Title: Atypical Multisensory Integration is Linked with Immature Gaze Patterns in Children with and without Autism

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Introduction: Typically developing (TD) children display eye gaze patterns that vary over the course of development. For example, they display pronounced looking to the moving mouth of their communication partners early in life when they are latching onto their native language and experiencing other qualitative changes in language development (e.g., around the onset of canonical babbling and the vocabulary burst), but then tend to gaze more so to the eyes of a communication partner once they are proficient in their native language. In contrast, children with autism spectrum disorder (ASD) often display altered eye gaze patterns towards their communication partners. It has been proposed that children with ASD present with differences in eye gaze to a speaker because they have difficulty integrating the audiovisual speech cues from the talking face. A number of studies have demonstrated that children with ASD do display disruptions in their integration of auditory and visual speech cues relative to their typically developing peers. For example, children with ASD may integrate auditory and visual speech cues over a wider window of time, or present with “extended temporal binding windows” (TBWs), relative to typically developing controls. The present study seeks to evaluate whether eye gaze during audiovisual speech (a) differs in children aged 6-18 years with and without ASD and (b) correlates with concurrent audiovisual integration (i.e., TBWs).

Method: Twenty-five school-age children with ASD (Mage = 11.36; 18 males) and twenty-five age- and sex-matched TD peers (Mage = 11.42; 18 males) were recruited for this study. TBWs for audiovisual speech were measured in a simultaneity judgement (SJ) psychophysical task, during which children were presented with auditory and visual speech cues at varied stimulus onset asynchronies (SOAs) and asked to report via button press whether they perceived the stimuli to occur at the “same time” or at a “different time.” Aggregate indices of eye gaze to the eyes, mouth, and face regions were derived from a concurrently-collected, remote eye tracking task wherein participants were presented with infant-directed (ID) and adult-directed (AD) monologues produced by a female speaker in their native language (English) and a nonnative language (Spanish).

Results: On average, TD participants looked significantly more to the eyes than the mouth regions of the face across the four monologues, t = 2.75, p = 0.011. Participants from the ASD group did not look significantly more to one region over the other, t = 0.06, p = 0.95. Regression analyses revealed a negative correlation between TBW and proportion of time spent looking to the eyes, zero order correlation = –0.33, p = 0.021, and a positive correlation between TBW for audiovisual speech and proportion of time looking towards the mouth, zero order correlation = 0.29, p = 0.045. None of these associations were moderated by diagnostic group.

Discussion: These findings provide empirical support for the theory that atypical looking patterns to speaker’s faces are associated with atypical multisensory integration. Specifically, across groups more typical audiovisual integration (narrower TBWs for audiovisual speech) was associated with more mature eye gaze patterns (as indexed by greater looking to the eyes), while more atypical audiovisual integration (as indexed by wider TBWs) was associated with more immature eye gaze patterns (more looking to the mouth). Further work is needed to evaluate (a) the direction and potentially causal nature of the observed associations between multisensory integration and eye gaze patterns and (b) potential clinical applications.

References: