

Precursors and Trajectories of Sensory Features: Qualitative Analysis of Infant Home Videos

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KEY WORDS

- autistic disorder
- developmental disabilities
- retrospective studies
- sensation disorders
- videotape recording

OBJECTIVE. This study explored precursors and trajectories of extreme sensory patterns in children with autism spectrum disorders (ASD) compared with children with developmental delay (DD).

METHOD. We conducted a retrospective analysis of home videos of 12 infants who later displayed extreme presence or absence of three sensory patterns at preschool and school age.

RESULTS. In ASD, hyporesponsiveness was most evident in infancy, followed by sensory repetitions. Hyporesponsiveness appeared stable over time and also was a precursor of sensory seeking. Infants with DD had few sensory precursors.

CONCLUSION. Precursors of extreme sensory features emerge early in children with ASD and appear relatively stable over time for a pattern of hyporesponsiveness but less stable for patterns of hyperresponsiveness and sensory seeking. These findings highlight the emergent nature of sensory features that may inform early identification and intervention.

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Sensory features are highly prevalent, heterogeneous, and problematic in children with autism spectrum disorders (ASD). Extreme patterns of either hyporesponsiveness or the co-occurrence of hyporesponsiveness with hyperresponsiveness appear to differentiate children with ASD from those with developmental delay (DD) by the time they reach school age (Baranek, David, Poe, Stone, & Watson, 2006; Rogers, Hepburn, Stackhouse, & Wehner, 2003). However, little is known about the precursors and developmental trajectories of sensory features.

A few retrospective video analysis studies have documented unusual responses to sensory stimuli in ASD during infancy using cross-sectional methodologies and quantitative coding (Baranek, 1999a; Osterling & Dawson, 1994; Palomo, Belinchón, & Ozonoff, 2006). These studies did not include in-depth qualitative analysis of extreme sensory patterns or consider change in patterns over time.

Some prospective studies with high-risk infant siblings of children with ASD have identified a developmental progression of early features (e.g., Bryson et al., 2007; Chawarska, Klin, Paul, & Volkmar, 2007); however, those reports were not focused on sensory precursors and trajectories. The current study used a qualitative methodology to elucidate infant precursors and trajectories of sensory features recorded in the context of family videos of children later diagnosed with ASD or DD. We addressed three primary questions:

1. Are precursors of extreme sensory patterns visible in early home videos, and if so, what is their nature?
2. Are these early sensory features stable over time?
3. How do early sensory features and trajectories in children with ASD compare with those of children with DD?

Method

Participants

Participants included 10 boys and 2 girls with diagnoses of ASD ($n = 6$) or DD ($n = 6$) confirmed by clinical diagnosis and gold-standard diagnostic measures conducted at age 2–6 yr. Cases that fell >1.5 standard deviations above or below the mean for sensory pattern scores of hyporesponsiveness, hyperresponsiveness, or sensory seeking were selected from a larger data set. The sensory pattern scores were derived from an aggregate factor score of 4 measures (2 parent report and 2 observed): the Sensory Experiences Questionnaire (Baranek, 1999b; Baranek et al., 2006), the Sensory Profile (Dunn, 1999), the Tactile Defensiveness and Discrimination Test (Baranek, 1998), and the Sensory Processing Assessment for Young Children (Baranek, 1999c; see Watson et al., 2011, for details of factor model and scores). We used 2 cases for each of 3 patterns within each group, yielding 12 cases of either an extreme presence or an extreme absence of sensory features at preschool or school age.

Data Collection

The institutional review board at the University of North Carolina at Chapel Hill approved all procedures as part of a larger grant. All parents signed written consent and were paid \$25 for the videos, which were copied and archived digitally. We used extreme case sampling (Tashakkori & Teddlie, 2003) to identify cases that were unusual in terms of the intensity of sensory patterns (i.e., hyporesponsiveness, hyperresponsiveness, and sensory seeking). Videos with sufficient footage between birth and age 2 yr were coded. Total footage for each case ranged from 1 hr, 13 min, to 25 hr, 52 min. A total of 63 hr, 54 min, of video footage was analyzed.

Qualitative Analysis of Home Videos

Our analysis was informed by a grounded theory approach (Strauss & Corbin, 1990), and we identified emergent codes through the lens of a conceptual framework (Watson et al., 2011) that categorizes sensory features within the three patterns of

hyporesponsiveness, hyperresponsiveness, and sensory seeking. Our research questions led the first author (Ashley Freuler) to identify instances of behaviors that appeared to be related to one of the three sensory features. The goals were to both strengthen theories surrounding sensory processing and explore the phenomena of sensory features and the nuances of the contexts in which they occur.

