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

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Background and Objective

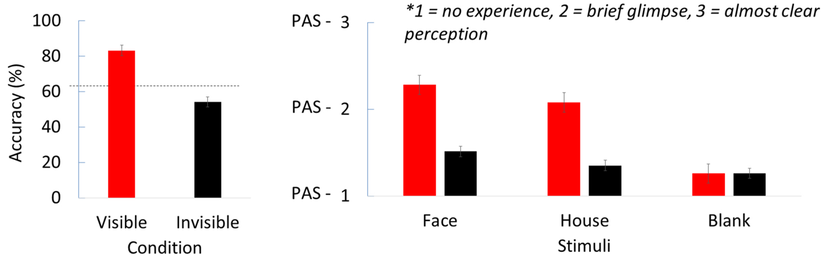
Background:

- When a reddish object on a greenish background is presented to one eye, and a greenish object on a reddish background to the other eye, the object is invisible (only a blank yellow background is seen) [3,5].
- When the object and background colors are the same in both eyes, the object is readily visible.
- Color visibility manipulation readily translatable to no-report paradigms for isolating possible neural correlates of consciousness (NCCs) not induced by participant reporting.
- Previous studies using this "dichoptic color fusion" technique along with concurrent brain recordings have all used trial-by-trial reports which are likely to mix together perceptual and task-related cognition differences.

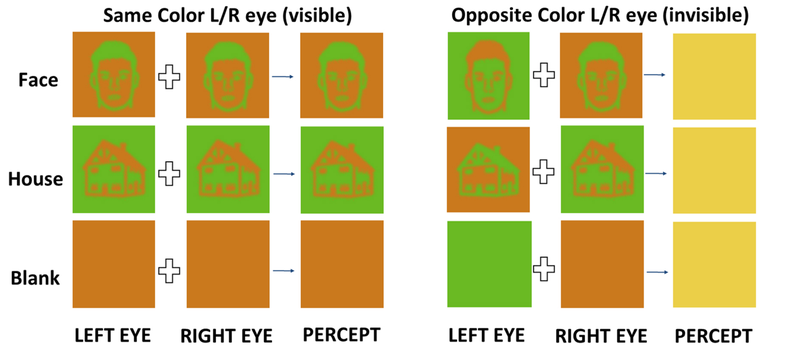
Objective:

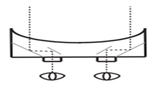
- **Use a "no-report" dichoptic color fusion paradigm to isolate differential EEG responses (visible versus invisible stimuli) from task-related brain activity [1].**
- **Use a "triangulation" approach across this experiment and two others (backward masking and inattentional blindness) to find generalizable neural signals associated with conscious perception.**

Report-Based Behavioral Control

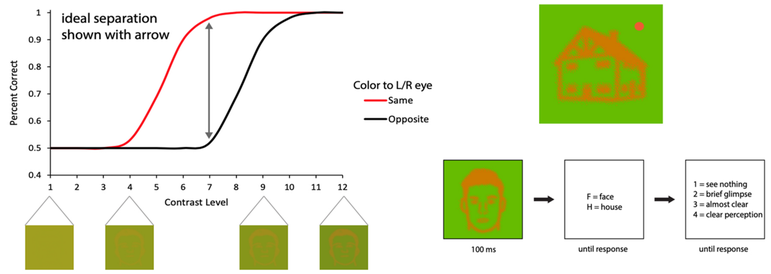


Dichoptic Color Fusion: Methods





Stimuli use equiluminant red and green colors to create images of faces and houses.
The images are presented independently to each eye via a stereoscope [4].



