



Dr. Oswald's Corner

Comments on recent
autism-related research reports

Sensory Differences in Autism

The presence of sensory differences is often included in the description of features related to autism spectrum disorders. Such differences are now included in the DSM-5 criteria for a diagnosis of autism spectrum disorder as an instance of restricted, repetitive patterns of behavior, interests, or activities: “Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment.” These differences are not further defined, but the text offers the following examples: “apparent indifference to pain / temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement.” (p. 50; APA, 2013)

However, references to these phenomena in relation to autism spectrum disorders are not new; indeed, the papers that first introduced autism and Asperger Syndrome both included observations about sensory differences. Kanner’s (1943) original description of autism commented on sensory aversion, noting: “Everything that is brought to the child from the outside, everything that changes his external or even internal environment, represents a dreaded intrusion.” (p. 244) While he offered as a first example of this dread of intrusions the food refusal often seen in young children with autism, Kanner goes on to say: “Another intrusion comes from *loud noises and moving objects*, which are therefore reacted to with horror. Tricycles, swings, elevators, vacuum cleaners, running water, gas burners, mechanical toys, egg beaters, even the wind could on occasions bring about a major panic.” (p. 245)

Asperger (1944/1991) made even more explicit reference to sensory differences:

“Over-sensitivity and blatant insensitivity clash with each other. . . . In the sense of taste we find almost invariably very pronounced likes and dislikes Many children have an abnormally strong dislike of particular tactile sensations, for example, velvet, silk, cotton wool or chalk. . . . There is hypersensitivity too against noise. Yet the same children who are often distinctly hypersensitive to noise in particular situations in other situations may appear to be hyposensitive. They may appear to be switched off even to loud noises.” (p. 80)

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While descriptions have evolved considerably over the past 70 years, those early references to sensory differences are a tribute to Kanner's and Asperger's clinical observations and descriptions, as well as documentation that some awareness of sensory differences in autism has been present from the very beginning. Interest in the scientific investigation of those differences has increased recently, as evidenced by a flurry of papers over the past year.

One of the challenges in following the literature on sensory differences has been somewhat slippery terminology. A wide variety of terms has been used to attempt to capture what it is about the sensory experience that appears to be different for people with autism spectrum disorders. Table 1 summarizes some of the most common terms used to describe sensory differences in ASD, along with definitions that have been offered for those terms, as they are described in recent papers. The citations do not necessarily identify the original use of the terms, but they offer examples of recent usage and definition.

Recent data suggest that sensory differences are associated with other important differences and skill deficits and excesses in individuals. For example, Lane et al. (2010) reported that sensory processing subtypes in autism were associated with communication competence and maladaptive behavior. Specifically, they noted that "global [sensory processing] dysfunction is predictive of maladaptive behaviors in autism" (p. 121). Patten et al. (2013) reported that, in children with ASD, sensory seeking behaviors and hyporesponsiveness were both associated with verbal status: nonverbal children were likely to demonstrate more pronounced hyporesponsivity and more sensory seeking patterns. They speculated that sensory hyporesponsiveness and sensory seeking might be important factors hindering the development of functional verbal communication in children with ASD. Liu (2013) observed that atypical sensory processing was associated with poorer fine and gross motor performance, suggesting that fine and gross motor difficulties of children with ASD may be related to their delayed sensory processing with respect to visual, auditory, tactile, and movement stimuli.

There are also emerging data that suggest that sensory processing differences are empirically associated with core features of autism spectrum disorder. Zachor and Ben-Itzhak (2013) noted that the features of 'unusual sensory interests' and 'negative sensory responses' were observed in two-thirds or more of their ASD sample, and that "Having 'unusual sensory interests' was associated with more severe reported and observed autism symptoms. . . . In contrast, having 'negative sensory responses' was only associated with more severe reported stereotyped behaviors." (unpaginated online version). Tavassoli et al. (2013) reported that sensory over-responsivity was positively correlated with features of autism as measured by the Autism Spectrum Quotient, a questionnaire designed to assess such features in adults with at-least-average intellectual ability. Sensory processing differences also appear to be related to the presence of sub-clinical features of autism in the general population. Robertson and Simmons (2013) reported a positive correlation between the number of autistic traits and the frequency of sensory processing problems in a general population sample.

These recent papers offer examples of efforts to generate data that provide a more complete picture of the differences found in people with ASD. As a final example, drawn from first-person accounts, Elwin et

