



Background

- **Neural responses to human faces become increasingly specialized across infancy**^{1,2}
 - Investigated using event-related potentials (ERPs)
- **Face-sensitive ERP components in infancy**
 - May represent precursors to the adult N170 component^{3,4}
 - Inversion effect evidenced by greater amplitude to inverted than upright faces
 - **N290** - increasingly more selectively activated to faces over the first year^{1,2}
 - **P400** - mixed findings on face sensitivity, demonstrates inversion effect in some infant studies^{1,2,5}

Objective

Examine the development of the N290 and P400 ERP components to upright and inverted face and non-face stimuli across 12-, 18-, and 24-month-olds

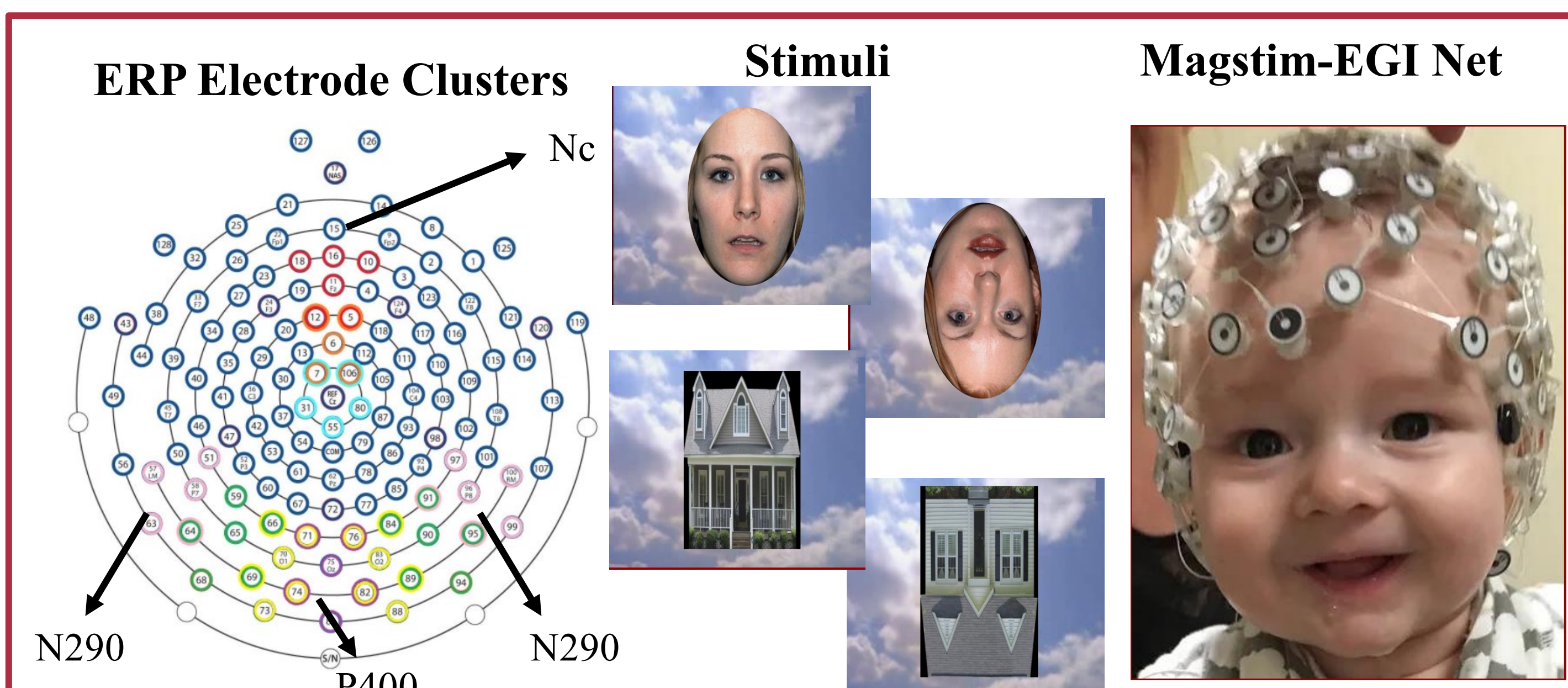
Method

Participants:

- 20 infants were included in final dataset ($M_{age} = 16$ months, $SD = 4.57$, range = 12-24 months), an additional 11 were excluded due to fussiness or technical error
- EEG recording: Magstim-EGI high-density 128-channel EEG system
- Stimuli: upright and inverted faces, upright and inverted houses
 - Randomized presentation with 500-1000 ms interstimulus interval

Data Processing:

- 0.10-30 Hz bandpass filtered, video coded for looking
- Segmented 100 ms before to 1000 ms after stimulus onset
- EEG inspected for excessive artifact and poor recording
- Segments of EEG were excluded if >15% of channels were removed
- Participants were required to submit at least 10 good trials per stimulus type



Data Analytic Plan:

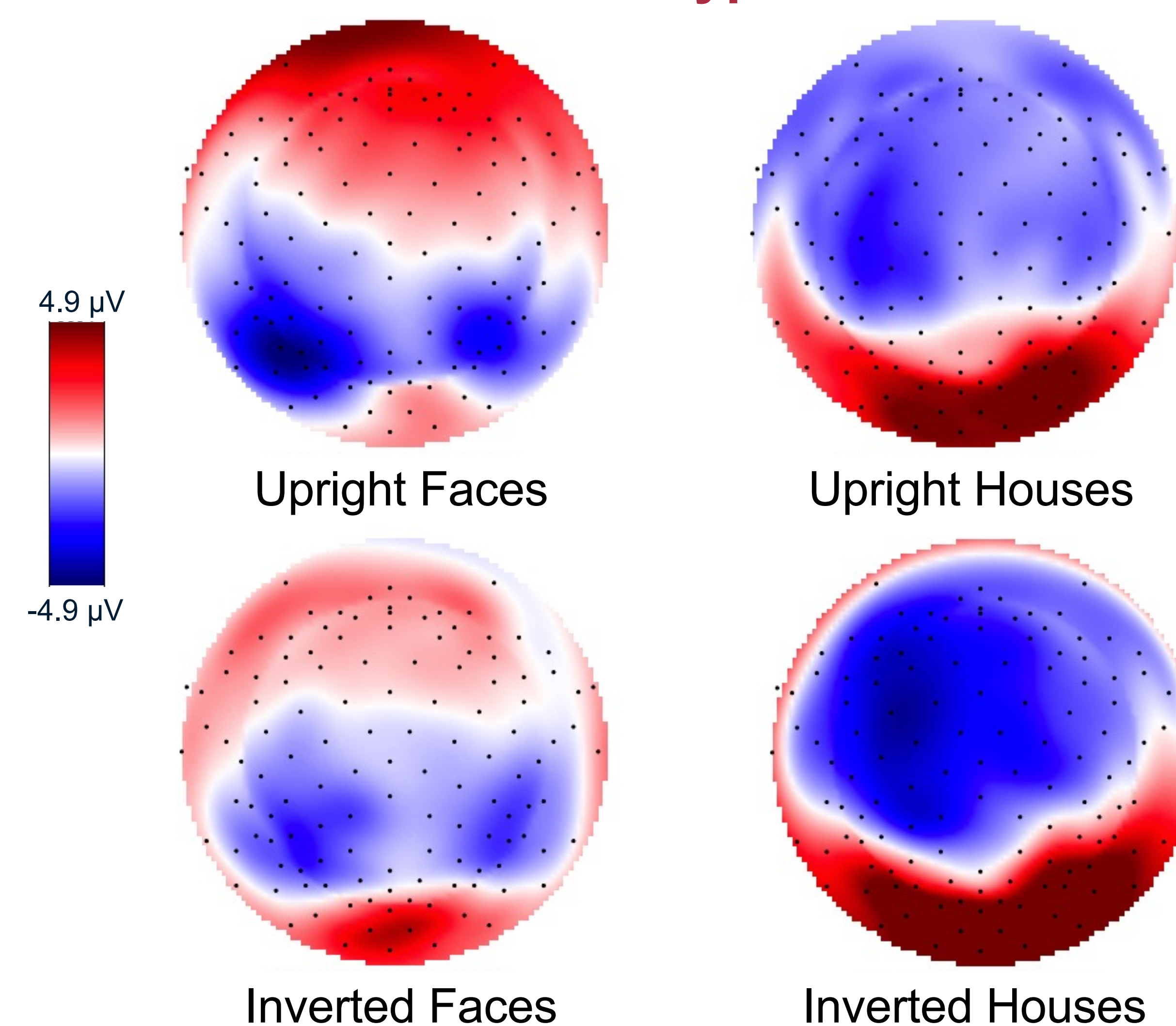
- **N290** – Minimum amplitude and latency to peak from 250-350 ms after stimulus onset at parietal and parietal-occipital electrode clusters
- **P400** – Maximum amplitude and latency to peak from 300-500 ms at medial occipital-inion electrode clusters
- Repeated Measures ANOVAs – Examined responses with stimulus orientation (2: inverted, upright), type (2: face, house), and electrode cluster as within-subjects factors, age (3: 12, 18, 24) as a between-subjects factor

