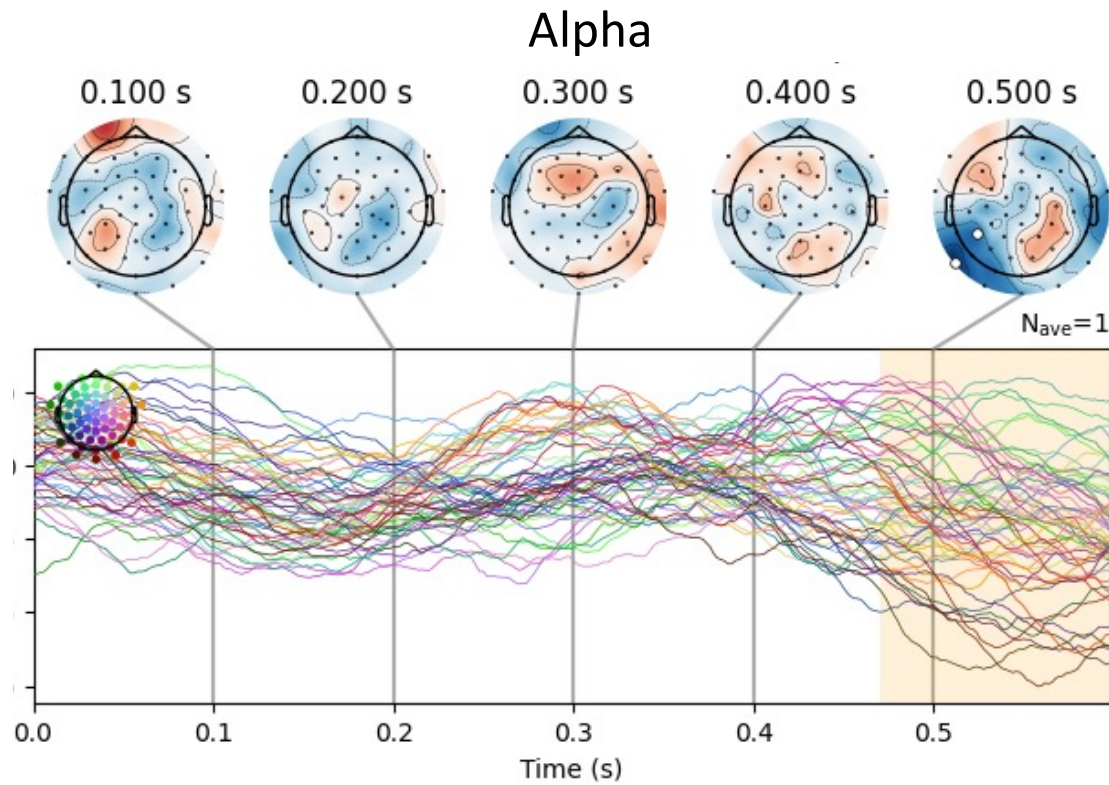
B

Houses: ERP (aware minus blind)



