**Symposium Title**: Behavioral and emotional consequences of sensory features in young children with and without Intellectual and Developmental Disabilities.

**Chair**: Julia Lisle[[1]](#footnote-1)

**Discussant**: Grace T. Baranek1

**Overview**: Challenges with behavior and self-regulation are associated with differences in sensory features, occurring in the general population and at higher rates in children with intellectual and developmental disabilities. However, existing literature lacks a comprehensive understanding of how specific sensory features impact self-regulation and ultimately contribute to behavioral challenges in young children. Further, there has been limited exploration of factors that may mitigate or exacerbate the relationship between sensory, self-regulation, and behavioral challenges, especially in diverse populations from various diagnostic groups and broad ages. The researchers in this symposium have used innovative approaches to further the field's knowledge of the relationship between these constructs and potential mitigating factors in children 6 months to 6 years old across various populations. The first paper investigates autism risk indicators (sensory responsiveness & social communication) in infants, 6-16 months, as a predictor of emotional reactivity at 3-4 years old and the mediating effects of sensory responsiveness at 3-4 years old on the predictive relationship. The second paper examines the associations between sensory responsiveness in the parent and child with internalizing and externalizing behaviors in a community sample of toddlers 23-28 months old. The third paper explores whether the relationship between sensory responsiveness and executive function changes when using an observational or parent-report measure of sensory responsiveness in children 36-72 months with autism. The fourth paper reports the relationship between modality-specific sensory responsiveness and anxiety symptoms in children with Fragile X syndrome, autism, and typical development. The discussant will highlight key findings, methodological innovations, and implications for future research.

**Paper 1 of 4**

**Paper Title**: **Early autism risk indicators in infancy predict later emotional reactivity in preschoolers**

**Authors**: Julia Lisle1, Megan Kim1, Sapir Soker1, Allison Q. Phillips1, John Sideris1, Grace T. Baranek1

**Introduction**: Autistic children have high rates of emotional dysregulation (Costescu et al., 2021). Autistic features, such as sensory responsiveness (SR) and social-communication (SC) are associated with emotional reactivity (ER) in cross-sectional studies of preschool- and school-age children (Sampson et al., 2013; Vasa et al., 2018). Autistic children who experience greater sensory seeking, hyperresponsiveness, poor affective engagement or communication also have greater emotional dysregulation measured concurrently (Rossow et al., 2021; Sung et al., 2024; Nuske et al., 2017). While intraindividual differences in SR and SC are relatively stable across age, it is unknown if early autism risk indicators in infancy are predictive of later ER due to the dearth of prospective studies. We aimed to: 1) Examine if autism risk indicators in SR and/or SC domains at 6-16 months of age predicted later levels of ER at 3-4 years; 2) Explore the mediating effects of concurrent SR levels (at 3-4 years) on this predictive relationship. We hypothesized that SR would be a stronger longitudinal predictor of ER than SC.

**Method**: Data were drawn from an ongoing longitudinal study evaluating SR and SC development in infants at varying levels of autism risk based on results of early screening. Participants were 24 children, with no known genetic conditions or visual/hearing impairments. When infants were between 6-16 months, their parents completed the First Years Inventory-Lite (FYI-Lite; Baranek, 2014), a 25-item parent-report screening that assesses autism risk indicators in both SR and SC domains. When children turned 3-years old, parents completed the Early Emotion Regulation Behavior Questionnaire (EERBQ; Perry & Dollar, 2021), a measure of ER and ER strategies, as well as the Sensory Experiences Questionnaire version 2.1 (SEQv2.1; Baranek, 1999), a measure of three SR patterns: hyperresponsiveness [Hyper], hyporesponsiveness [Hypo], and seeking [Seek]. Regression models were used to assess whether age-adjusted autism risk scores in FYI-SR and/or FYI-SC predicted scores on the ER domain of the EERBQ. We tested mediation as the reduction in the strength of the association of FYI-SC & FYI-SR with EERBQ-ER in the presence of SEQ Hyper, Hypo, or Seek and at age 3.

