2021 Gatlinburg Conference Poster Submission

EXAMPLE

Title: Hierarchical Acoustic Structure During Parent-Child Interactions of Toddlers with Typical Development and Autism Spectrum Disorder

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Introduction: Parent-child interactions are a key supporting factor in children's development for both typically developing (TD) children and children with Autism spectrum disorder (ASD). Interactional variables such as synchrony and parental responsiveness, which relate to later social communication and language skills in children with ASD (Siller & Sigman, 2002; Hudry et al., 2013), highlight the key role of timing and temporal structure in supporting successful social interaction. Importantly, temporal structure unfolds over multiple timescales, which are hierarchically related to each other (e.g., syllables nested within phrases nested within utterances). Degree of hierarchical temporal clustering can be measured via Allan Factor analysis, which examines variability of acoustic events across multiple timescales (Falk & Kello, 2017). Recent investigations of parent speech demonstrate increased hierarchical clustering in infant-directed speech than adult-directed speech, and that adults adapt the level of hierarchical clustering in their speech to the level of clustering from infant vocalizations (Falk & Kello, 2017, Abney et al., 2016). However, this analysis method has not yet been applied across a dyadic interaction, with both parent and child contributing to the broader acoustic signal, and has not been applied to a clinical population. Because of the transactional nature of parent-child interactions and their implications for language and social development, the current study will examine how acoustic temporal clustering of parent-child interactions, as measured by Allan Factor, differ based on autism diagnostic status. We hypothesized greater hierarchical clustering in ASD dyads because of the adaptations that parents make to attract and maintain their child's attention, in addition to the variability in the child's social communication skills.

Method: As a part of a larger study of toddlers with and without ASD, 39 parent-child dyads (24 TD, 15 ASD) participated in a 10-minute parent-child free play activity, where parents were given a set of toys and were told to play with their child as they would at home. Audio recordings from these interactions were collected and analyzed across 12 timescales ranging approximately from a phoneme-level scale to the phrase-level scale and quantified via Allan Factor variances. Quadratic slopes were then fit for each dyad to quantify acoustic clustering patterns across timescales. Slopes of typically developing dyads were compared to slopes of ASD dyads using a Welch two-sample t-test.

Results: Overall, the slopes derived from Allan Factor analysis of dyadic interactions were significantly lower in the typically developing cohort (M = 0.69, SD = 0.086) than the ASD cohort (M = 0.75, SD = 0.082), $t(30.5) = -2.16$, $p = 0.039$. The difference in slope indicates greater hierarchical clustering of the acoustic signal in the dyads with children with ASD versus children with TD.

Discussion: Overall, this study both addresses the feasibility of applying fine-grained acoustic methodologies across a dyadic interaction and in a clinical population. Results provide preliminary evidence that hierarchical acoustic clustering in parent-child interactions may differ with ASD diagnostic status. The difference in parent-child vocal structure may relate to both the different communication patterns of toddlers with ASD and parents' adaptations to the social communication needs of their child. Future analysis will compare the acoustic temporal clustering of the ASD cohort to a language-matched sample, and examine turn-taking and vocal behaviors of both parents and children to determine which individual characteristics impact temporal clustering and trajectories over time.

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