Exploration of a Potential Relationship between the N200 Peak-Latency and Visual Encoding Time

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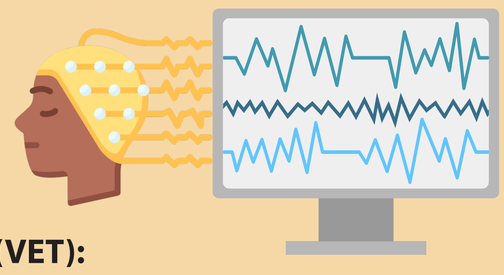


Visual Encoding Time (VET):
- initial period for visual information processing
- thought to reflect early cognitive processes like **figure-ground segregation**
- **150-200 ms post stimulus**, depending on visual noise, levels of attention

Non-Decision Time (NDT):
- period within **response time (RT)** that includes cognitive processes not related to evidence accumulation in decision-making tasks
- an independent estimate that is **thought to include VET** and is derived from cognitive models of RTs

N200:
- negative **Event-Related Potential (ERP)** typically occurring **180-325 ms post stimulus** presentation (Patel & Azzam, 2005)
- thought to reflect processes associated with **perception, selective attention, and cognitive control** (Folstein & Van Petten, 2008; Patel & Azzam, 2005)

Goal of the study:
Investigate the hypothesis that the peak-latency of the N200 tracks NDT and, by extension, VET, in perceptual decision-making tasks (Nunez et al., 2019)

This was done by applying regression analysis on **three available EEG datasets** that suited the **selection criteria**:

two-alternative forced-choice task in the visual modality with a clear stimulus onset time and recordings of RT

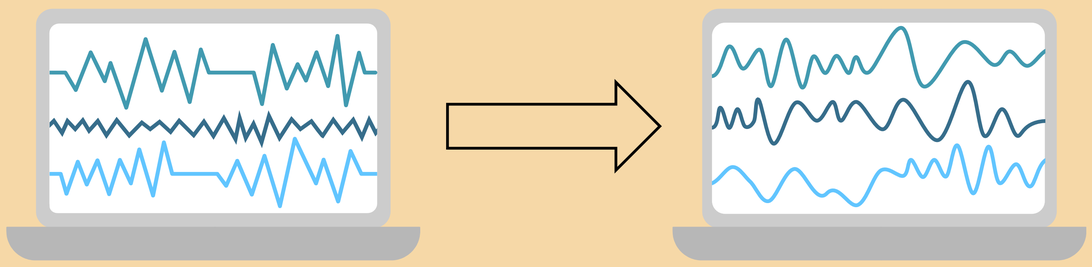
	Electrodes	Sampling Rate (Hz)	Participants (n)	Task	Conditions
Dataset 1	256	256	22	Two-Back Continuous Performance	1 condition
Dataset 2	128	1000	49	Gabor's Orientation & Frequency Discrimination	Easy, Medium, Hard
Dataset 3	32	500	25	Random Dot Motion	1 condition

The peak-latency of the **N200** component **tracks Visual Encoding Time** (VET) during perceptual decision-making tasks, under **certain conditions**.

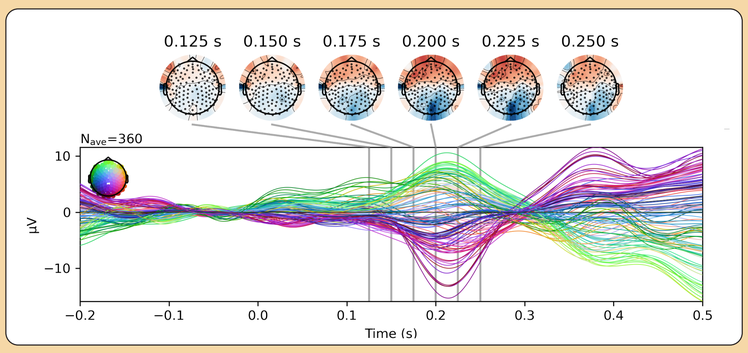
Scan the QR code to access the analysis scripts and more information regarding the study

Automated N200 identification Pipeline

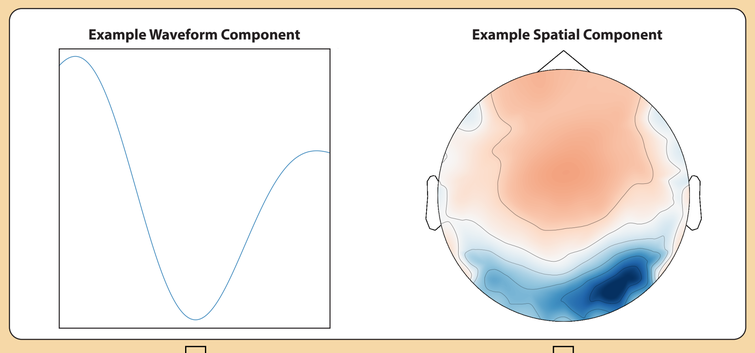
1. Preprocesssing the Data (Averaging, Filtering, Artifact Removal)