**Results**: FYI-SR (*B=*1.1, *p=*.04) in infancy was found to be a significant predictor of later EERBQ-ER, while, FYI-SC (B=-.066, *p=.*89) was not. Also, FYI-SR was found to be significantly correlated with SEQ Hyper (r=.50, *p=*.013) and Hypo (r=.43, *p=*.04) but not Seek (r=.25, *p=*.24). At age 3, EERBQ-ER was concurrently correlated with SEQ Hyper (r=.38, *p=*.105) and Hypo (r=.34, *p=*.064), but not Seek (r=.17, *p=*.43). Both SEQ Hyper (r=.3) and Hypo (r=.3) partially mediated the relationship between FYI-SR (but not FYI-SC) in infancy and EERBQ-ER scores at age 3.

**Discussion**: As hypothesized, sensory responsiveness is an early and significant predictor of later emotional reactivity; this association appears partially mediated by concurrent levels of sensory responsiveness at age 3. These findings provide growing support for a developmental cascade model, stressing the precedence and impact of sensory processing differences in infants at varying levels of autism risk on later behavioral outcomes. Future replication studies with larger samples over a broader range of these variables are needed to more confidently estimate the magnitude of these effects.

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**Paper 2 of 4**

**Paper Title**: Parent and Child Sensory Reactivity Independently Predict Behavior Problems in Toddlerhood

**Authors**: Emily Campi [[2]](#footnote-2), Laura Glynn2

**Introduction:** Internalizing and externalizing behavior problems have significant influence on children’s meaningful and effective engagement in daily activities, especially in the classroom (Olivier et al., 2020). Predictors of behavior problems include early parenting as well as child sensory reactivity (Dean et al., 2018; Kurasawa et al., 2024; Méndez Leal et al., 2023; Rose et al., 2018; Tseng et al., 2011). Despite heritability of sensory reactivity (Missitzi et al., 2018; Schneider et al., 2016) and the high frequency and intensity of sensory input involved in parent-child interactions (Hugill, 2015; O’Brien & Lynch, 2011), little is known about the contributions of parental sensory reactivity to risk for child behavior problems. The purpose of this investigation was to examine the associations between parent and child sensory reactivity and child internalizing and externalizing behavior in a community sample.

**Method:** Participants were 23-28 month-old toddlers (N = 59; *Mage* = 24.1 months, *SD* = 0.8) and their Spanish- or English-speaking mothers (39.0% with bachelor’s or greater education) enrolled in an ongoing longitudinal study of early life adversity and psychopathology. Recruitment occurred through a large network of pediatric primary care clinics in Southern California, and the study sample reflects the racial and ethnic (40.7% of mothers and 45.8% of children Latino/a) diversity of this region. Maternal sensory reactivity was measured using the Infant/Toddler Caregiver Self-Report form of the Sensory Processing Measure-2nd Edition (SPM-2; Parham et al., 2021) at child age 24 months, child sensory reactivity was measured using the Sensory Experiences Questionnaire, version 2.1 (SEQ; Baranek et al., 2006) at child age 18 months, and child internalizing and externalizing behavior was measured using the Child Behavior Checklist 1.5-5 year form (CBCL; Achenbach & Rescorla, 2000) at child age 24 months. Hierarchical linear regression models were calculated to test the differential predictive utility of parent and child sensory reactivity for child internalizing and externalizing behavior.

**Results:** Maternal and child sensory hypo- and hyperreactivity were moderately correlated, though correlations did not reach statistical significance (hyporeactivity *r* = 0.19, *p* = 0.14; hyperreactivity *r* = 0.20, *p* = 0.14). Child sensory hyperreactivity was the most robust predictor of both internalizing (β = 0.37, *p* = 0.007) and externalizing (β = 0.55, *p* < 0.001) behavior, even after adjusting for parent hypo- and hyperreactivity and child hyporeactivity. Parental hyporeactivity also predicted child externalizing behavior (β = 0.28, *p* = 0.05) after adjusting for all other sensory reactivity variables.

**Discussion:** These results demonstrate the importance of considering sensory reactivity in both members of the dyad when examining risk factors for child behavior problems. Parental sensory hyporeactivity could contribute to less responsive parenting, which is a known contributor to behavior problems (Rose et al., 2018). Future research should examine the predictive power of interactions between sensory reactivity patterns in parent and child and consider tailored interventions to improve sensory reactivity at the level of the dyad.

