A no-report dichoptic color fusion EEG paradigm for isolating NCCs

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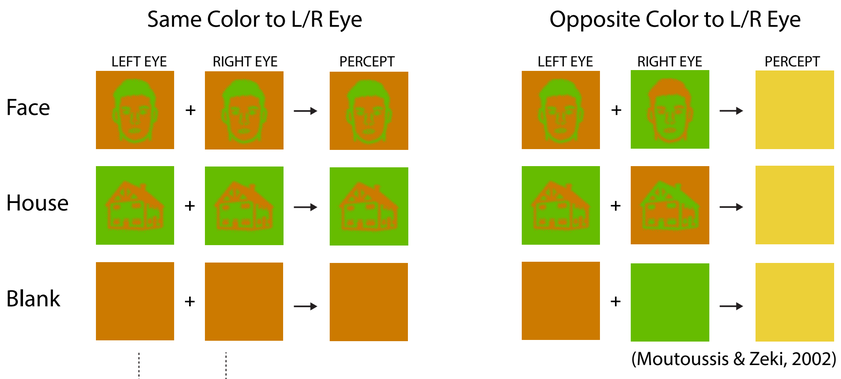
Background and Objectives

Background: Dichoptic color fusion offers a powerful technique for comparing consciously and unconsciously perceived stimuli to investigate neural correlates of consciousness and has not previously been used with a no-report design.

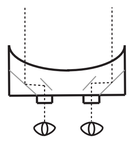
Objective: Use no-report paradigm to compare EEG responses for faces and houses that are unconsciously versus consciously perceived due to dichoptic color fusion

Dichoptic Color Fusion



(Moutoussis & Zeki, 2002)

Stimuli for this experiment use equiluminant red and green colors to define images of faces and houses



A stereoscope presents the images independently to each eye, and the fusion of colors can create a visible or invisible condition (Schurger et. al, 2015).

Methods

Subjects (N = 22) completed 5 tasks:

Fusion Check

Random dot stereogram used to check that dichoptic fusion was working properly

Training to See Color Contrast

Stimuli: faces and houses, same color to L/R eye (all visible)

Task: 2AFC - press F for face or H for house

3 blocks, color contrast level and stimulus duration decreased each time

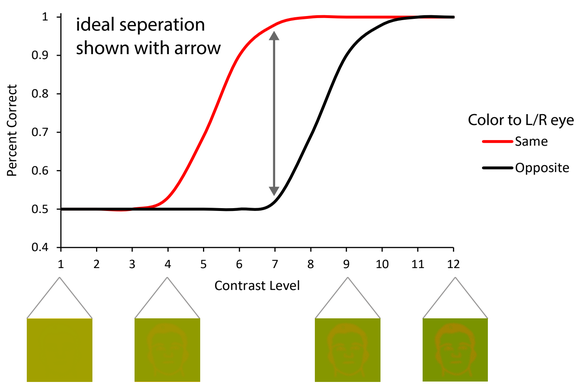
Tuning of Color Contrast

Stimuli: faces and houses,
same or opposite color to L/R eye,
12 different constrast levels

Task: 2AFC- F for face or H for house

Results used to choose ideal contrast level for main EEG experiment

Example of resulting graph



No-report EEG Experiment

Stimuli: 100 ms stimulus duration, 1500 -1800 ms ISI
6 conditions (175 trials each) - faces, houses and blanks, same or opposite color to L/R eye

Task: Press spacebar when red dot appears (15% of trials)

