

# Neural specialization for face processing in the second year of life

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## Introduction

- **Neural responses to human faces become increasingly specialized over development**
  - Investigated using event-related potentials (ERPs), segments of electroencephalography time-locked to an event of interest
- **Face-processing ERP components in infancy**
  - May represent precursors to an adult face-specialized component, the N170<sup>4,5</sup>
    - Inversion effect evidenced by greater amplitude to inverted than upright faces
  - **N290** – increasingly more selectively activated to faces over the first year<sup>1,2</sup>
  - **P400** – mixed findings on face sensitivity, demonstrates inversion effect in some infant studies<sup>1,2,3</sup>
  - **Nc** – greater in response to highly salient or novel stimuli, reflects attentional engagement
- Investigation of face-sensitive ERP responses in the second year will provide insight into how ERP responses become more adult-like over time

## Objective

To examine developmental change in ERP responses associated with face processing (i.e., N290, P400) and attentional engagement (i.e., Nc) to upright and inverted face and non-face stimuli across the second year of life

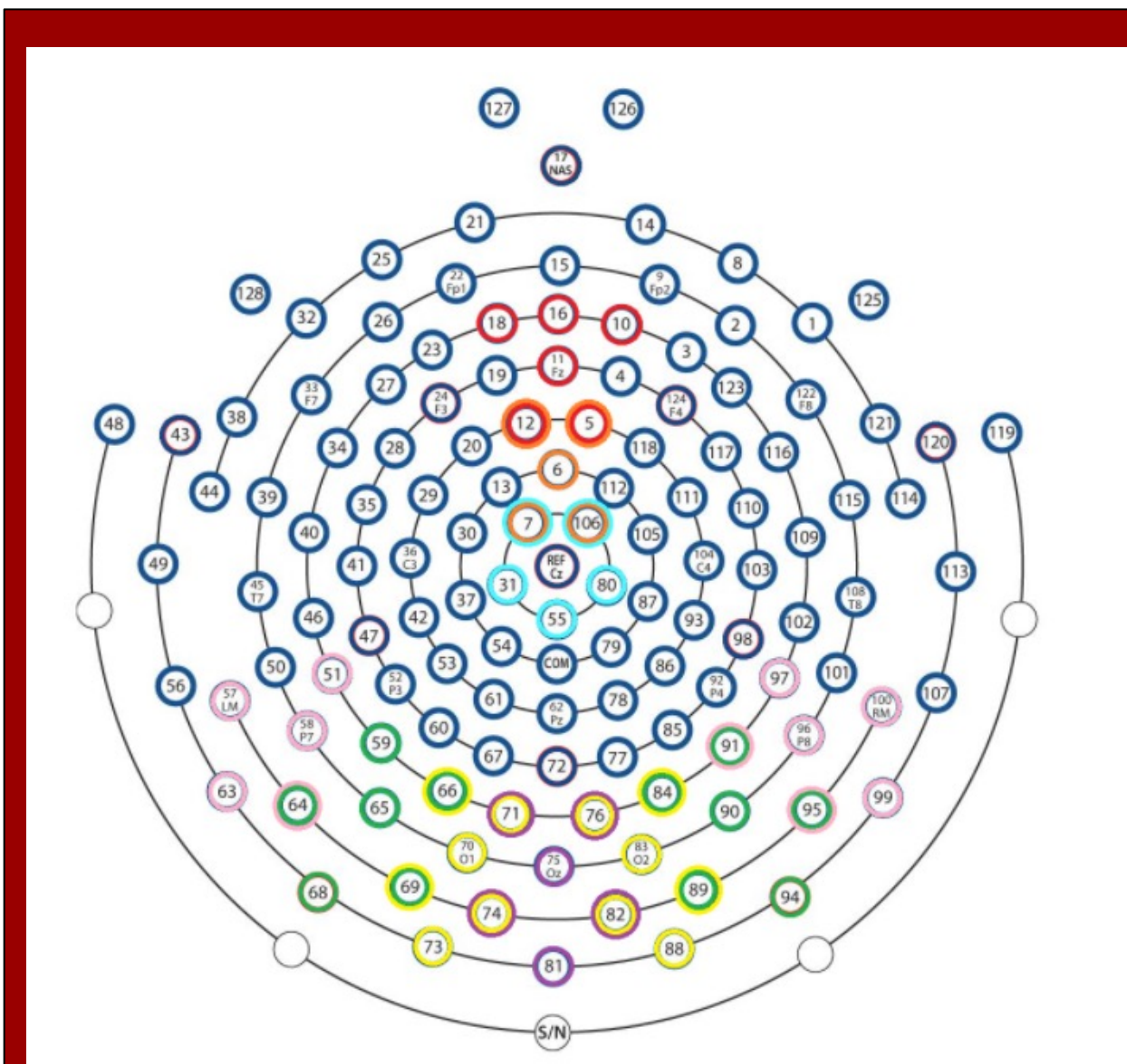
## Method

### Participants:

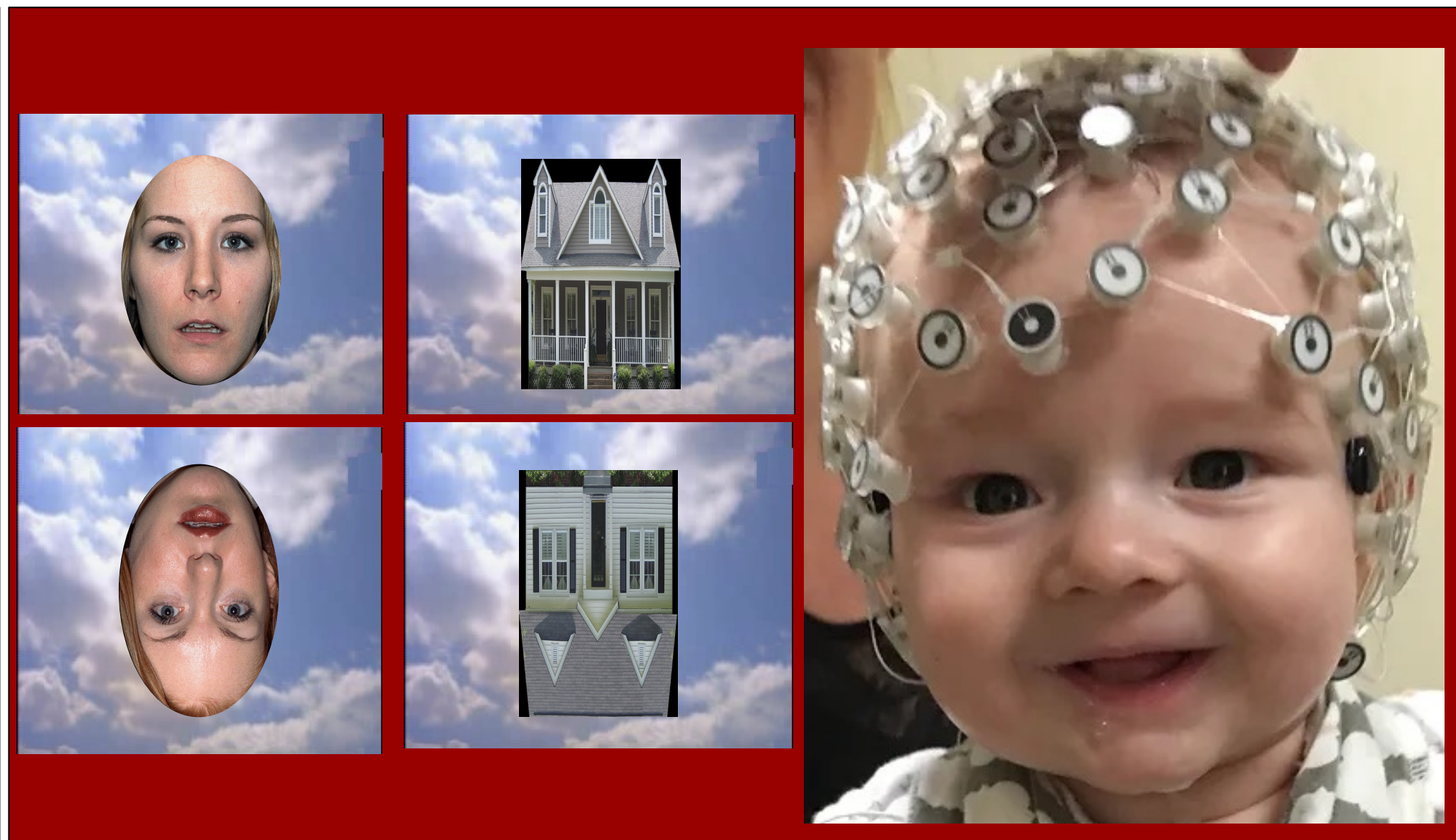
- 15 infants (Mage = 15.73 months, SD = 4.57, range = 8–24 months)

### EEG recording: Magstim-EGI high-density 128-channel EEG system

- Stimuli types: upright and inverted faces, upright and inverted houses
- Presented in randomized order with random interstimulus interval of 500–1000ms



EEG channel map with highlighted electrode clusters



Example stimuli – upright and inverted faces, upright and inverted houses

### Data cleaning:

- Raw EEG filtered with 0.10–30 Hz bandpass filter
- Video feed coded for attention, segmented 100ms before to 1000ms after stimulus onset
- Channel removed if differences of 200 $\mu$ V are observed in signal during trial
- Segment excluded if >15% of channels are removed
- Participants required to submit >10 trials per stimulus type

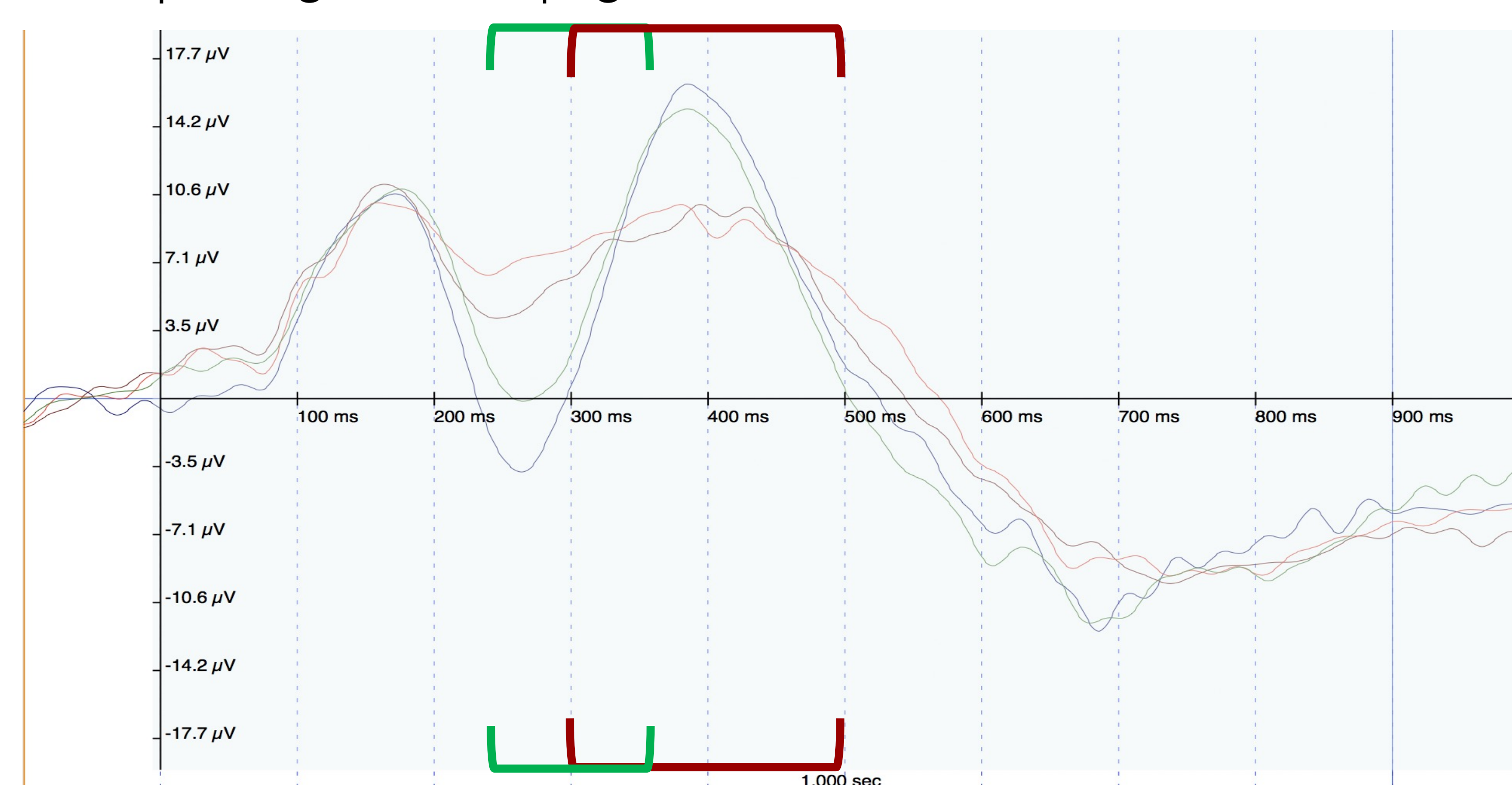
## Data Analytic Plan

- **N290** – minimum amplitude and latency to peak 250–350ms after stimulus onset at parietal and parietal-occipital electrode clusters
- **P400** – maximum amplitude after stimulus onset 300–500ms at medial occipital-inion electrode clusters
- **Nc** – mean amplitude 300–500ms after stimulus onset at frontocentral electrode clusters
- **ANOVAs** – examine responses by stimuli type (4: upright house, inverted house, upright face, inverted face) with follow-up comparisons
- **Regressions** – examine age-related changes in ERP responses