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**Paper 3 of 4**

**Paper Title**: The Influence of Sensory Processing on Executive Function in Young Autistic Children

**Authors**: Jamie L. Courtland [[3]](#footnote-3), Grace T. Baranek 1 Lauren DeMoss[[4]](#footnote-4), Elizabeth Glenn[[5]](#footnote-5), Hannah Riehl 6, Geraldine Dawson7, Kimberly L.H. Carpenter 7

**Introduction**: Sensory differences and executive function (EF) challenges are highly prevalent in autistic individuals, can significantly impact both daily functioning and intervention response (Ben-Sasson et al., 2019; Boyd et al., 2010; Crane et al., 2009; Crasta et al., 2023; Demetriou et al., 2018; Granader et al., 2014; Kern et al., 2006; Leung et al., 2016; Rosenthal et al., 2013). Emerging evidence from caregiver report in school-age children suggest that sensory processing differences may contribute to the variability in executive abilities across autistic individuals (Kiep et al., 2023; Pastor-Cerezuela et al., 2020). However, no study has yet focused specifically on preschool-aged autistic children or used observational methods to explore the link between sensory processing and executive differences. Here, we present a study exploring whether differences in sensory processing, as measured with both caregiver report and observational assessments, are associated with executive function differences in young autistic children.

**Method**: We analyzed the relationship between sensory processing differences and executive function abilities in 63 autistic children, ages 36 to 72 months. Sensory processing behavior – including sensory hyperreactivity, sensory hyporeactivity, and sensory interests, repetitions, and seeking behaviors (SIRS) – was assessed using both the caregiver reported Sensory Experiences Questionnaire (SEQ) and the play-based observational Sensory Processing Assessment (SPA) (Baranek 2009; Baranek et al., 2007). Executive function was assessed via caregiver report on the Behavior Rating Inventory of Executive Function (BRIEF) (Gioia et al., 2003).

**Results**: When measured via caregiver report, SIRS behavior and sensory hyporeactivity were significantly predictive of global executive function challenges in autistic children after controlling for developmental level, age, sex, and co-occurring disorders. When measured via observational assessment, only SIRS behavior was significantly predictive of executive function challenges in autistic children. Exploratory sub-analyses of the relationship between SIRS behavior and executive function subdomains revealed a significant relationship between SIRS and working memory when measured by either caregiver report or observational scores.

**Discussion**: Our findings indicate that specific sensory processing differences, particularly SIRS behaviors, are linked to executive function difficulties in young autistic children, regardless of whether sensory processing was measured through caregiver reports or observational assessments. This suggests a potential bidirectional relationship: sensory preoccupations may interfere with attention to cognitively demanding tasks, while children with poor executive function might display more sensory-seeking behaviors as a compensatory mechanism. This link was especially evident in working memory challenges, pointing to a nuanced relationship between SIRS and specific executive function subdomains. Additionally, the differences observed in the association between executive functions and either caregiver-reported or observational assessments highlight the importance of using multimodal approaches to measure complex behaviors. In summary, these data suggest that early supports around sensory processing differences could improve executive function outcomes in autistic children Moreover, understanding the link between SIRS and executive difficulties may guide interventions that prioritize sensory accommodations to regulate arousal states, enhancing learning and reducing the impact of SIRS on executive functioning.

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**Paper 4 of 4**

**Paper Title**: Detangling the Relationship between Sensory Responsivity and Anxiety Symptoms in Preschoolers with Autism and Fragile X Syndrome: Cross-Syndrome Similarities and Differences

**Authors**: Kimaya Sarmukadam 8, Moji Norozi 8, Abigail Hogan[[6]](#footnote-6)8

**Introduction**: Sensory impairments, particularly hyper-responsivity to sensory stimuli, affect at least 50% of children with autism and fragile X syndrome (FXS). Sensory impairments have been shown to contribute to anxiety symptoms in autistic children (Green & Ben-Sasson, 2010; Green et al., 2012; MacLennan et al., 2020), but there is limited research exploring this relationship in children with FXS (Crawford, 2023). Furthermore, the impact of modality-specific (e.g., visual, auditory responsivity) sensory impairments on anxiety symptoms in preschool-aged children with FXS and autism with co-occurring intellectual disability (ID) is largely unknown. Elucidating the interactions between specific sensory impairments and their contribution to anxiety symptoms during early development is crucial in identifying risk factors, facilitating the development of targeted interventions, and improving functional outcomes associated with anxiety, such as engaging in social situations. Thus, the objective of this study was to identify the relationships between modality-specific sensory impairments and anxiety symptoms in autistic preschoolers and preschoolers with FXS and typical development (TD).

