Neural Responses to Faces in the First Year of Life

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Introduction

The experience gained with faces in the first months of life is critical to promote infants' ability to adapt to their social environment. Beginning around 3 months of age, and over the first year, cortical circuits in the ventral visual pathway become selectively tuned towards the processing of the most frequently experienced category of stimuli (e.g. human faces). Studies on electrophysiological activity in infants showed that the N290 component displays some specificity for human faces. However, little is known about systematic changes in neural responses to faces during the first year of life, and the localization of these responses in infants' brain. In a cross-sectional study, we examined neural responses to pictures of faces and objects in infants from 4.5 months through 12 months. We recorded event-related potentials (ERPs) in response to human faces and objects, with particular interest to amplitude variations of the N290 ERP component. Further, we identified neural regions responsible for the component through the application of cortical source localization methods that included realistic head models based on individual MRIs and age-appropriate infant templates. Results revealed that the N290 occurred at about 288 ms following stimulus onset, and showed increasing responses over age. Moreover, we observed significant larger responses to faces than objects at parietal and parietal-occipital electrode locations. The neural sources of the N290 were identified with cortical source analysis in "regions-of-interest" (ROIs) theoretically involved in face processing. Analyses of current density reconstruction (CDR) values showed significantly larger activity in response to faces than objects localized in the middle fusiform gyrus.

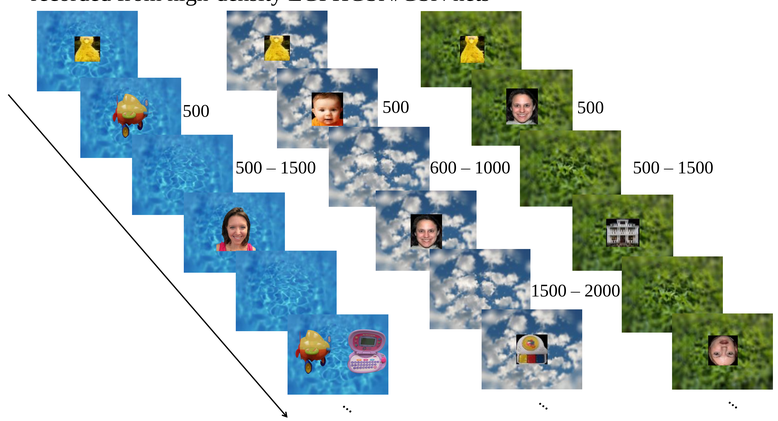
Methods

Participants

4.5 (N = 37), 6 (N = 39), 7.5 (N = 13), 9 (N = 8), 12 (N = 35) months

ERP Procedure

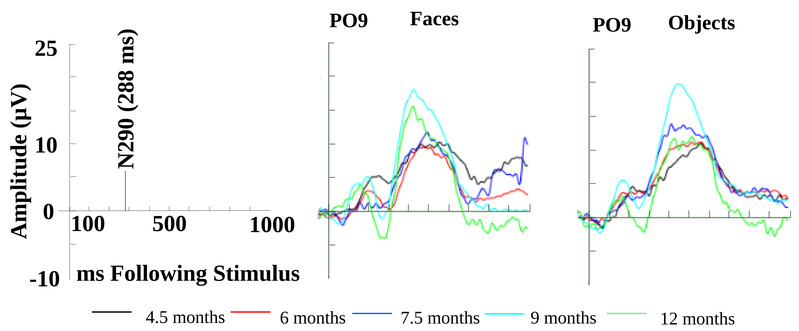
Infant passively viewed brief stimulus presentations (500 ms). EEG activity was recorded from high-density EGI HGSN/GSN nets



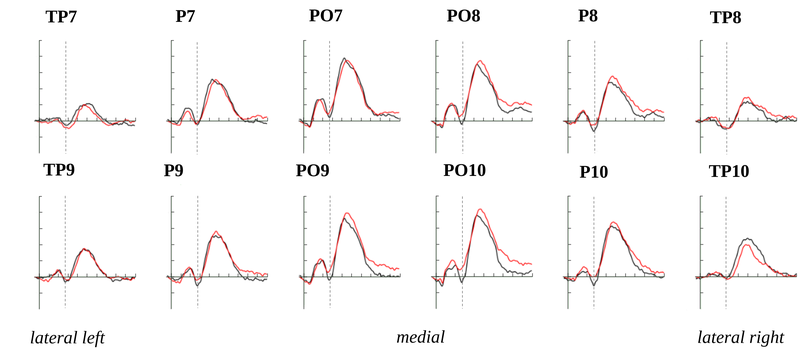
Guy et al. (2016, 2017) | Xie & Richards (2016) | Conte & Richards (2018)

