Task paradigm

The experiment uses a Rapid Serial Visual Presentation (RSVP) paradigm with 18 images from two categories: faces and dollhouses. Each image is repeated 4 times, totaling 80 stimulus presentations. Each stimulus appears for 100 ms with a 200 ms inter-stimulus interval. Participants are instructed to maintain fixation.

- EEG acquisition: 64-channel EEG (10-10 system), sampled at 100 Hz. Online filters: 0.1 Hz high-pass and 100 Hz low-pass. The Fz electrode is used as reference.

- Stimulus triggers are recorded in the last channel: 496# marks face images and 436# marks dollhouse images. The number following the # corresponds to the image ID.

Note: For ease of analysis, we extracted epochs around stimulus onset from -500 ms to +1500 ms. Sharp edges at the beginning and end are expected and should not be mistaken for noise.

Instructions and Questions

(2) Preprocessing Preprocess the EEG data so that it can be used for the following analyses.

- Describe each preprocessing step (e.g., filtering, epoching, baseline correction, ICA).

- Justify your choices. What did you include or exclude? Why?

- Use any software toolbox you prefer, but ensure you understand and can explain each step.

(3) ERP Plot the ERP for face vs. dollhouse stimuli.

– Use appropriate time-locking and baseline correction.

– Conduct statistical comparisons (e.g., permutation tests or cluster-based statistics).

– Highlight and interpret significant differences.

(4) Time-Frequency Analysis Analyze the EEG signal in the frequency domain.

– You may use wavelet or short-time Fourier transforms.

– Compare time-frequency maps across categories.

– Discuss neural oscillations (e.g., alpha, beta, gamma) and their role in perception.

(5) MVPA Apply both temporal and spatial MVPA to the EEG data.

– Temporal MVPA: Train classifiers at each time point to distinguish face vs. dollhouse trials.

– Spatial MVPA: Use patterns across electrodes to decode the stimulus category.

– Optionally, use cross-temporal generalization (train on one time, test on others).

Questions to consider:

– Can face and dollhouse stimuli be reliably distinguished using EEG patterns?

– Are some time periods or scalp regions more informative?

– What does the MVPA reveal about the dynamics of object processing in the brain?

(6) RDM and RSA Plot the Representational Dissimilarity Matrix (RDM) for the categorical data.

– Use EEG activation patterns to compute RDMs across time and/or channels.

– Compute the Representational Similarity Analysis (RSA) between your EEG RDMs and those derived from deep neural networks (e.g., CORnet-S).

– Use CORnet-S model features from early to late visual layers (e.g., V1, V2, V4, IT).

You can use the CORnet-S model from this repo: GitHub Corresponding paper: Kubilius et al., 2019