

The Effect of Isolated Facial Features on the Identity Sensitive N250r ERP

Sarah Mohr, Anxu Wang, & Andrew D. Engell

Kenyon Psychological Neuroscience Laboratory, Kenyon College, Gambier, OH 43022 (USA)



Kenyon College

Introduction

- The N250r event-related potential, recorded primarily from inferior occipitotemporal electrodes, is the earliest neural marker of familiar face perception.
- This ERP is evoked by presenting a prime face followed by a target face. If the prime and target faces are the same individual there will be a pronounced negative deflection in the waveform at ~200 – 300 ms after the onset of the target face.
- Moreover, the N250r is observed even when the prime and target images of the same individual are taken at different angles or with them expressing different emotions. This suggests that the repetition effect is not merely due to simple visual adaptation, but rather reflects the matching of a perceptual representation of a face to a stored representation of that face.
- It is currently unknown whether face parts, such as eyes and mouths, are effective primes capable of producing the N250r familiarity response or whether this requires holistic processing of the face.
- In this study, we investigate whether stored representations of familiar faces are activated by faces parts, as indexed by the N250r.

Methods

Participants

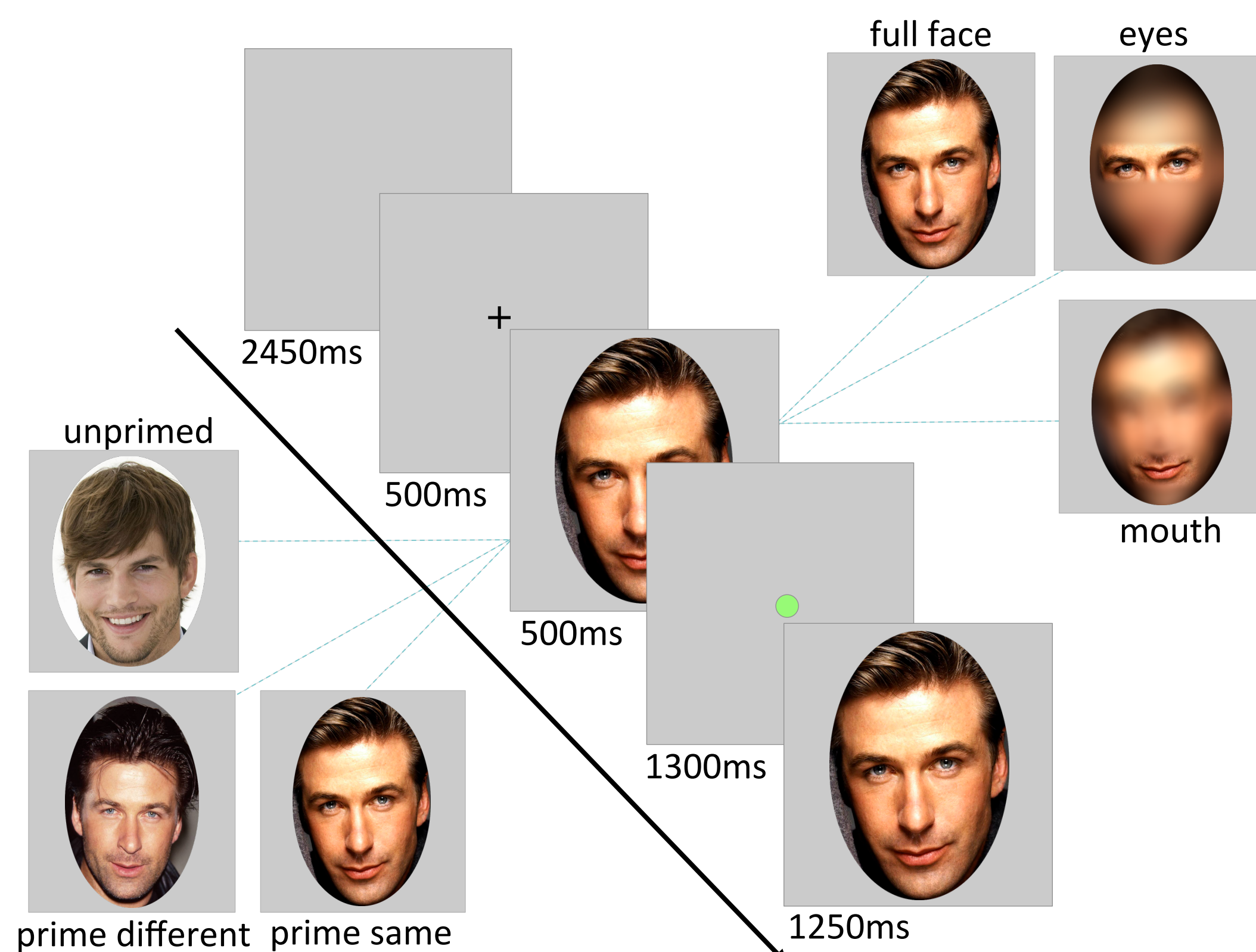
- N = 25 (9 male, 16 female, mean age = 20.1 years)