**Method**: Participants included 46 autistic children [M(SD)age = 3.60(0.50) years; 17% female; M(SD)IQ = 59.26(14.50)], 37 children with FXS [M(SD)age = 3.87(0.82) years; 35% female; M(SD)IQ = 57.36(12.14)], and 33 TD children [M(SD)age = 3.56(0.86) years; 21% female; M(SD)IQ = 101.09(16.70)]. Groups did not differ on age (*F*(2,113) = 1.92, *p* = .151). Sensory impairments were measured using the Sensory Experiences Questionnaire – Version 2.1 (SEQ; Baranek, 1999), while anxiety symptoms were measured using the Preschool Anxiety Scale-Revised (PAS-R; Edwards et al., 2010). Group differences in modality-specific sensory impairments were first evaluated by conducting a multivariate general linear model (GLM) to compare SEQ modalities (auditory, visual, tactile, gustatory/olfactory, vestibular/proprioceptive) between groups (autism, FXS, TD). Network analyses were then conducted separately for each group using undirected graphical least absolute shrinkage and selection operator (gLASSO; Friedman et al., 2007) as a form of regularization in R to explore how all SEQ modalities interacted with each other and the PAS-R Total Score. All variables were converted to *z*-scores for standardization. Network centrality measures (strength, closeness, and betweenness) were obtained.

**Results**: Groups did not differ on PAS-R scores (*F*(2,113) = 1.50, *p* = .228). Findings from the multivariate GLM indicated that there was a significant (*p* <.001) group effect on sensory modalities (*F*(10, 220) = 7.21, Pillai’s Trace = .49, *ղp2* = .25). When between-subject effects were considered, tactile, auditory, visual, gustatory/olfactory, and vestibular/proprioceptive modality scores all reached statistical significance (*Fs*(2,113) ≥ 7.29, *ps* ≤ .001, *ղp2* = .11). Post-hoc pairwise comparisons (Bonferroni-adjusted) indicated that the autistic group exhibited significantly higher atypical sensory responses than the TD group for all sensory modalities (*ps* < .001) and the FXS group exhibited significantly higher atypical sensory responses than the TD group for most SEQ modalities (*ps* ≤ .001) except for auditory (*p* = .112) and gustatory (*p* = .384) responsivity. The autistic group also exhibited significantly higher scores than FXS group for SEQ gustatory responsivity (*p* = .004) with non-significant differences for all other modalities (*ps* > .179).

Findings from the network analysis indicated that there was a moderately strong positive association between anxiety and gustatory (*r* = .32) and auditory (*r* = .38) responsivity in autistic preschoolers, with tactile responsivity showing a weak negative association with anxiety (*r* = -.19). For preschoolers with FXS, anxiety was moderately positively associated with gustatory responsivity (*r* = .31), while for TD preschoolers, anxiety was moderately positively associated with SEQ tactile responsivity (*r* = .38) and weakly positively associated with gustatory responsivity (*r* = .28). Centrality statistics indicated that gustatory and tactile modalities were most frequently occurring in both autistic and FXS networks (*z* ≥ 1), with the addition of anxiety also frequently occurring in the autistic network. All centrality statistics indicated that tactile responsivity was most recurrent in the TD network.

**Discussion:** To our knowledge, this is the first study to investigate the impact of modality-specific sensory impairments on anxiety in autistic preschoolers, preschoolers with FXS, and TD. These results suggest that a combination of different sensory stimuli in the environment may interact with and influence anxiety symptoms in autistic preschool children as compared to FXS and TD preschoolers. In preschoolers with FXS, gustatory responsivity may act as a bridge between anxiety and other sensory modalities such as auditory responsivity. Targeted interventions such as increasing habituation to gustatory and auditory stimuli in autistic preschoolers and focusing on gustatory responsivity in preschoolers with FXS may assist with reducing anxiety symptoms in both clinical populations.

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