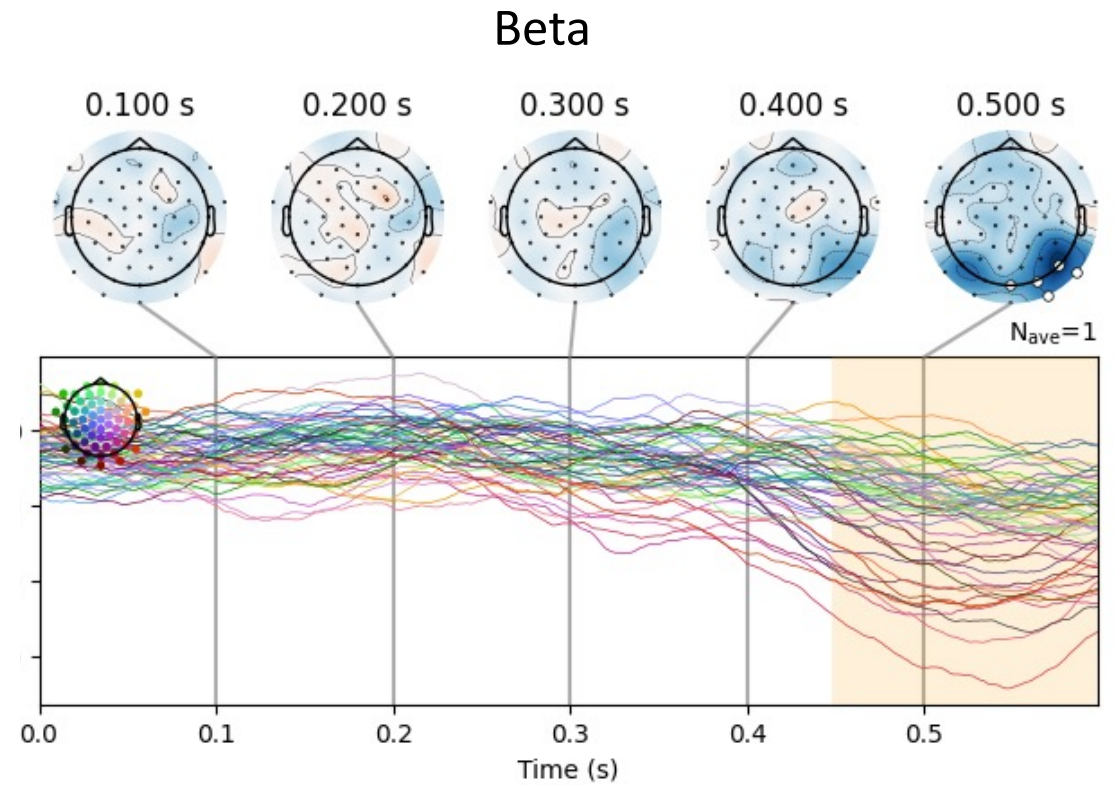
N = 42

Houses: Time-Frequency (aware minus blind)