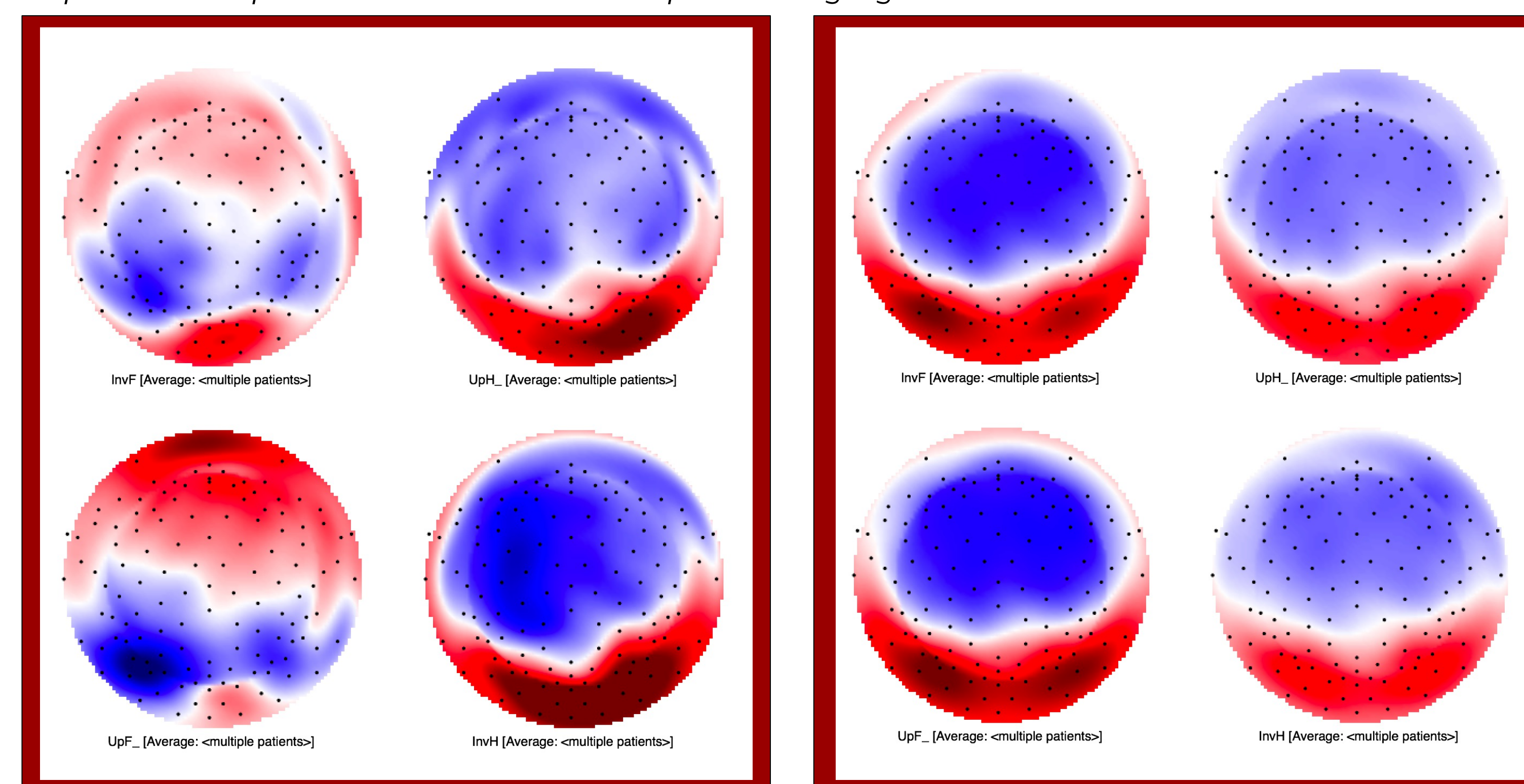
## Results

### Differences by stimuli type

- N290 responses were greatest in response to upright faces across all electrode clusters
- Planned contrasts showed upright faces were differentiated from houses at all scalp locations
- Left scalp clusters differentiated upright and inverted faces, right scalp clusters did not
- P400 was not modulated by stimulus type
- Nc response greater to upright faces than houses at Cz electrode cluster



ERP response at occipital electrode. Time window for N290 highlighted at 250–250ms, P400 at 300–500ms



Topographical plot of ERP responses by stimulus type during N290 time window (left), P400/Nc window (right)

### Developmental changes in ERP responses

- N290 – longer to upright houses with age at right parietal-occipital cluster
- P400 – decrease in response with age to inverted houses at left occipital cluster, inverted faces at right occipital cluster, and to upright faces and inverted faces and houses at Oz cluster
- Nc – Cz cluster showed significant increase in response to inverted faces as participants aged

## Discussion

- Infants show specialized ERP responses to upright faces across the second year of life
- Inversion effect not observed at N290
  - No developmental change in amplitude or latency to human faces
- P400 response was not modulated by stimulus type and declined in strength across the second year to both faces and houses
  - Possible developmental change related to the integration of the P400 and N290 toward the adult N170
- Nc response increased to inverted faces with age, showing heightened salience and attentional engagement with these stimuli as participants aged
- Data collection is ongoing and contributes to literature on face processing in the second year as responses continue to develop and become more adult-like

## References

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