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Forwarding the Science of Sensory Features in Autism and Related Conditions

Roseann C. Schaaf¹, Nicolaas A. Puts², Zachary J. Williams³, Tiffany Woynaroski⁴

¹Jefferson Autism Center of Excellence, Department of Occupational Therapy, Therapy, Thomas Jefferson University College of Rehabilitation Sciences, Philadelphia, PA, USA

²Department of Forensic and Neurodevelopmental Sciences and MRC Centre for Neurodevelopmental Disorders, Institute of Psychiatry, Psychology, and Neuroscience, King's College, London, UK

³Vanderbilt University School of Medicine Affiliate, Vanderbilt Kennedy Center and Frist Center for Autism and Innovation, Nashville, Tennessee, USA

⁴Hearing and Speech Sciences, Vanderbilt University Medical Center, First Center for Autism and Innovation, Nashville, Tennessee, USA

Abstract

This editorial accompanies the JADD Special Issue on Sensory Features in Autism and Related Conditions: Developmental Approaches, Mechanisms and Targeted Interventions. The editorial is a commentary on the state of the science in sensory features in autism and related conditions and provides a synopsis of the information contained in the special issue including provocative thoughts about moving the field forward in this area.

Keywords

Autism; Sensory; Mechanisms; Intervention

Guest Editors:

We are very pleased to serve as the guest editors for this special issue of the *Journal of Autism and Developmental Disorders* on *Sensory Features in Autism and Related Conditions: Developmental Approaches, Mechanisms and Targeted Interventions*. Sensory features were frequently noted in early reports of autism including the influential case descriptions of both Kanner (1943) and Asperger (2009). They have now been included among the diagnostic criteria for autism for nearly a decade (American Psychiatric Association, 2013). Sensory features in autism include hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment such as apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement. We now know that many

[✉] Roseann C. Schaaf, Roseann.Schaaf@jefferson.edu.

autistic persons also have challenges in sensory perception and integration (Molholm & Foxe, 2010; Robertson & Baron-Cohen, 2017; Schaaf et al., 2022) as described in more detail below.

Over the past decade, research on the sensory features of autism has expanded tremendously (e.g., Ben-Sasson et al., 2019). We now recognize that most (over 70%) of individuals on the autism spectrum have sensory features that span a broad range of types, sensory modalities and patterns (Ausderau et al., 2014; Kirby et al., 2022; Lane et al., 2022; Robertson & Baron-Cohen, 2017) and that these sensory features frequently impact function, participation in activities and tasks, mental health, and quality of life (Jones et al., 2020; Lin & Huang, 2019; Little et al., 2015; Oakley et al., 2021; Schaaf et al., 2011; Verhulst et al., 2022). First-person accounts of the sensory experiences of some cognitively- and linguistically-able autistic persons add a wealth of information into the phenomenology of sensory features (for a review, see Sibeoni et al., 2022). These accounts highlight that some autistic individuals derive joy and pleasure from certain sensory experiences rather than perceive them as inherently distressing or problematic (Ashburner et al., 2013; Howe & Stagg, 2016; Jones et al., 2003; Kapp et al., 2019; Kirby et al., 2015; MacLennan et al., 2022; Robertson & Simmons, 2015; Sibeoni et al., 2022; Smith & Sharp, 2013).

Although we have come a long way toward understanding the role of sensory features in autism, there is still so much to learn. We know that sensory features in autism are highly heterogeneous, affect some more than others, and that multiple patterns can co-exist in one individual (e.g., hyperreactivity can co-occur with poor perception (Uljarević et al., 2017; Robertson & Baron-Cohen, 2017). We also know that they extend beyond hypo- and hyper-reactivity to sensation, to include challenges in sensory perception and multisensory integration, and that they impact a wide array of functions including adaptive behaviors, anxiety, postural control, praxis, movement and motor development (e.g., Feldman et al., 2018; Proff et al., 2022; Robertson & Baron-Cohen, 2017). We have also learned that there are benefits to studying sensory modalities separately, particularly when studying sensory reactivity (e.g., Dwyer, Takarae, et al., 2022, Tavassoli et al., 2019; Williams et al., 2023) to build understanding (e.g., Boudjarane et al., 2017; Little, 2018; Mikkelsen et al., 2018; Williams et al., 2021), and to study multisensory integration in varied sensory systems and from neuron to brain (Brandwein et al., 2014; Stein et al., 2014). Further, we now understand that sensory features can potentially affect many domains of physical and mental health across the lifespan (e.g., Donaghy et al., 2023; Han et al., 2022; Leader, Flynn, et al., 2021; Leader, O'Reilly, et al., 2021; Mazurek et al., 2013; Muskett et al., 2019; Rossow et al., 2021; Stein et al., 2011; Verhulst et al., 2022). Despite our many advancements, we still do not fully understand the underlying causes or developmental consequences of these sensory features. Further, while an emerging body of evidence points towards some promising treatment options (e.g., Baranek, 2002; Fung et al., 2012; Hume et al., 2021; Schaaf et al., 2014; Schoen et al., 2019), we still do not understand which therapies are most efficacious for influencing sensory function and to what extent these have subsequent impacts on optimizing participation in daily life for autistic individuals and quality of life for them and their family (Randell et al., 2022). Importantly, we need to understand more about *when* in the course of development sensory features may be most sensitive to intervention, and which candidate interventions would work best for specific sensory features and types.