ATLAS.ti (Version 5.0, Scientific Software Development, Berlin) was used for reviewing and coding. In the first of three phases, Freuler repeatedly viewed all footage for each case and identified incidents of behaviors as units of analysis (Larkin, 2009). These incidents included any behaviors that appeared to be sensory in nature, any behaviors that were potentially related to development of sensory patterns, and any other behaviors of interest that emerged as unusual or noteworthy during the coding process (e.g., atypical motor patterns).

In the second phase, Freuler reviewed the incidents using open coding to describe the context or observed activity (e.g., *free play, community*), observed behaviors or perceived affect (e.g., *spinning object, positive affect*), and sensory-related descriptors (e.g., *hyporesponsiveness*). Although a conceptual lens surrounding sensory features guided the coding process, she remained open to emergent codes that appeared to be relevant to the current study. Finally, Freuler re-reviewed all footage to ensure that the assigned codes described the identified incidents. Following the open coding process, she used her familiarity with the totality of the footage for each child to give an overall clinical impression of the observed sensory features for each child (Figure 1). In line with the qualitative nature of the study, Freuler was not blind to diagnostic group.

All authors participated in an ongoing process of reviewing the video segments and associated codes and engaging in theoretical discussion surrounding Freuler's observations, coding, and clinical impressions for the purpose of member checking. Further, all authors reviewed a series of incidents from selected cases to validate the clinical impressions.

Results

Precursors

Qualitative analysis of infant home videos revealed a number of emergent codes, some of which identified early features that may be precursors to later extreme sensory patterns in the ASD group. These codes included *hyporesponsiveness* (e.g., child displays lack of response to bubbles being blown in his or her direction), *hyperresponsiveness* (e.g., child displays aversive reaction to being dipped in ocean as evidenced by holding feet up coupled with a negative affective facial expression), *sensory repetitions* (e.g., spinning, mouthing objects), and *atypical motor postures* (e.g., unsteady gait, posturing). Overall clinical impressions of features in the infant videos showed that hyporesponsiveness was most evident in the ASD group, followed by sensory repetitions. Hyperresponsiveness was noted in only two cases at infancy. No evidence was found of intense sensory seeking that was qualitatively distinct from the developmentally common sensory repetitions noted above.

In the DD group, evidence of sensory precursors was surprisingly lacking in the infant videos. In two cases, instances of atypical motor postures and mouthing were seen; however, each case in the DD group gave an overall clinical impression of no significant evidence of sensory features during infancy.

Stability of Features

In the ASD group, two trajectories were observed: (1) stability of hyporesponsive patterns from infancy to preschool or school age and (2) shift from hyporesponsiveness in infancy to sensory seeking at preschool or school age (see Figure 1). Of the ASD cases presenting with stable hyporesponsive features, all children also showed sensory repetitions in the videos. In contrast, for those cases for which a clinical impression of hyperresponsiveness was given during infancy, an extreme absence of any of the three sensory patterns was noted at a later age. In the DD group, all of the cases presented with little evidence of sensory precursors on the basis of clinical impressions of observed home movies,

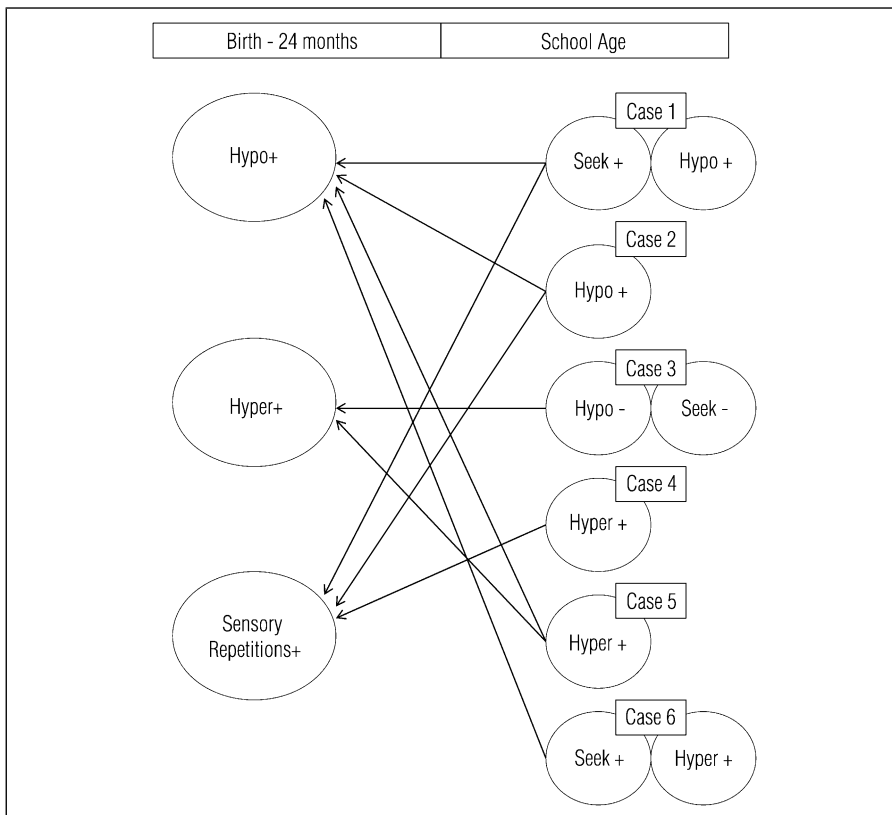


Figure 1. Trajectory of sensory features—autism spectrum disorders group only.

Note. + = presence of sensory feature; - = absence of sensory feature; Hyper = hyperresponsiveness; Hypo = hyporesponsiveness; Seek = sensory seeking.

regardless of the extreme presence or absence of the three sensory patterns evident at preschool or school age.

Discussion

The analysis revealed that precursors to sensory features emerge early in children with ASD. Despite heterogeneity in sensory patterns at preschool or school age, early features were more homogeneous, providing evidence that hyporesponsiveness may be a precursor for all three extreme sensory patterns present at later ages. Hyporesponsiveness was also relatively stable across time, perhaps suggesting that these features may be related to enduring temperamental traits. Alternatively, sensory hyperresponsiveness was less evident during infancy, and no strong evidence was found for stability over time. Although parents may not videotape situations that cause distress for infants, it is also possible that hyperresponsiveness becomes apparent in later years as children are exposed to increased sensory challenges in their environments and begin to assert more

independence in their activity patterns (e.g., avoiding foods or play materials, showing distress during grooming).

We also found that children with DD who presented with extreme sensory patterns at school age did not demonstrate sensory precursors in infancy. It is unclear why this would be different for the two groups. Possibilities requiring further research are that sensory features may emerge later in the DD group, children with DD may present with fewer or less intense features, or parents of infants with DD may be more aware of unusual behaviors associated with known disabilities and more likely to make accommodations.

The lack of evidence for intense or unusual sensory seeking in the infant videos was surprising, although one study using a parent report measure also identified fewer sensory-seeking features in toddlers with ASD (Ben-Sasson et al., 2007). Sensory seeking may emerge from more typical infant repetitive behavior (Thelen, 1979) but intensify with age, or parents may not videotape behaviors that

are clearly unusual in appearance. We suggest that current conceptualizations of sensory seeking developed from observations with older children may not capture the nuances of sensory features during infancy.

Limitations

This study demonstrates the utility of a qualitative approach in the discovery of infant precursors of later sensory features in ASD; however, assumptions surrounding the generalizability of these findings should be interpreted cautiously given the exploratory nature of this study and the inherent methodological limitations of retrospective video analysis (Baranek, 1999a; Palomo et al., 2006). Difficulty controlling the variability inherent in home videos serves to further strengthen the choice of qualitative methods to gain rich insights into the nuances of early-emerging sensory features in their naturalistic contexts.

The current study did not consider the specific contexts in which sensory response patterns occur as differentially influencing the quality or pattern of sensory responses. Rather, Freuler reviewed the cross-section of available footage for each case, which most often consisted of free play, grooming, or mealtime in the home environment, to determine an overall clinical impression of presenting sensory features. Future research should consider specific contexts (e.g., birthday party, free play, mealtime) as differentially influencing particular sensory response patterns. Finally, our qualitative method incorporated infants' group assignments into the coding process but potentially introduced bias to our findings.

Implications for Occupational Therapy Practice

The results of our study have the following implications for occupational therapy practice:

- Precursors to sensory features emerge early in infants later diagnosed with ASD and may be assessed with detailed observational systems of family activities and routines.

- Practitioners should consider the changing nature of sensory features over time and their impact on children's later development. In particular, hyporesponsiveness in infancy may be an early precursor of extreme sensory patterns evident in children with ASD in the pre-school and school-age years.
- The absence of sensory features in infancy (as recorded in home movies) does not necessarily preclude development of later sensory features, particularly for children with developmental delays. Practitioners should be cognizant of how sensory features manifesting at any age affect children's occupations and family routines.

Conclusion

This study provides evidence of the early-emerging nature and individual differences in trajectories of sensory features over time. These findings suggest that practitioners need to be sensitive to a pattern of sensory hyporesponsiveness in infancy as a potential behavioral precursor of more extreme sensory patterns in children with ASD later in development. Further research is needed to more comprehensively study the emergence of sensory features within the context of daily activities for children with ASD and DD and to refine conceptual models that explicate the nuances of the developmental trajectories of sensory patterns and their impact on participation. ▲

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