Stimuli

- Images were of celebrities known to college-age adults.
- There were nine possible types of prime.
- 3 (unprimed, prime different, prime same) x 3 (full faces, eyes, mouth)

Procedure

- Participants were instructed to indicate the sex of the target face.



EEG Acquisition

- Continuous EEG was recorded with the BioSemi ActiveTwo system.
- Data were acquired from 64 channels and sampled at 2048 Hz.
- 2 external electrodes were placed around the left eye to record EOG associated with eye blinks and saccades.

EEG Preprocessing

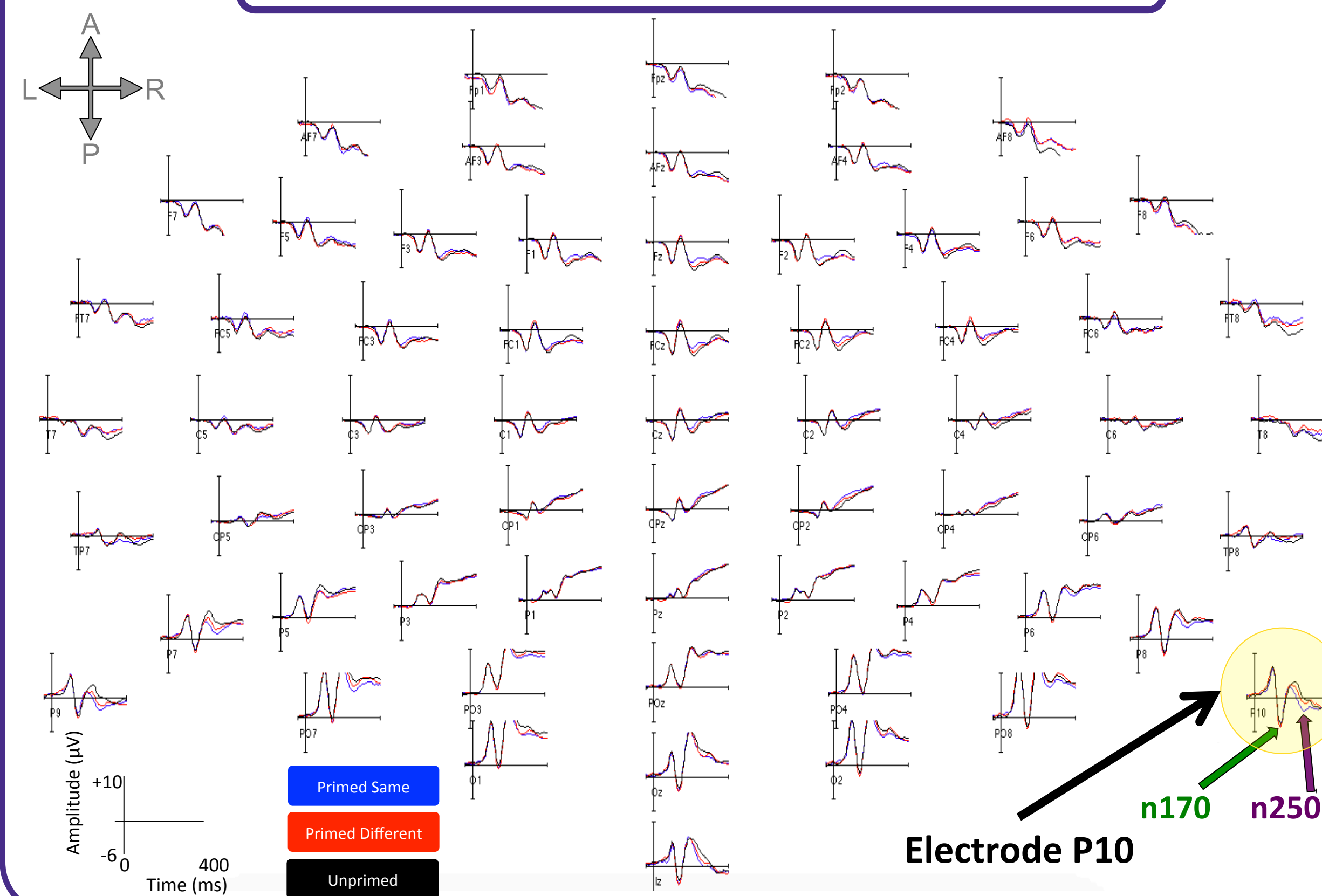
- Off-line preprocessing and analysis were conducted with the MATLAB toolbox EEGLAB and the ERPLAB plugin.
- Data were bandpass filtered: 0.1 – 100 Hz and downsampled to 256 Hz.
- Data were referenced to the average of all scalp electrodes.
- Epochs (-1000 to 2000 ms) were extracted from the EEG time locked to the onset of the target face.
- Independent component analysis was run and components likely associated with eye blinks were removed from the data.