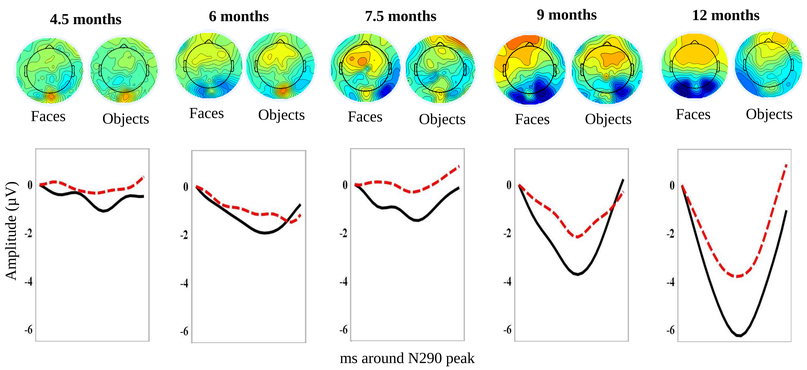
ERP Analyses

- Electrodes clustered into virtual "10-10" electrodes
- Individualized peaks at inferior-lateral posterior sites



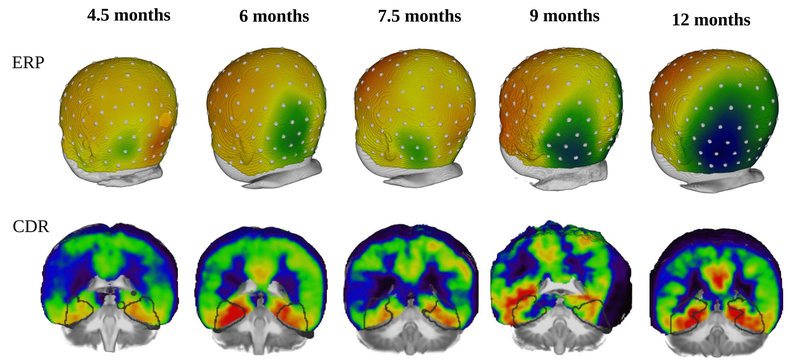
N290 at 12 months

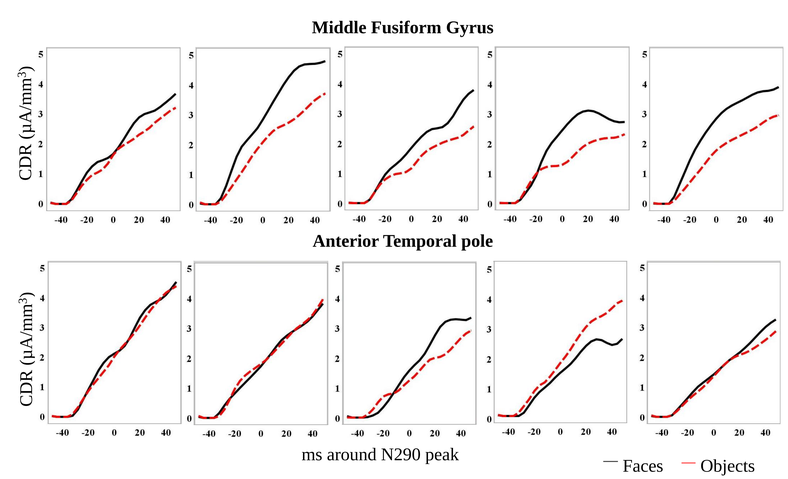


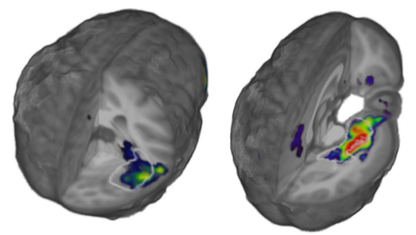


Current Density Reconstruction

Realistic head models were created for the MRIs, in which materials within the head were identified, segmented, and assigned a relative conductivity. CDR of the ERP component was done with head models, from the infant's own MRI, or MRI from an infant with similar age and head size, anatomically defined ROIs







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