Results

N290

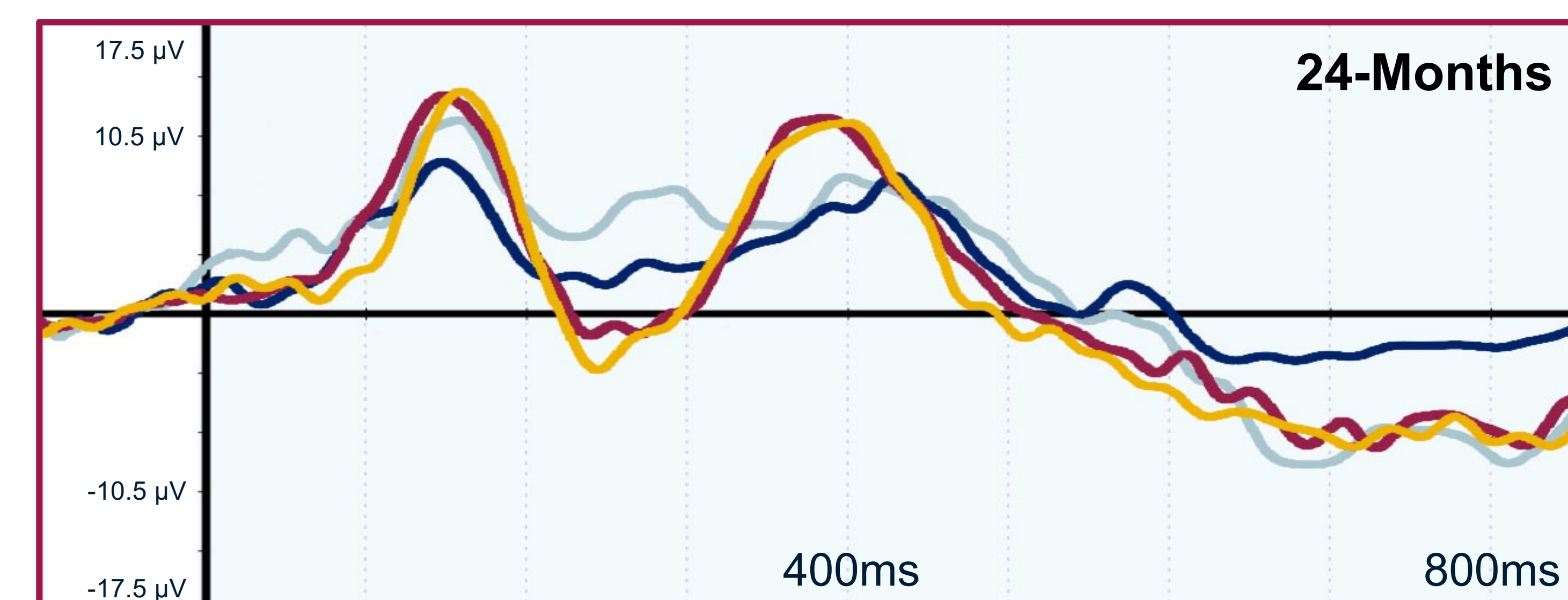
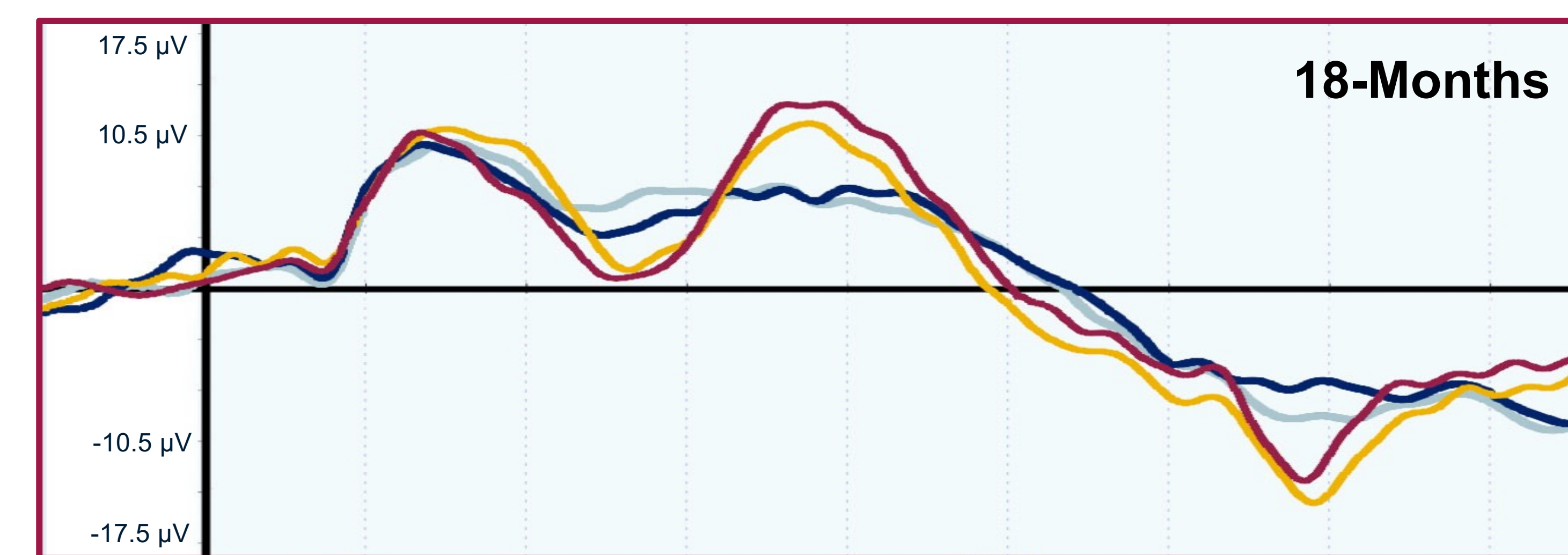
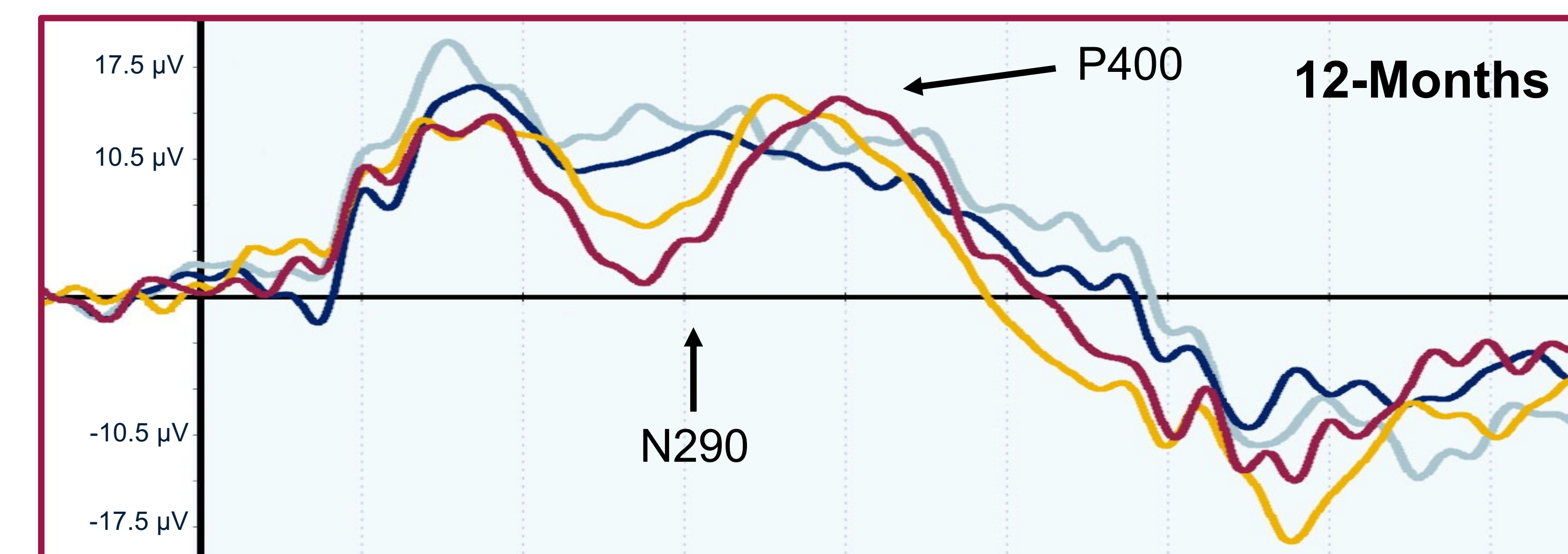
- **Effects of stimulus type and orientation:**
 - Stronger amplitude to faces than houses, $F(1, 17) = 17.59$, $p < .001$
 - Stronger amplitude to upright than inverted, $F(1, 17) = 15.42$, $p = .001$
 - Longer latency to faces than houses, $F(1, 17) = 41.40$, $p < .001$
 - No interactions of stimulus type and orientation
- **P400** amplitude and latency not modulated by stimulus type or orientation
- ERP responses were not statistically significantly modulated by age, although emerging effects are evident in ERP plots

Topographical Plots for the N290 Response by Stimulus Type



ERP Responses by Age

Red = Up. Face Gold = Inv. Face
Dark Blue = Up. House Light Blue = Inv. House



Discussion

- Infants show continued specialization of ERP responses to faces across the second year of life
- **N290 stronger to faces compared to houses and upright compared to inverted stimuli across all clusters**
 - Longer latency to faces than houses, suggesting greater processing demands for faces compared to objects
- **Contrasts adult research on N170 inversion effects**
- Emerging inversion effect and shorter N290 latencies evident in 24-month ERP plots
 - **Preliminary evidence of developmental change of N290 to more adult-like N170 response**
- **P400 amplitudes not impacted by stimulus type**
- Data collection is ongoing, future analyses will consider developmental change in ERP responses by age

References

1. Conte, S., Richards, J. E., Guy, M. W., Xie, W., & Roberts, J. E. (2020). Face-sensitive brain responses in the first year of life. *NeuroImage*, 211, 116602.
2. Guy, M. W., Zieber, N., & Richards, J. E. (2016). The cortical development of specialized face processing in infancy. *Child Development*, 87(5), 1581-1600.
3. Halit, H., Csibra, G., Volcic, A., & Johnson, M. H. (2004). Face-sensitive cortical processing in early infancy. *Journal of Child Psychology and Psychiatry*, 45(7), 1228-1234.
4. Halit, H., De Haan, M., & Johnson, M. H. (2003). Cortical specialisation for face processing: face-sensitive event-related potential components in 3-and 12-month-old infants. *NeuroImage*, 19(3), 1180-1193.
5. de Haan, M., Pascalis, O., & Johnson, M. H. (2002). Specialization of neural mechanisms underlying face recognition in human infants. *Journal of cognitive neuroscience*, 14(2), 199-209.