Table 1. **Sensory Differences: Terminology**

Difference	Definition / Examples	Citation
Hyperresponsiveness	an exaggerated, often negative, response to stimuli (e.g., child attempts to avoid stimulation, such as covering ears to filter certain sounds, or shows an aversive response to tactile stimuli that would not bother others)	Patten, et al., 2013
Hyper-reactivity	becoming distressed by sounds that do not affect others, and having unusually acute hearing or negative reactions to gentle touch	Elwin et al., 2013
Sensory over-sensitivity / responsiveness	an exaggerated behavioral response to sensory stimuli intense and prolonged negative responses towards commonplace sounds, sights, tastes, smells, movements, and touch leading to negative emotionality, distractibility, heightened stress, and avoidance of such input (e.g., avoiding eating soft textured foods, distress from sound of home appliances) as well as aggressive and defiant behavior	Zachor & Ben-Itzhak, 2013 Ben-Sasson et al., 2013
Sensory hypersensitivity	lack of habituation, i.e., often bothered by nearly continuous stimuli that most people ignore soon after onset; annoying sensations are provoked by stimuli that are faint in intensity and have little apparent value an 'overload' of stimuli—e.g. noises seem exceptionally loud and lights unbearably bright.	Panagopoulos, et al., 2013 Robertson & Simmons, 2013
Negative sensory responses	undue general sensitivity to noise – general increased sensitivity to everyday sounds; abnormal idiosyncratic negative response to specific sensory stimuli – some form of idiosyncratic, negative, emotional reaction other than fear	Rutter et al., 2003
Enhanced perception	superior acuity in the awareness of specific sensory stimuli and focuses on specific perceptual elements (e.g., recognizing perfect pitch, superior ability to recognize minor changes in visual appearance)	Ausderau et al., 2013
hypersensitive hearing, oversensitivity to sound, hyperacusis	abnormally sensitive hearing in which normally tolerable sounds are perceived as excessively loud; an increased sensitivity to sound perception, subjective in nature	Lucker, 2013

Table 1. (continued)

Difference	Definition / Examples	Citation
Sensory undersensitivity / responsiveness	a failure to respond to sensory stimuli as expected unawareness or slow response to sensory input (e.g. tends to walk into things)	Zachor & Ben-Itzhak, 2013 Ben-Sasson et al., 2009
Hyporesponsiveness	delayed, absent, or more attenuated responses to stimuli than expected (e.g., child requires multiple or intense auditory cues to elicit an orienting response) a lack of or delayed response to sensory stimuli (e.g., a lack of orienting to loud sounds, slow to react to pain)	Patten et al., 2013 Ausderau et al., 2013
Hypo-reactivity	Indifference to pain, heat, and cold	Elwin et al., 2013
Hypo-sensitivity	the individual under-reacts to the presentation of sensory stimuli (or actively seeks them out—sometimes called “sensory seeking behaviour”)	Robertson & Simmons, 2013
Sensory-seeking behaviors	actions that intensify a sensory experience, such as smelling, touching and/or staring at objects behaviors that appear to reflect a fascination with or craving of sensory stimulation that is intense or unusual and maybe repetitive in nature (e.g., child uses peripheral vision to sight objects, repeatedly rubs a texture, or sniffs objects)	Zachor & Ben-Itzhak, 2013 Patten et al., 2013
Unusual sensory interests	unusual strong or repeated reaction to, or seeking of, stimulations from the basic sensation of sight, touch, sound, taste, or smell, dissociated from meaning Interest in the feel of certain surfaces or in seeing things spin	Rutter et al., 2003 Elwin et al., 2013
Sensory interests, repetitions and seeking behaviors	a fascination with or craving of sensory stimulation which is intense and may be repetitive in nature (e.g., fascination with flickering lights or rubbing textures)	Ausderau et al., 2013

al. (2013) described seven aspects of sensory experiences that individuals with autism spectrum disorders identified as challenging: Being hyper- and hypo-reactive, reacting to general overload, having strong stimuli preferences, managing attentiveness to stimuli, managing sensory / motor stimuli, and dealing with consequences of sensory reactions in daily life. These aspects were derived from interviews with fifteen individuals with autism spectrum disorder diagnoses.

There is some evidence that sensory differences are associated not just with the core features of ASD, and with other individual strengths and weaknesses, but also with family characteristics and challenges.

Ben-Sasson et al. (2013) reported that higher sensory over-responsivity was associated with higher levels of family life impairment and parenting stress.

Early reports about sensory differences in autism were often criticized for their over-reliance on parent report, the assumption being that parental descriptions are subject to many irrelevant influences and do not constitute objective observation. This objection has some basis in reality, though it is not limited to parents; clinicians' observations are also subject to irrelevant influence and fall short of objective accounts. However, recent work has sought to overcome this deficit in the literature by investigating the biological bases of sensory differences.

For example, Donkers et al. (2013) examined event-related potentials (measured by means of electroencephalography [EEG]) associated with responses to novel sounds. They noted specific differences in the autism group and found that those differences were associated with greater sensory seeking behaviors. They suggested that "attenuated early sensory as well as later attention-orienting neural responses to stimuli may underlie selective sensory features" (unpaginated online version). Schaaf et al. (2013) reported a different pattern of parasympathetic activity (as detected by electrocardiogram) during sensory stimulation for a group of children with ASD. Findings were discussed in relation to the biological mechanisms of sensory processing in autism, insight into the autism phenotype, and the utility of ANS activity as an outcomes marker. Thus, while this work is still in a relatively early stage, emerging evidence offers some support for biologically-based differences in the sensory processing of individuals with ASD.

There has been a tendency, on the part of professionals with a strong behavioral orientation, to be somewhat dismissive of reports of sensory differences in autism, and particularly of efforts to treat those differences. And, in fact, much of the early literature on sensory processing was less rigorous than we have come to expect, a critique that could be fairly made of most fields of investigation in their infancy.

But emerging evidence, especially that which seeks to relate sensory processing to physiological differences, may serve to overcome some of the hesitation. Many people would agree that sensory experiences are powerful in affecting cognition, affect, and behavior; a logical extension is that variations in the way individuals experience sensation may be important in understanding cognitive, emotional and behavioral differences, including those differences that we associate with autism spectrum disorder.

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