A

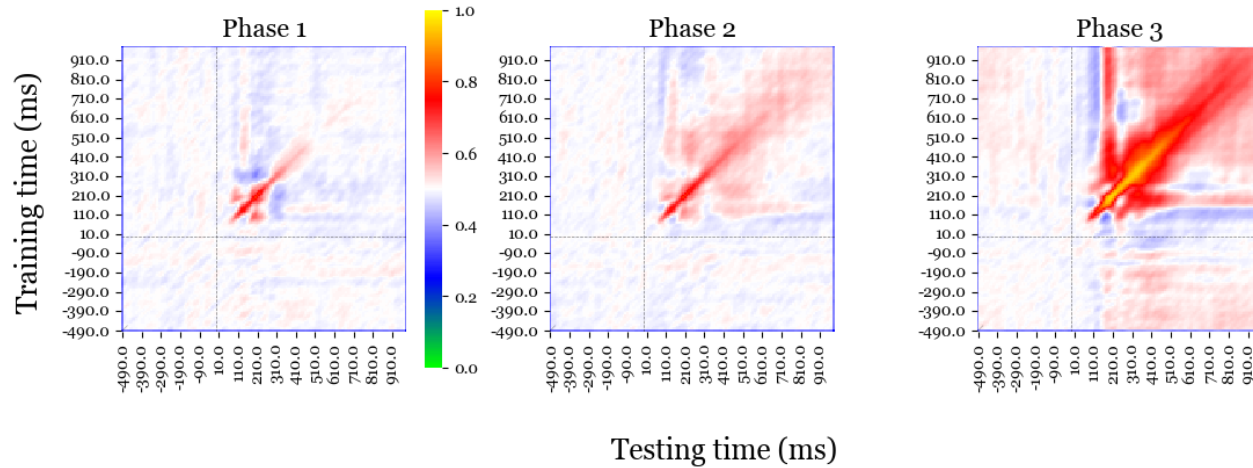
N = 42



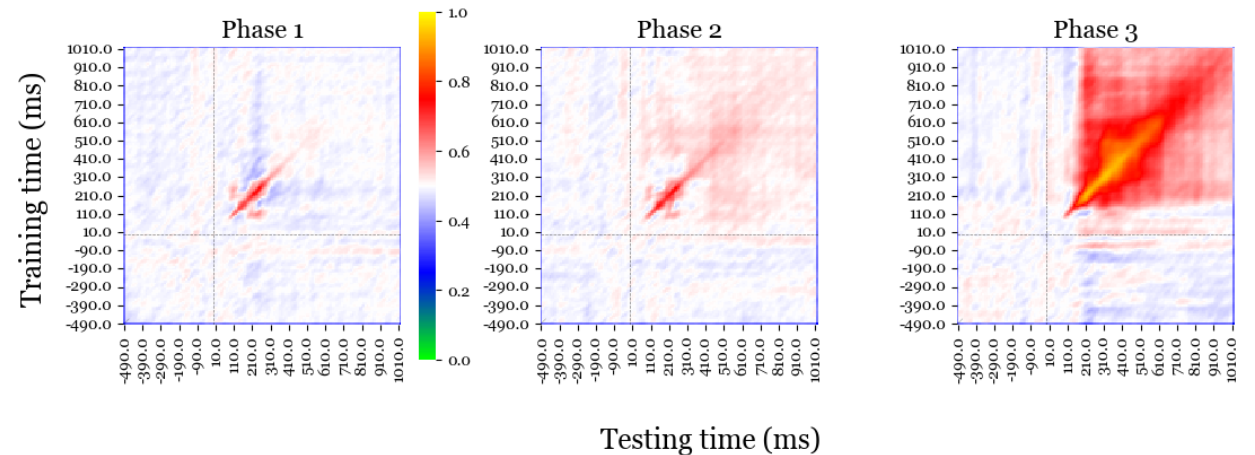
B

Temporal Generalization of Decoding

Temporal Generalization - Faces



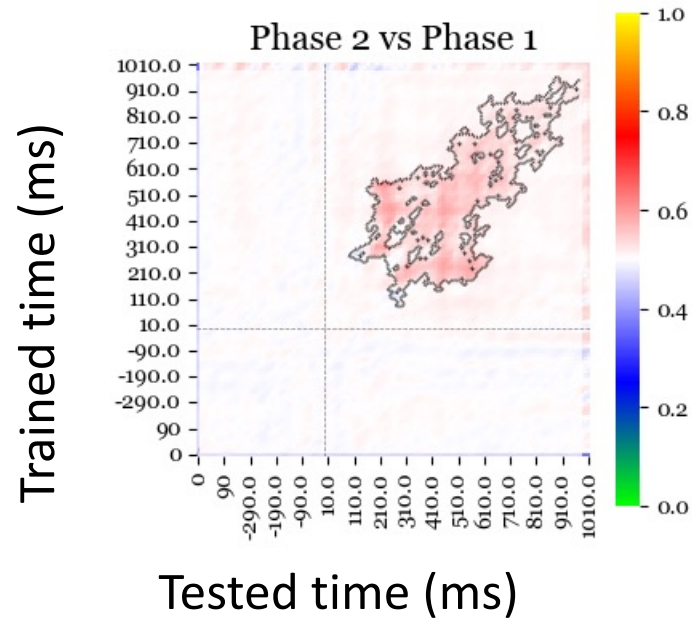
Temporal Generalization - Houses



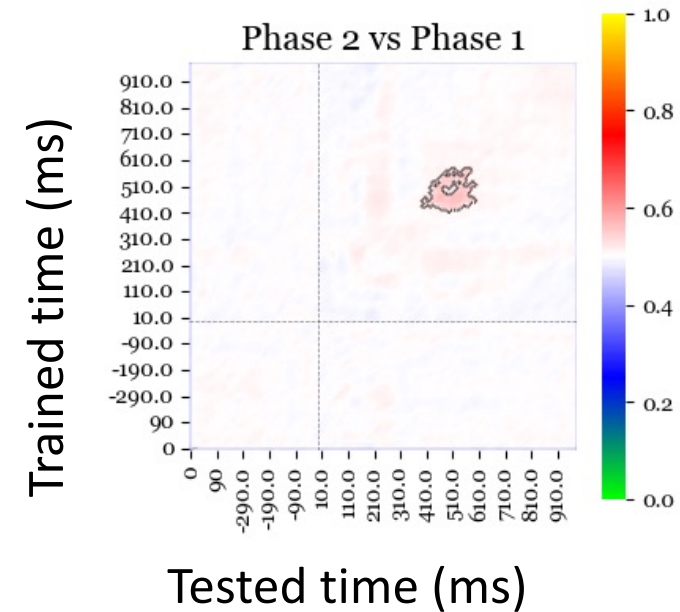
N = 42

Temporal Generalization (aware minus blind)