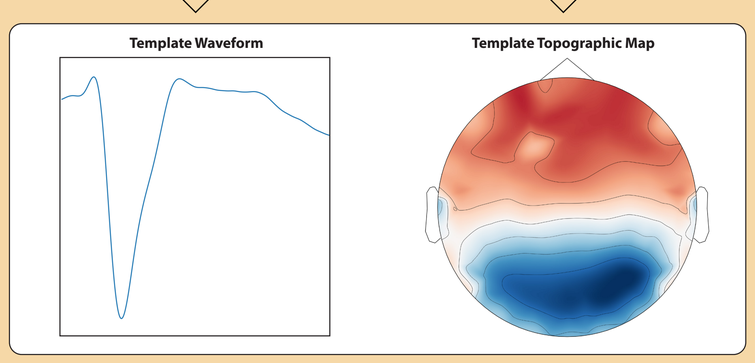
2. Generating Event Related Potentials (ERPs) & Their Associated Topographic Maps



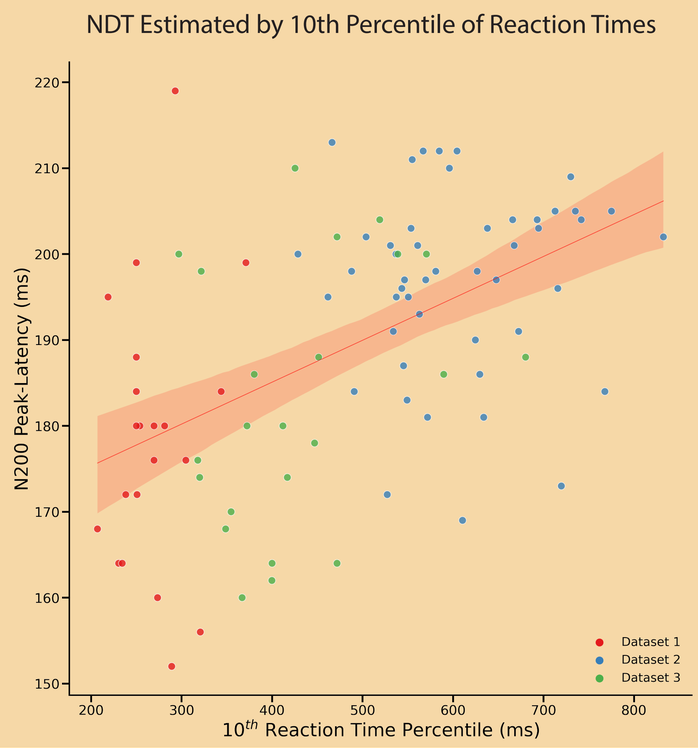
3. N200 extraction using Singular Value Decomposition (SVD)

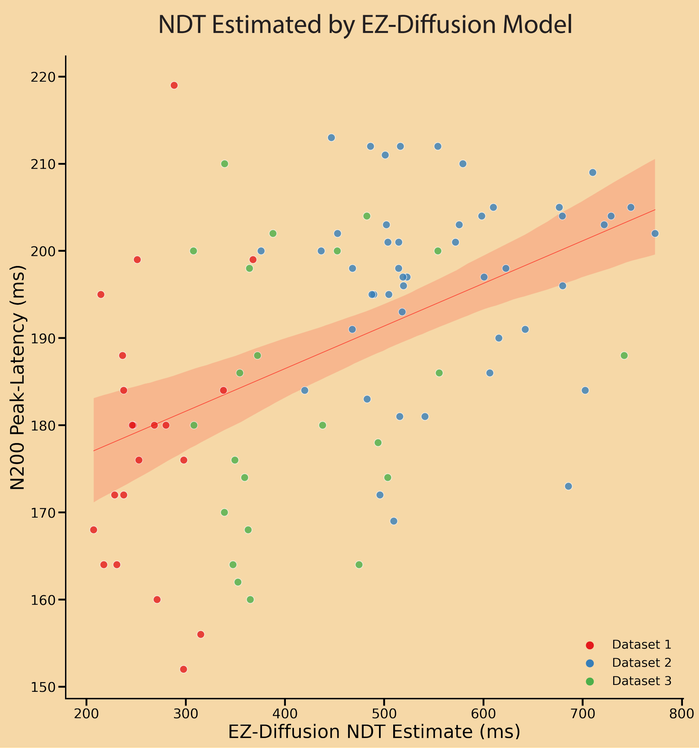


4. Template Matching



Regression Plots: N200 Peak-Latency vs. NDT





Results

- Although not replicating the 1-to-1 ms relationship found in Nunez et al. (2019), the results indicate a **significant positive relationship** between estimates of NDT and the peak-latency of the N200 under certain conditions

- The regressions were especially **influenced by 5 outliers and by experimental conditions** in dataset 2
- This relationship was **only shown with the medium and hard conditions** (medium condition shown here)

Limitations

- A relatively **small number of participants** in datasets 1 & 3
- **Five participants** from dataset 1 **dropped** from final analysis due to missing information
- Some of the choices that were made to **increase data quality** were envisioned **a priori**

Open Science

All the scripts used in this study, including the automated N200 identification procedure are openly available online and can be readily implemented in new projects (see QR code above)

References

- Folstein, J. R., & Van Petten, C. (2008). Influence of cognitive control and mismatch on the N2 component of the ERP: A review. Psychophysiology, 45(1), 152–170. https://doi.org/10.1111/j.1469-8986.2007.00602.x
- Nunez, M. D., Gosai, A., Vandekerckhove, J., & Srinivasan, R. (2019). The latency of a visual evoked potential tracks the onset of decision making. NeuroImage, 197, 93–108. https://doi.org/10.1016/j.neuroimage.2019.04.052
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