Subjects (N = 32) completed 3 pre-test tasks and 2 experimental tasks

1: Fusion Check

Random dot stereogram to check if dichoptic fusion is working properly

2: Training to See Color Contrast

Stimuli: Same color presented to left and right eye
Task: 2 Alternative Forced Choice → press 'f' for face and 'h' for house

3 blocks, contrast level and timing decreased in each block
Tested accuracy → needed 95% or higher to pass

3: Finding Ideal Contrast Level

Stimuli: Same or opposite color to each eye, visibility varies as contrast level changes
Task: 2AFC - face and house

Results are used to find ideal color contrast level for each participant

4: No-Report EEG Task

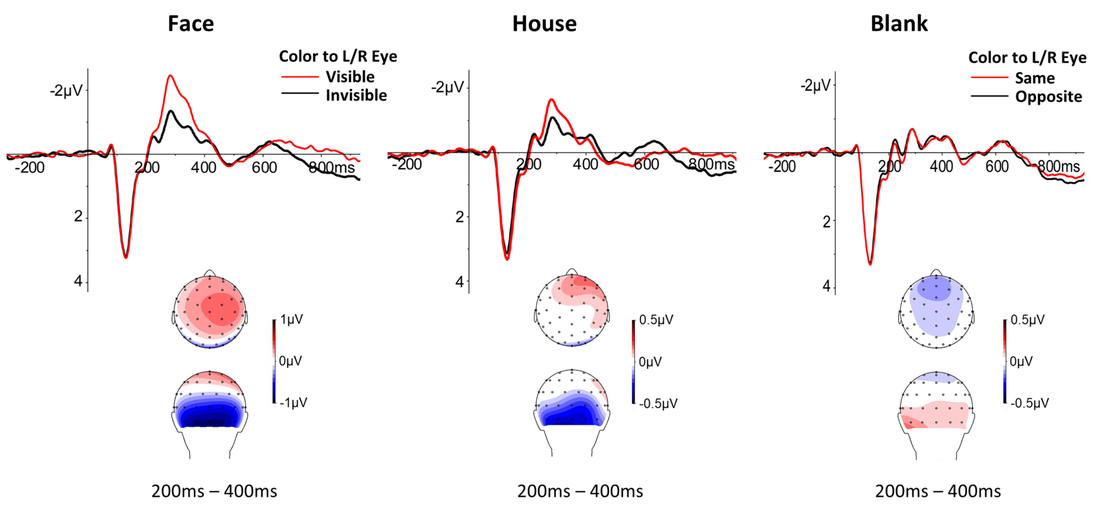
Stimuli: 100ms duration, 1500-1800ms ISI
10 blocks, 175 trials per block
6 conditions: Same or opposite colors to each eye
Task: Press the spacebar when a red dot appears

64 channel EEG recorded (average referenced)
All red dot trials excluded

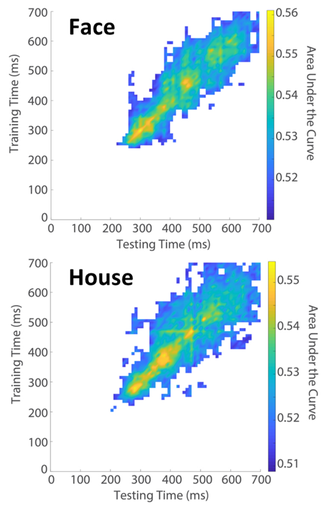
5: Report-Based Behavioral Control

Stimuli: Same as no-report task
Task: 2AFC - face house →'f' for face and 'h' for house
Then PAS of 1-4 [4]

EEG Results



Temporal Generalization



**No significant decoding (of same vs. opposite colors) was found for the blank control stimuli.*

Conclusions

- Negative-going ERP difference from ~200-400ms for visible versus invisible faces/houses (consistent with an N170/VAN) [3]. This signal was absent in the control (blank) condition ruling out a dichoptic-fusion-based explanation.
- P3b was not evident for any stimuli (due to the no-report task design).
- Decoding of visible vs. invisible faces/houses showed patterns of temporal generalization from ~200-800ms supporting previous proposals [2,6]
- Further analyses will be conducted to triangulate across all three paradigms: inattentional blindness, backwards masking, and DCF → attempting to get closer to uncovering generalizable NCCs

References and Acknowledgments

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