Temporal Generalization - Faces

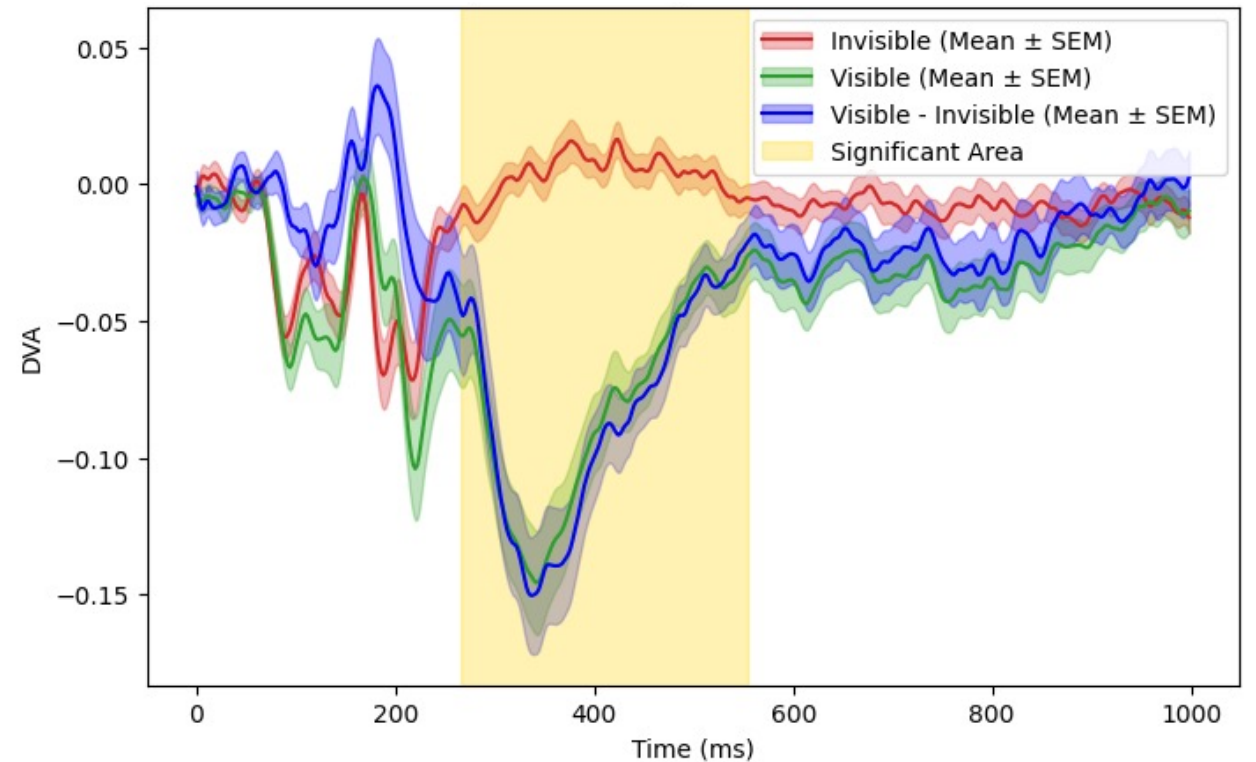
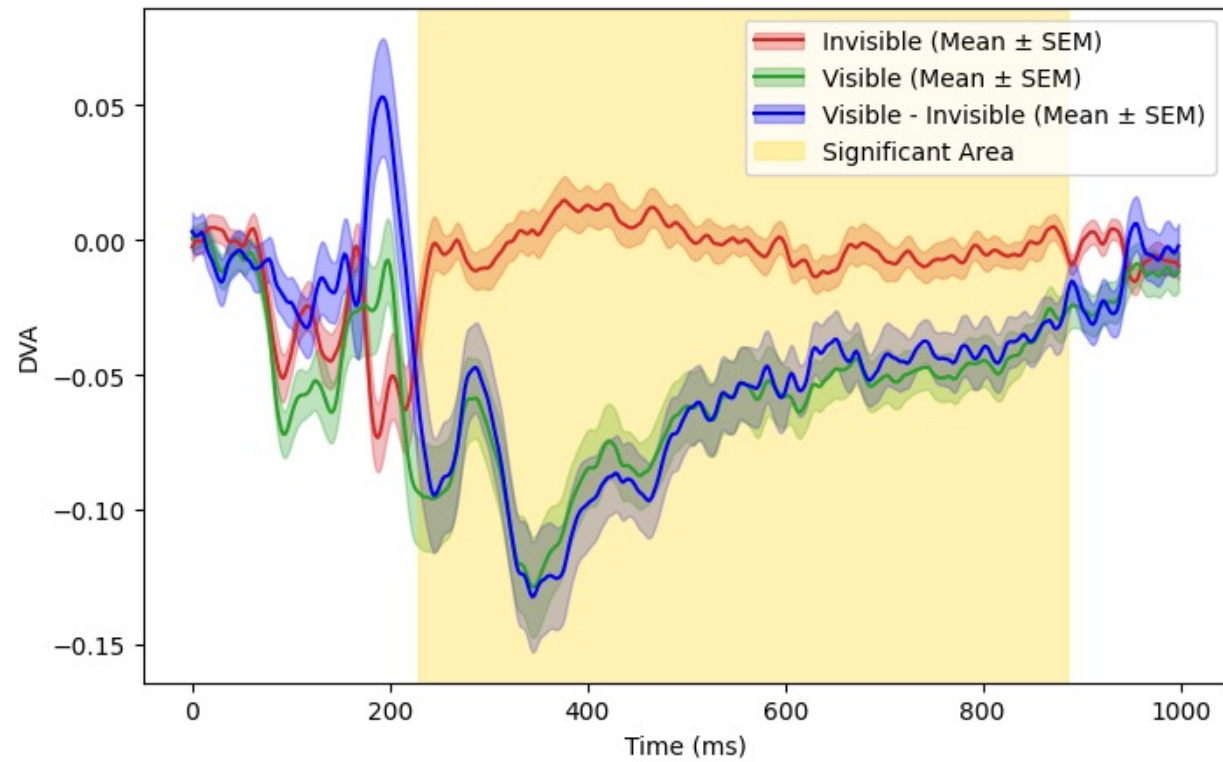