ERP Analysis

- ERPs were normalized to a 150 ms pre-stimulus epoch and lowpass filtered with a cutoff of 40 Hz.
- Mean amplitude was extracted from 225 to 300 ms post target onset and analyzed using a repeated-measures ANOVA with the factors of prime (same, different, unprimed) and feature (face, eyes, mouth).
- Planned comparisons using paired one-way t-tests further explicated any main and interaction effects.

Results

Topographic Map of ERP Waveforms



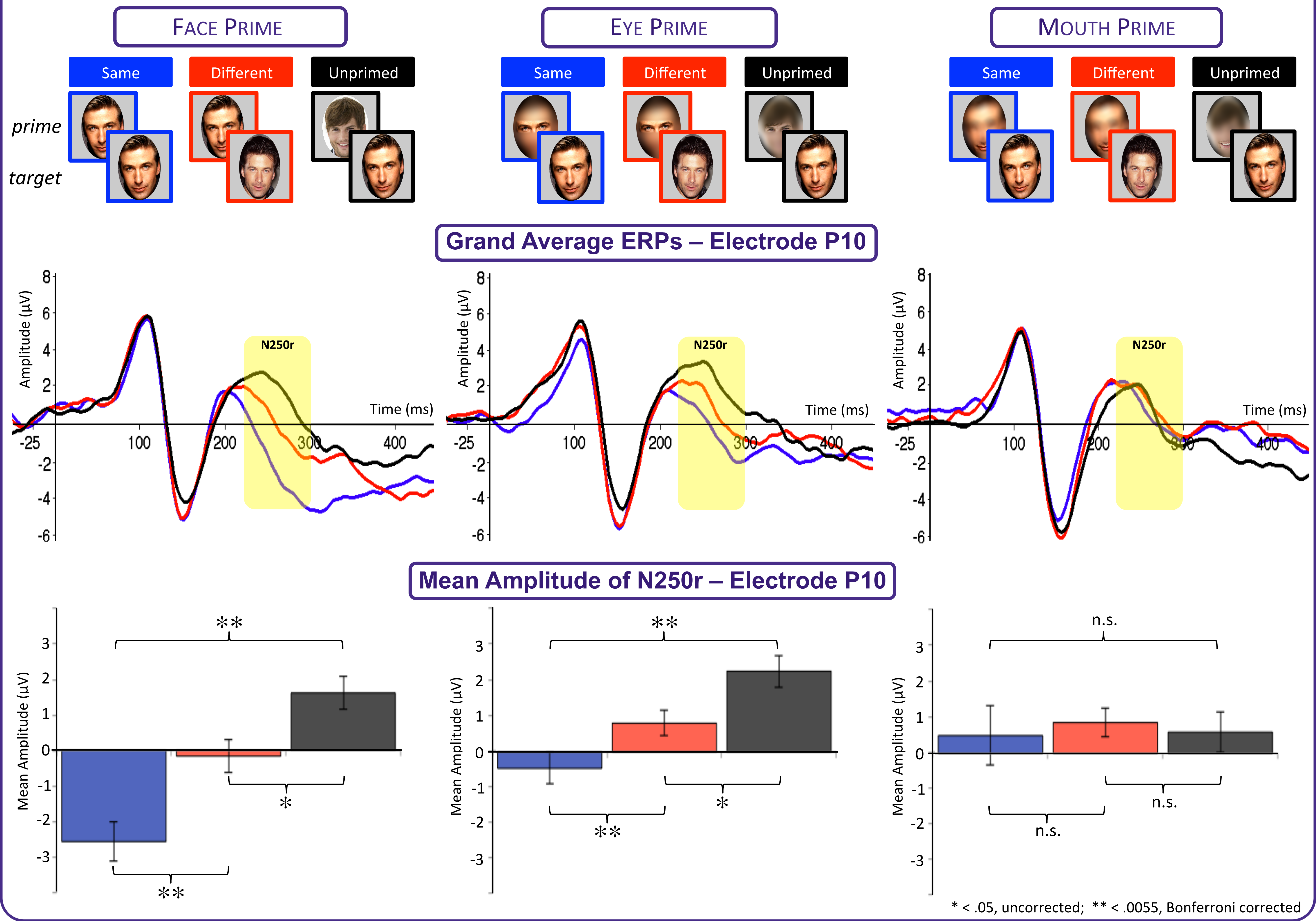
Acknowledgments

We would like to thank Kenyon College for funding Summer Science Scholars and this study. We would also like to thank Henry Quillian and Josué Parr for assistance with data collection.

Results

- There was a main effect of prime ($F(2, 48) = 7.44, p = 0.0015$) and feature ($F(2, 48) = 7.53, p = 0.0014$).
- There was an interaction between prime and feature ($F(4, 96) = 4.87, p = 0.0013$).
- Priming with the **same pictures** of full faces or isolated eyes evoked a familiarity repetition effect compared to the unprimed condition ($p_{\text{same-face}} < 0.001, p_{\text{same-eyes}} < 0.001$) while mouths did not ($p_{\text{same-mouth}} = 0.47$).
- Priming with **different pictures** of full faces or isolated eyes evoked a familiarity repetition effect compared to the unprimed condition ($p_{\text{diff-face}} = 0.008, p_{\text{diff-eyes}} = 0.009$) while isolated mouths did not ($p_{\text{diff-mouth}} = 0.70$).

Results



Results Summary

- Familiar face primes resulted in a significant N250r evoked by the target face.
- Familiar eye primes resulted in a significant N250r evoked by the target face.
- Familiar mouth primes did *not* result in a significant N250r evoked by the target face.

Conclusions

- The current results suggest that the early activation of stored familiar face representations does not rely on holistic processing but rather can be evoked by parts-based feature analysis.
- However, eyes seem to be privileged in this regard, as familiar mouths did not effectively activate stored familiar face representations.