**Title: Links between Sensory Responsiveness and Caregiver-Child Engagement in Infants with Autistic and Non-autistic Siblings**

**Authors:** S. Madison Clark1, Jacob I. Feldman1,2, Jennifer E. Markfeld3, Shannon C. LaPoint4, So Yoon Kim5, Kristen Bottema-Beutel6, Drina Agojci3, Bahar Keceli-Kaysili1, & Tiffany G. Woynaroski1,2,7,8,9

**Introduction**: Sensory differences are highly prevalent in autism, and include hyporesponsiveness (i.e., reduced or absent responses to sensory stimuli), hyperresponsiveness (i.e., exaggerated or defensive responses to sensory stimuli), and sensory seeking (i.e., behaviors that intensify or extend sensory experiences). Theory suggests that sensory responsiveness may influence language acquisition by impacting children’s ability to engage with others in their environment early in life. The present study represents a preliminary test of this theorized mechanism in infants at increased familial likelihood for autism (i.e., Sibs-autism; infants with an older autistic sibling) and infants at relatively lower, general-population level likelihood for autism (i.e., Sibs-NA; infants with only non-autistic older siblings). We specifically focused on two types of supported joint engagement, which occur when caregivers influence their children’s toy play: higher-order supported joint engagement (HSJE) involves reciprocity with the caregiver from the child (e.g., turn-taking, imitating), and lower-order supported joint engagement (LSJE), involves little to no reciprocity in play from the child. Our research questions were:
(1) Do sibling groups differ in the amount of time they spend in supported joint engagement (i.e., HSJE, LSJE, or total supported joint engagement)?;
(2) To what extent is early sensory responsiveness (i.e., hyporesponsiveness, hyperresponsiveness, or sensory seeking) associated with supported joint engagement (i.e., HSJE, LSJE, or total supported joint engagement) across sibling groups?; and
(3) Do associations between early sensory responsiveness and supported joint engagement vary by sibling group?

**Method**: We recruited 50 monolingual English-speaking infants (27 Sibs-autism and 23 Sibs-NA) matched at the group level on sex assigned at birth and chronological age. At the first timepoint in the study (i.e., Time 1, at infant age 12–18 months), each caregiver completed two surveys regarding their infant’s patterns of sensory responsiveness: the Sensory Experiences Questionnaire (SEQ) and the Infant/Toddler Sensory Profile Caregiver Questionnaire (SPCQ). Approximately 9 months later (i.e., Time 2; at infant age 21–27 months), infants engaged in two, 15-minute free play sessions with their primary caregiver using a standardized toy set. A previously developed, timed-event coding scheme (Bottema-Beutel et al., 2014) was utilized to code the free play sessions for the amount of time that caregiver-child dyads spent in (a) HSJE, (b) LSJE, and (c) total supported joint engagement. Relevant subscores for the SEQ and the SPCQ for hyporesponsiveness, hyperresponsiveness, and sensory seeking were derived and aggregated for use in analyses (*r* values for relevant subscores ranged from .57-.72). Engagement state scores were averaged across the two 15-minute play sessions for use in analyses. Independent-samples t-tests were run to evaluate mean differences in time spent in supported joint engagement for Sibs-autism versus Sibs-NA. A series of regression models was conducted to assess associations between hyporesponsiveness, hyperresponsiveness, and sensory seeking and later HSJE, LSJE, and total supported joint engagement. Sibling group was considered as a putative moderator of the relations of interest.

**Results**: There was a significant between-group difference in the total time spent in supported joint engagement (*t*(48) = –2.17, *p*= .035, Cohen’s *d* = 0.63), such that Sibs-NA spent significantly more time on average in total supported joint engagement compared to Sibs-autism, with a moderate effect size. There were no significant between-group differences in the amount of time spent in LSJE or HSJE. Indices of sensory responsiveness and later engagement states were not significantly correlated across groups. However, sibling group significantly moderated the associations between sensory hyperresponsiveness and (a) HSJE and (b) total time spent in supported joint engagement (*p* values for hyperresponsiveness x sibling group interaction term = .002 and .003 for the aforementioned relations, respectively). These correlations were positive and significant in Sibs-NA (HSJE: *r* = .73, *p* < .001; total time spent in supported joint engagement: *r* = .50, *p* = .016). There were no significant associations between any indices of sensory responsiveness and supported joint engagement in the Sibs-autism group.

**Discussion:** These findings indicate that theorized relations between early sensory responsiveness and later engagement states may be stronger in Sibs-NA than in Sibs-autism. Future work will investigate other factors that may explain the relations that have been observed between early sensory responsiveness and later language in Sibs-autism (e.g., resting brain states, caregiver follow-in talk). Implications for research, theory, and clinical practice will be discussed.

**Selected References:**

Ben-Sasson, A., Hen, L., Fluss, R., Cermak, S. A., Engel-Yeger, B., & Gal, E. (2009). A meta-analysis of sensory modulation symptoms in individuals with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *39*(1), 1-11.

Bottema-Beutel, K., Yoder, P. J., Hochman, J. M., & Watson, L. R. (2014). The role of supported joint engagement and parent utterances in language and social communication development in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *44*(9), 2162-2174.

Damiano-Goodwin, C. R., Woynaroski, T. G., Simon, D. M., Ibañez, L. V., Murias, M., Kirby, A., Newsom, C. R., Wallace, M. T., Stone, W. L., & Cascio, C. J. (2018). Developmental sequelae and neurophysiologic substrates of sensory seeking in infant siblings of children with autism spectrum disorder. *Developmental Cognitive Neuroscience*, *29*, 41-53.

Feldman, J. I., Cassidy, M., Liu, Y., Kirby, A. V., Wallace, M. T., & Woynaroski, T. G. (2020). Relations between sensory responsiveness and features of autism in children. *Brain Sciences*, *10*(11), Article 775.

Feldman, J. I., Raj, S., Bowman, S. M., Santapuram, P., Golden, A. J., Daly, C., Dunham, K., Suzman, E., Augustine, A., Garla, V., Muhumuza, A., Cascio, C., Williams, K., Kirby, A., Kecili‐Kaysili, B., & Woynaroski, T. (2021). Sensory responsiveness is linked with communication in infant siblings of children with and without autism. *Journal of Speech, Language, and Hearing Research*, *64*(6), 1964-1976.

Watson, L., Patten, E., Baranek, G. T., Poe, M., Boyd, B. A., Freuler, A., & Lorenzi, J. (2011). Differential associations between sensory response patterns and language, social, and communication measures in children with autism or other developmental disabilities. *Journal of Speech, Language, and Hearing Research*, *54*(6), 1562-1576.

 Vanderbilt University Medical Center

2 Vanderbilt Frist Center for Autism and Innovation

3 Vanderbilt University

4 Florida State University

5 Duksung Women’s University

6 Boston College

7 Vanderbilt Brain Institute

8 Vanderbilt Kennedy Center

9 University of Hawaii at Manoa