Temporal Generalization - Houses



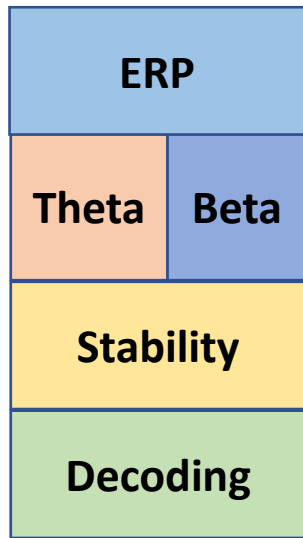
N = 42

Stability of Signal (DVA) – Faces and Houses



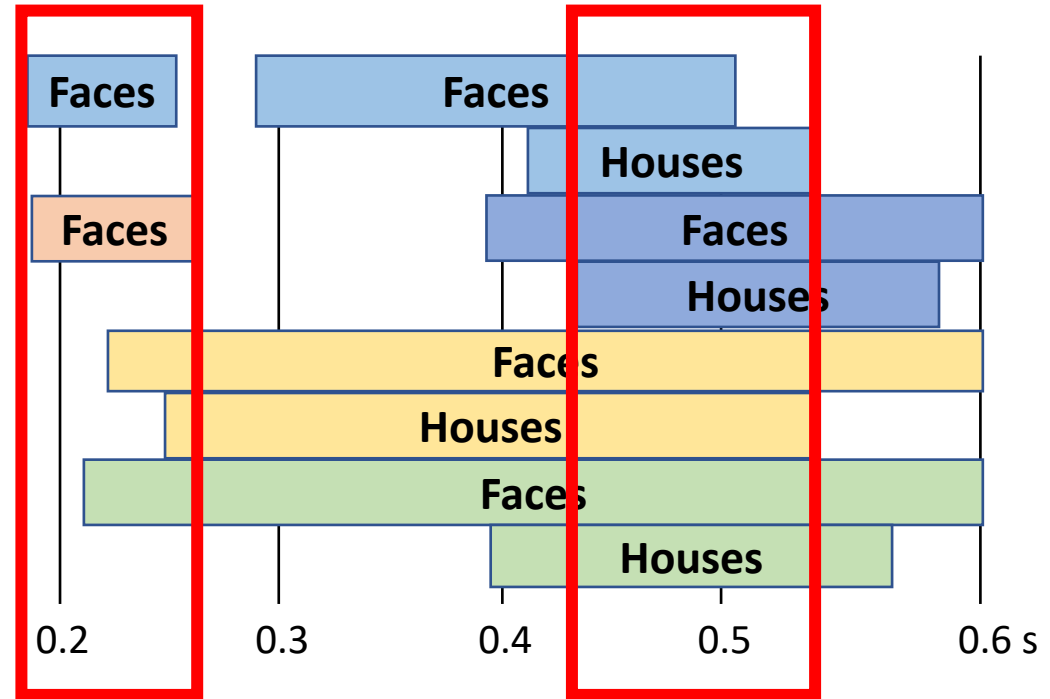
N = 42

Summary



0.0

0.1



Conclusion

- The results suggest a possible early signal of awareness, but may be stimulus specific
- The late signal was present for both stimuli, and may be more generally related to awareness
 - Late “VAP”, Beta desynchronization, Decoding, Stability
 - Results replicated in 30 subs in an independent lab (Tel Aviv University)

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Back-up Slides:

- signal stability analysis details
- previous fcN2/LVAP findings
 - faces vs. houses ERPs
- report vs. no-report ERPs

DVA: Signal Stability in EEG

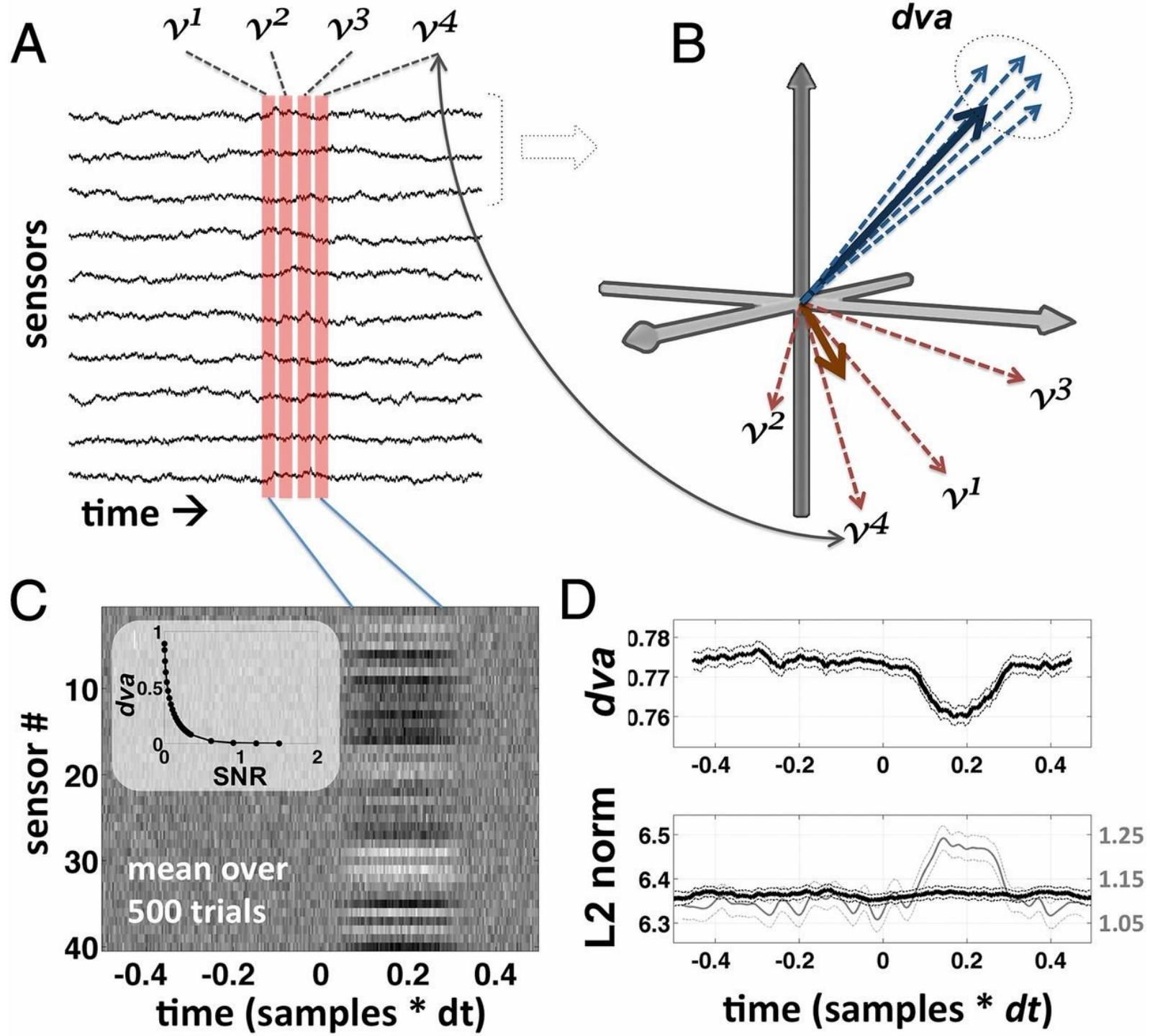
- **Dynamic Variance Analysis (DVA)** quantifies the **stability** or **consistency** of EEG signals over time.
- It applies a **moving window** across the EEG signal and calculates the **variance** of the signal within each window.
- **Lower variance** = more stable signal (less noise or fluctuation)
Higher variance = unstable or noisy signal
- It shows us whether the signal of awareness is stable and for how long

$$DVA(t) = \frac{1}{L} \sum_{i=0}^{L-1} (x(t-i) - \mu_t)^2$$

$$\mu_t = \frac{1}{L} \sum_{i=0}^{L-1} x(t-i)$$

$x(t)$: EEG signal at time t ; L : Length of the sliding window μ_t : Local mean of the signal within the window ending at time t

$DVA(t)$: Local variance (or second moment) of the signal over that window



Previous findings

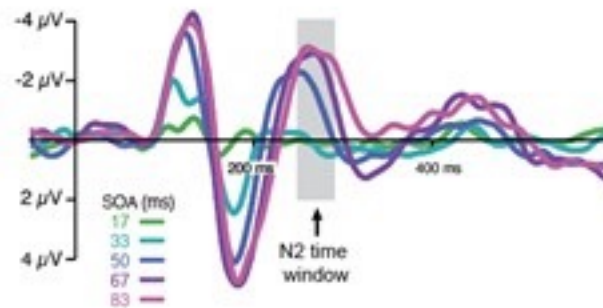
- This signal has been noted once before, at Cohen et al. 2023 it was previously named a N2 for its central negativity

A Non-linear, bifurcated N2 in the *no-report* condition

Scalp topography and N2 electrodes



Time course of ERP



Average voltage from N2 time window

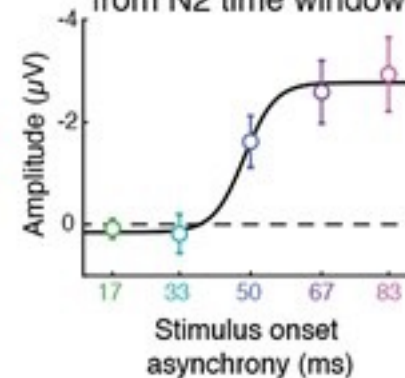


Figure by Cohen et al. (2023)

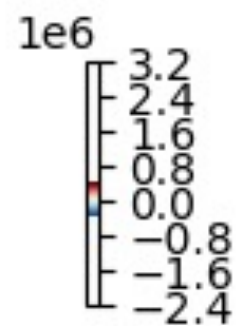
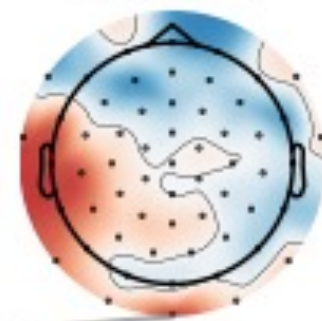
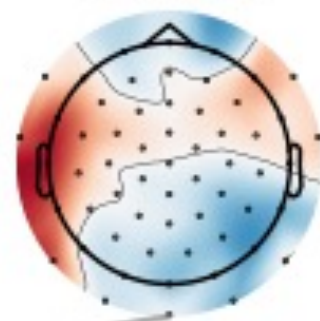
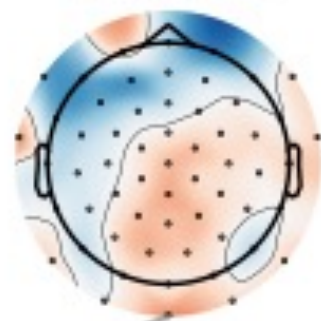
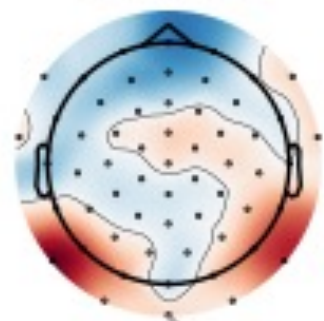
Average ERP accross participants, Faces vs Houses - Phase 1

0.200 s

0.300 s

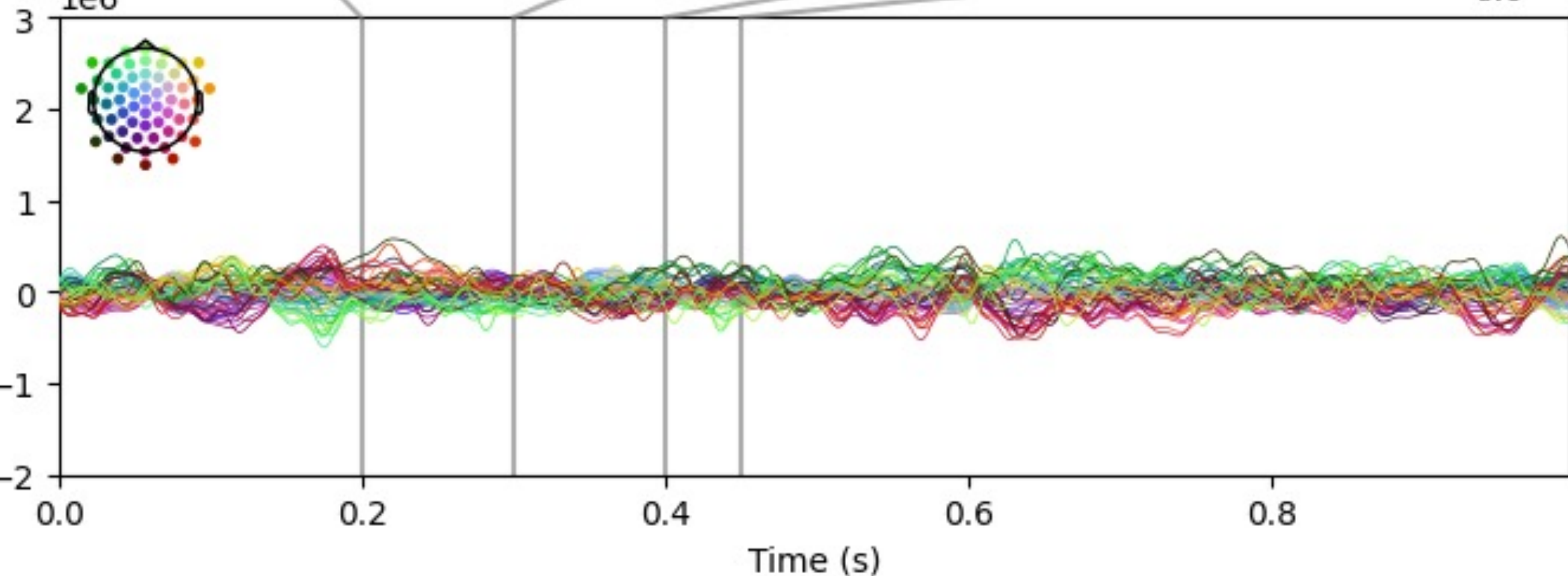
0.400 s

0.450 s



$N_{ave}=1$

$1e6$

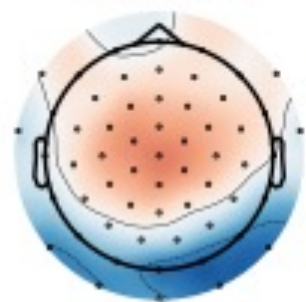


Decibels

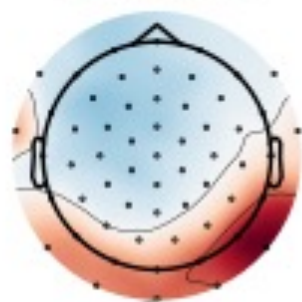
Time (s)

