Title: The Association between Social and Language Phenotypes in Specific Language Impairment versus High Functioning Autism

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Introduction: The language phenotype of individuals with autism spectrum disorders (ASD) is heterogeneous, although most findings suggest subgroups of individuals with ASD experience language deficits (Kjelgaard & Tager-Flusberg, 2001). Evidence have emerged showing that cognitive and specifically, language profiles, between youth with ASD versus those with specific language impairment (SLI) are distinct (Taylor, Maybery, Grayndler, & Whitehouse, 2014). Yet, children with SLI share various social characteristics, including elevated problems with social communication, insight in social relations, and prosocial gestures (Bishop & Norbury, 2002; Leyfer, Tager-Flusberg, Dowd, Tomblin, & Folstein, 2008). Currently, it is unclear whether the social and language profiles are associated in ASD versus SLI, such that their interpersonal difficulties are subserved by common cognitive factors and related neural substrates. The purpose of this study was to characterize the language and social phenotypes in children with SLI versus high functioning autism (HFA), and to determine whether neural correlates of language processing are differentially associated with interpersonal functioning across the neurodevelopmental disorders.

Method: Participants were 13 children with SLI (Mean Age = 9.76 years; 3F), 13 with HFA (Mean Age = 9.80 years; 5F), and 13 typically developing youth matched on age (Mean Age = 9.80 years; 5F). The Clinical Evaluation of Language Fundamentals, 4th Edition (CELF-4; Semel, Wiig, & Secord, 2006); Peabody Picture Vocabulary Test, 3rd Edition (PPVT-3; Dunn & Dunn, 1997); Expressive One Word Vocabulary Test (EOWPVT), and Letter-Word Identification and Spelling subtests from the Woodcock Johnson, Tests of Achievement 3rd Edition, Woodcock, McGrew, Mather, & Schrank, 2001) were administered to determine functioning across language domains. The parent-report version of the Social Responsiveness Scale (SRS; Constantine & Gruber, 2007) was completed by caregivers to assess day-to-day social functioning. All participants completed MRI and DTI scans to assess for any abnormalities in neural substrates (pars opercularis, pars triangularis, superior temporal gyrus) and circuits involved in language functions (superior longitudinal fasciculus).

Results: Multivariate analysis of variance (MANOVAs) were performed to assess between-group differences in language domains. The analyses were repeated with DTI measures (mean diffusivity, MD), and cortical thickness/area, with whole brain fiber, cortical thickness, and area as covariates respectively. Pearson correlations were computed per clinical group to assess correlations between Total SRS score with language measures, MRI and DTI indices. Results showed group differences across CELF-4 Receptive Language, CELF-4 Expressive Language, Letter-Word Identification (i.e., decoding words), and Spelling, Fs> 6.05, ps<0.01, but not receptive and expressive vocabulary knowledge (PPVT-3, EOWPVT), suggesting those with HFA and SLI benefit from visual cues. Specifically, SLI group performed more poorly than the other two groups in CELF-4 Receptive Language and Letter-Word Identification, but comparable to those with HFA in CELF-4 Expressive Language and Spelling. In regards to social functioning, group differences were observed across all subdomains of the SRS including Awareness, Social Cognition, Social Communication, Motivation, and Autistic Mannerisms, Fs>7.96, ps<0.001. Generally, those with HFA showed more difficulties across each subscale than TD and SLI groups, with the exception of Social Awareness and Motivation, where HFA and SLI children were comparable. No group differences were observed in cortical volume, area, FD, and MD.

Pearson correlations were computed between language measures with Total SRS score, an index of overall social functioning, and language measures. No associations were observed in the TD and SLI groups. However, among children with HFA, greater social impairment was related to poorer performance on the EOWPVT, CELF-4 Receptive, and CELF-4 Expressive Language. Similarly, across TD and SLI groups, no significant findings yielded from correlational analyses with neurobiological measures and Total SRS score. However, among those with HFA, cortical thinning of the right superior temporal gyrus, \( r(13)=-0.70, p=0.008 \), and lower MD of the left superior longitudinal fasciculus to the parietal region was related to higher SRS score, \( r(11)=-0.61, p=0.04 \), reflecting greater social deficits.

Discussion: Children with SLI showed greater deficits than HFA youth in receptive but not expressive language measures. Both clinical groups generally showed more language deficits than TD children; however, no differences were observed when picture cues were employed in eliciting vocabulary knowledge. Uniquely, in HFA children, social difficulties were related to their language performance, and structural abnormalities of neural substrates and circuits involved in language comprehension and visual-spatial attention. Results suggest that the etiology of the social phenotype associated with SLI versus ASD youth are likely
distinct. Furthermore, findings implicate that early and intensive speech/language intervention in children with ASD may reap more benefits on later social development.

References/Citations: