Developmental changes in brain bases of face perception in autism as revealed by ERPs

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Background: Individuals with autism spectrum disorder (ASD) tend to exhibit behavioral and neural anomalies in face perception, which has been posited to reflect immature expertise resulting from reduced social motivation and consequent inattention to faces during development. Event-related potential (ERP) studies in typically developing children and adults have shown that face-sensitive ERP components (P1 and N170) change in amplitude, latency, and morphology with age. Functional magnetic resonance imaging studies reveal corresponding developmental shifts in cortical loci for both face and object recognition. Collectively, these studies demonstrate the importance of understanding developmental changes in face processing. Previous work in a large sample of children with ASD and typically developing counterparts identified preserved specialization for a non-social cognitive process, letter perception, subserved by distributed cortical regions. The current study uses source localization within the same population in order to investigate the neural sources underlying face-sensitive ERP components associated with developmental maturation between middle childhood and adulthood.

Objectives: To chart changes in neural sources of face-related electrophysiological brain response associated with chronological development in individuals with ASD.
Methods: ERPs were recorded from high-functioning children with ASD and typically developing peers using a 256 electrode Geodesic Sensor Net. Participants viewed social and non-social stimuli from highly familiar and unfamiliar categories (human faces vs. houses, Roman letters versus pseudoletters). Peak amplitude and latency were extracted for components at 100 ms (P1), 170 ms (N170), and 250 ms (N250) over occipitotemporal scalp regions. GeoSource software (EGI) was used to calculate a minimum-norm inverse solution to derive sources for each time window. Individualized sensor registration was performed using a Geodesic Photogrammetry System, and analyses in progress will compute source estimates based on individual-specific three-dimensional head models to improve the accuracy of derived source localizations for each subject.

Results: Source analysis revealed distinct patterns of face and letter processing in typically developing individuals and those with ASD. Estimations of neural sources showed developmental changes in both groups across a network of brain regions including the fusiform gyrus, superior temporal sulcus, visual cortex, and orbitofrontal cortex. Preliminary results using standard head models show that levels of activation across all brain regions in the network decreased with age in both groups. Analyses in progress are refining these findings using individual-specific head models.

Conclusions: This is the first study to employ dense array EEG and individualized head models to estimate neural sources associated with temporally distinct processing stages for face perception. Results reveal distinct profiles of developmental maturation between individuals with ASD and typical counterparts.

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