Average ERP accross participants, Faces vs Houses - Phase 2

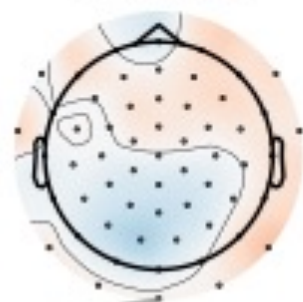
0.200 s



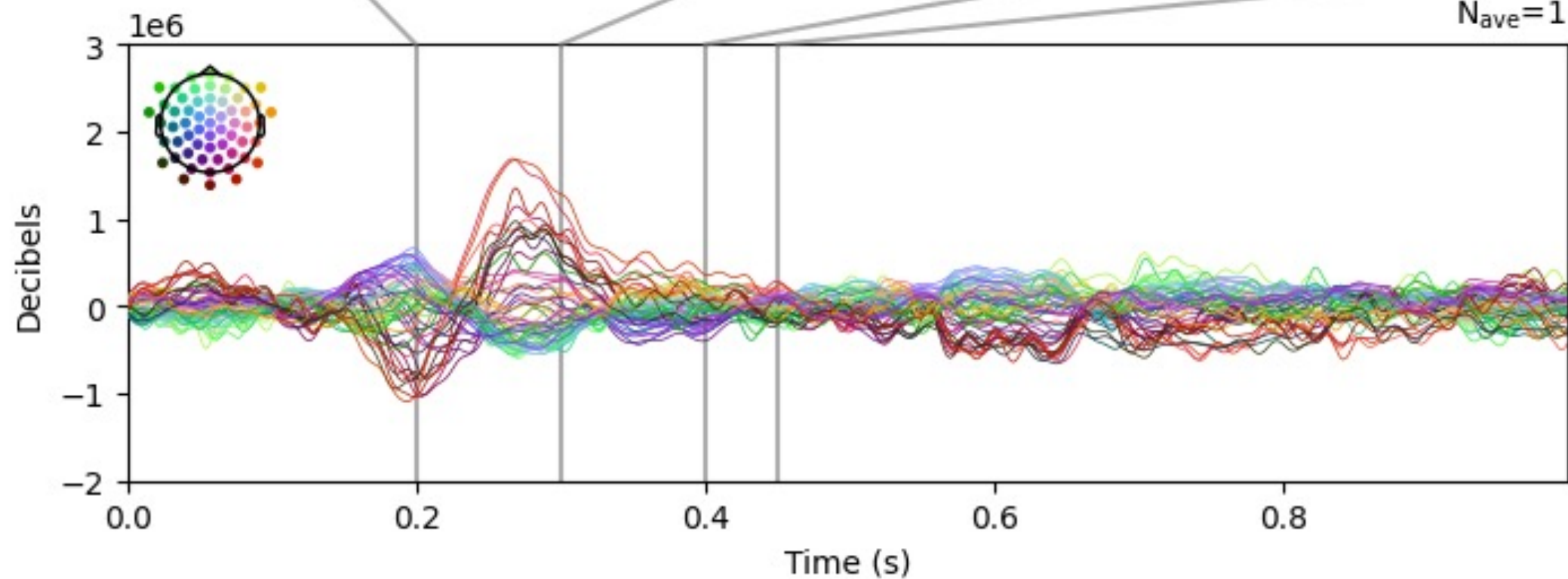
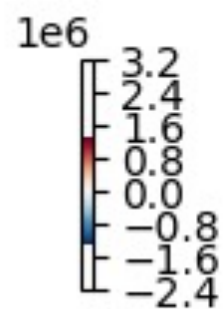
0.300 s



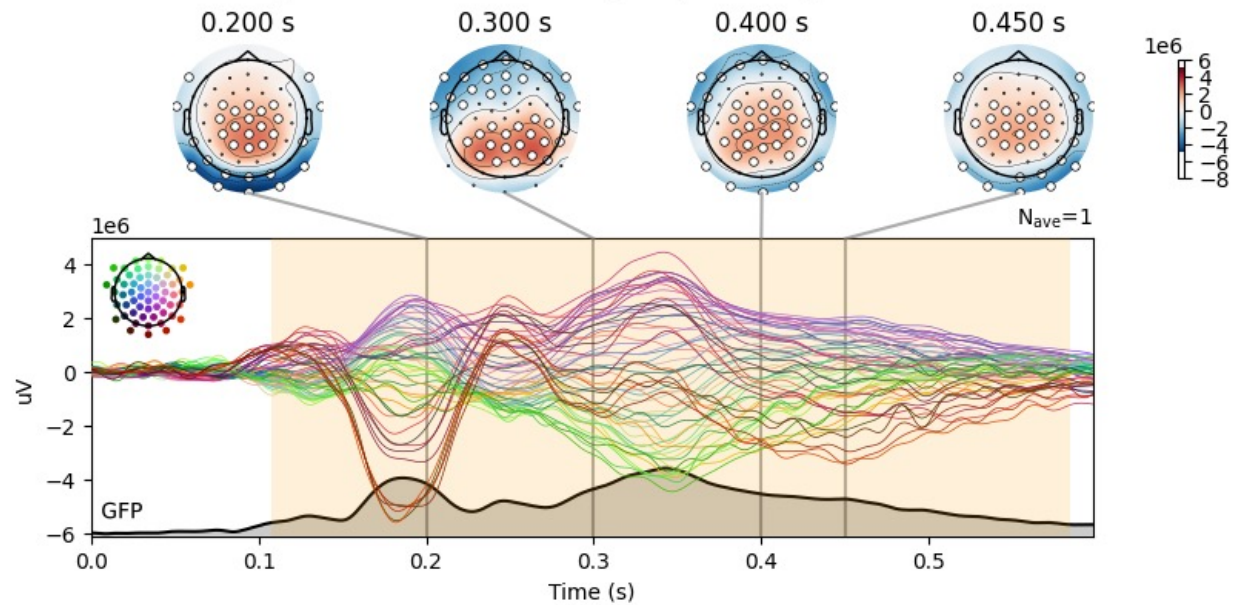
0.400 s



0.450 s



Reed - Sig. Clusters ERP Difference, face, Phase reported - Phase visible



Reed - Sig. Clusters ERP Difference, house, Phase reported - Phase visible

