Title: Mechanisms By Which Early Eye Gaze to Multisensory Speech Influences Expressive Communication Development in Infant Siblings of Children with and without Autism

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Introduction: Autism is often associated with difficulties in expressive communication that impact long-term social, academic, and vocational outcomes. Past research has shown that eye gaze, in particular looking to the mouth of a speaker during audiovisual speech, is useful for predicting expressive communication in children with and at increased likelihood for autism, but the mechanisms by which eye gaze may influence communication development were previously unknown. We hypothesized that a generalized tendency to look to the mouth of a speaker may scaffold expressive communication by signaling to caregivers that children are ready for increased supported joint engagement, which subsequently supports prelinguistic vocal development and translates to broader gains in expressive communication. The present project represents a preliminary test of this theory in infants with a heightened likelihood of future autism diagnosis (Sibs-autism; i.e., infants with an older sibling with autism) and infants at relatively lower, general population level likelihood of future autism diagnosis (Sibs-NA; i.e., infants with non-autistic older sibling/s). The purpose of this study was to evaluate: (a) if there were between-group (Sibs-autism vs. Sibs-NA) differences in looking to the mouth during audiovisual speech, (b) if individual differences in looking to audiovisual speech indirectly influenced expressive communication via supported joint engagement and prelinguistic vocal complexity, and (c) if the aforementioned indirect effect varied according to sibling status.

Method: Participants were recruited from a larger, longitudinal study of infants from primarily English-speaking households. Fifty infants aged 6-18 months have completed the study to date (27 Sibs-NA, M_{age} = 12.9 mo, 55.5% male; 23 Sibs-autism, M_{age} = 11.9 mo, 47.8% male). Infants' eye gaze to the mouth during audiovisual speech was measured via a remote eye tracking task wherein infants viewed a video of a woman producing a 50s monologue in infant-directed speech in their native language (English). Parent-child engagement was measured in two 15-minute parent child free play (PCFP) sessions. Video files from each PCFP session were coded by an independent coder from Boston College who was naïve to infants' risk status to derive total time spent in *higher-order supported joint engagement* (HSJE; wherein a caregiver influences child's play, and the child acknowledges the caregiver by engaging in reciprocal play). Prelinguistic vocal complexity was measured using the Communication and Symbolic Behavior Scales Developmental Profile Behavior Sample (CSBS-DP). A partial interval coding system was utilized to code media files of CSBS-DP samples for the presence/absence of communication acts, vocalizations including canonical syllables, and selected consonants. Two indices of vocal development were derived: (a) canonical syllabic communication (i.e., the proportion of intentional communication acts that included a canonical syllable), and (b) consonant inventory (number of different consonants used in communication acts). Z-scores for these two component variables were combined to create an aggregate score. Expressive communication was assessed using three measures: the MSEL, the Vineland Adaptive Behavior Scales, second edition (VABS), and the MacArthur-Bates Communicative Development Inventory: Words and Gestures (MCDI). Expressive language age equivalency scores from the MSEL, expressive communication age equivalency scores from the VABS, and the expressive vocabulary raw scores from the MCDI were derived as indices of expressive communication.

Results: No between-group differences were found for looking to the mouth during audiovisual speech (t = –0.92, d = –0.26, p = 0.36). However, looking to the mouth of a speaker during audiovisual speech was indirectly associated with expressive communication via increased higher-order supported joint engagement and prelinguistic vocal complexity (95% CI = [0.001, 0.009]). Moderated mediation model indicated that sibling-status did not moderate any of the relations relevant to the aforementioned indirect effect.

Discussion: This study provides preliminary support for the hypothesis that children's gaze patterns influence expressive communication via increased supported joint engagement which, in turn, scaffolds prelinguistic and linguistic development. Additional, longitudinal research is needed to further characterize and increase confidence in this hypothesis. Additionally,

results suggest that looking behavior in infancy does not differentiate infants at high versus general population-level likelihood for autism on average, Limitations, implications, and future directions for this line of research will be discussed.

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