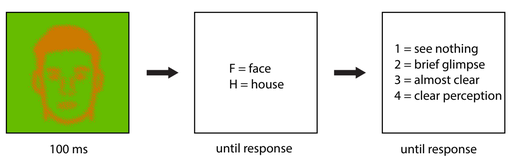
- 64 channel EEG recorded
- Average referenced
- All red dot trials excluded

example red dot trial

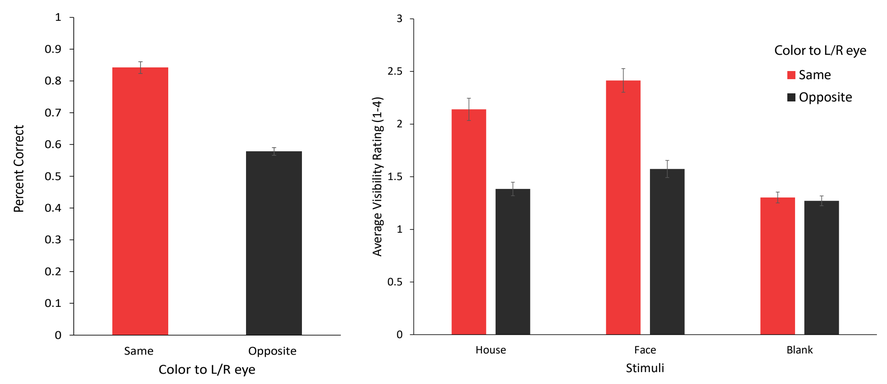
Report-based Behavioral Control

Stimuli: Same stimuli as in main trials

Task: 2AFC- F for face or H for house,
then PAS (1-4) rating



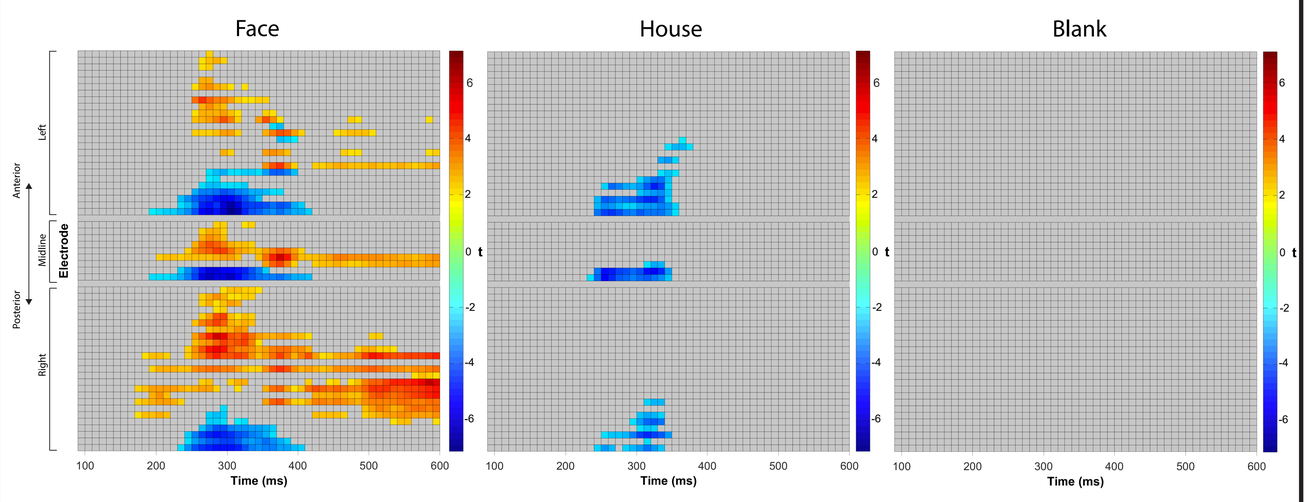
Behavioral Results

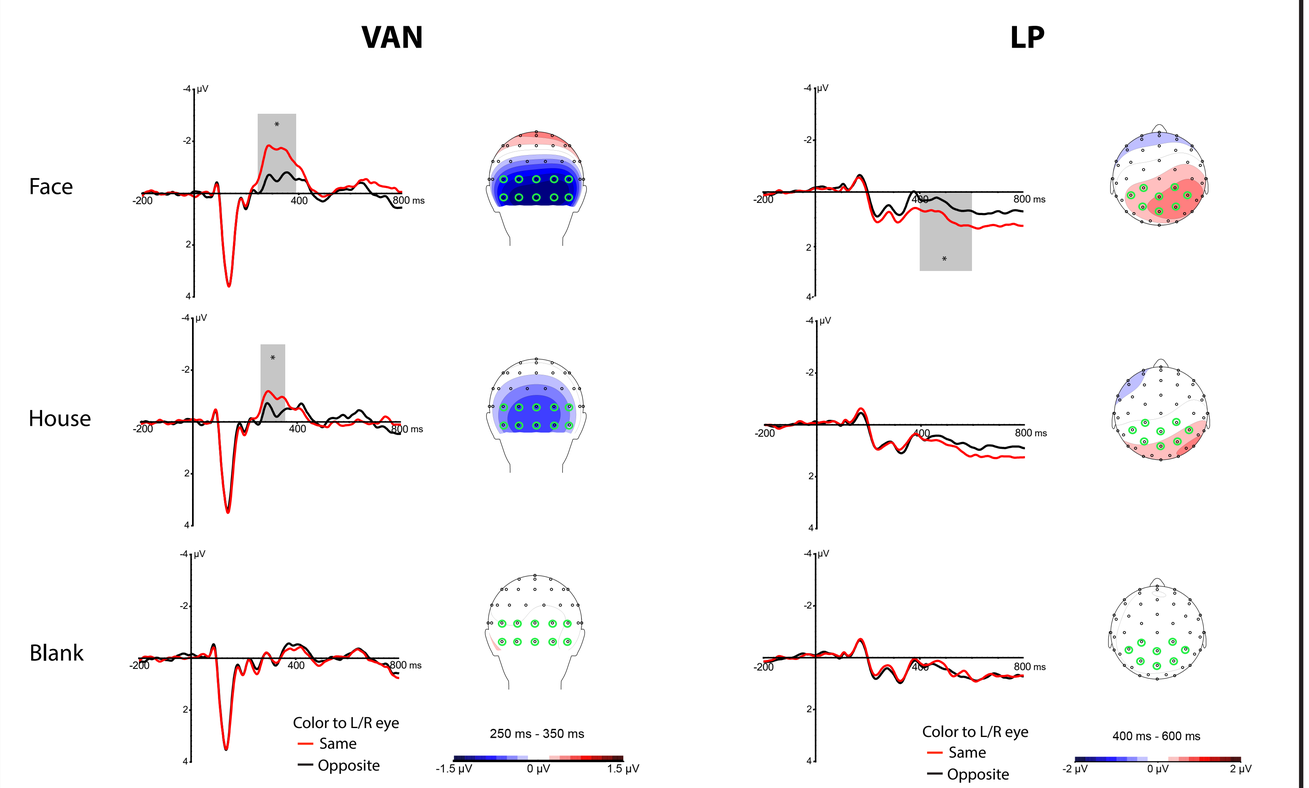


Report-based behavioral report control task confirmed that the visibility manipulation worked.

EEG Results

Mass univariate cluster permutation analysis of ERPs was used to identify time periods and electrode clusters with significant amplitude differences between the visible and invisible conditions.





Difference maps are for same - opposite (visible - invisible) conditions and ERPs are averaged from circled electrodes

Conclusions and Future Directions

- The posterior negativity around 250 - 350 ms for faces and houses is consistent with a visual awareness negativity (VAN) (Dembski et. al, 2021).
- A late positivity (LP) around 400 - 600 ms was present for faces but not for houses. The LP may be present due to task relevant carry effects from the color contrast training and tuning tasks.
- These results suggest that no-report dichoptic color fusion paradigms may be ideal for isolating NCCs. It will be useful to adapt this paradigm for fMRI, MEG, ECoG, etc.
- Subsequent analysis will explore decoding of visibility and event-related time frequency spectra.

References

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