In this special issue, we attempt to move the field forward, toward a greater understanding of the sensory features in autism and other neurodevelopmental disorders, by sharing research conducted by many of the leaders on this topic from around the world. A portion of the work presented here emanated from the activities of the Autism Sensory Research Consortium (ASRC), a group of researchers dedicated to the study of sensory functions in autism. This group was initiated with generous support from the Nancy Lurie Marks Family Foundation (Home - Nancy Lurie Marks Family Foundation (nlmfoundation.org) who are committed to understanding autism from a scientific perspective, increasing opportunities and services available to the autism community, and educating the public about autism in order to help those with autism lead fulfilling and rewarding lives. We thank them for their support of this important area of study. A central tenant of the ASRC's work has been to highlight that early sensory perceptions and experiences may set the stage for subsequent neurodevelopment, influencing the development and elaboration of functional brain networks in neural systems that play a role in shaping an autism phenotype, and that this influence may be bidirectional. In keeping with this mission, the purpose of this special issue is to expand our collective understanding and chart a path for future research in this area. The articles presented in this issue fall broadly into four categories: (1) phenotypic characterization of sensory features and their correlates in autism and related groups including infants at high risk for autism (Campi et al., 2022; Feldman, Garla, et al., 2022; Scheerer et al., 2022); (2) investigation of sensory features using psychophysical paradigms, structured clinician-administered measures, and other more "objective" assessments (Asaridou et al., 2022; Espenhahn et al., 2022; Haskins et al., 2022; Lazerwitz et al., 2022; Ramappa et al., 2022; Williams et al., 2022; Schaaf et al., 2022); (3) investigations into the neural and genetic underpinnings of sensory features in autism (Dwyer, Vukusic, et al., 2022; Green et al., 2022; Haigh et al., 2022; Hudac et al., 2022; Haskins et al., 2022; Matsuba et al., 2022; Del Río et al., 2022) and (4) management of and treatment for sensory differences (Feldman, Dunham, et al., 2022; Litwin & Sellen, 2022). A final article by Hantman et al. (2022) explores the perspectives of parents of autistic individuals regarding the impact of their children's sensory differences on the transition to adulthood. Together, these articles demonstrate that sensory features are an important aspect of the autism phenotype that impact many aspects of development, behavior, and function.

In summary, this special issue represents an important step forward in our understanding of sensory features in autism and related conditions, but also underscores the many aspects of sensory development (and its disruptions) that require greater study. Specifically, more research is needed to understand the behavioral and neural underpinnings of these sensory features, their types, patterns and associated phenotypic characteristics. This can lead to the identification of relevant sensory subtypes that can help further categorize children for optimal treatments. Further, we need to know more about the developmental sequelae of altered sensory perception, reactivity and integration, and causal mechanisms that lead to the downstream consequences of atypical sensory development. More research is also needed on the impact of these sensory features, not only on brain development but also on daily life (positive and negative), quality of life, and mental health. Alongside these more substantive questions, there is a need for more foundational theoretical and psychometric work in this area, which seeks to (a) better define the myriad constructs included under the

umbrella of “sensory reactivity” and (b) purposefully develop reliable and valid measures of each construct spanning different sensory modalities, levels of analysis (i.e., behavioral, self-report, perceptual, neural), and developmental stages. Lastly, more awareness of existing evidence-based treatment for these sensory features, for whom and when they are most effective, the best timing and dosage of treatment, and implementation of these in real world environment. It is our hope that this special issue is a springboard for this future research.

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