

# Autism Research Update

## Issue 3: Sensory issues

Autism Research Network

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# A challenging, unpredictable world for people with Autism Spectrum Disorder.

*M. Gomot & B. Wicker*

International Journal of Psychophysiology (2011)

## **Introduction**

Marie Gomot and Bruno Wicker propose an integrative theoretical framework to organize our knowledge about ASD. This theory focuses on the need for predictable structure in the life of many autistics, the difficulties in dealing with change – in particular unpredictable social interactions – and restrictive and repetitive activities. This approach is novel in being largely based on ideas from neuroscience. In particular, the authors link the pro-active (or predictive) brain account with recent findings about differences in large-scale connectivity in the brains of ASD populations, to make sense of the distinctive set of strengths (details) and weaknesses (global structure) of autistics frequently reported in experiments.

## **The Study and Findings**

According to the pro-active brain account, perception is mainly about actively constructing predictions about upcoming events based on integrating current information with past experience and other modalities. Incoming new information is interpreted with reference to our predictions, similar to planning and controlling actions. Hearing a series of beats is a simple example: we strongly react to a skipped beat, because our prediction based on past experience is violated. The authors review a host of sometimes conflicting studies pointing to a set of strengths and weaknesses in ASD groups, who, crucially, often show a decreased brain response (measured using EEG and MEG) to expectancy violations.

The pro-active brain framework is integrated with recent advances in

mapping the large scale structure of brain connectivity. In a nutshell, the connectivity patterns of autistics tend to have denser local connections, and sparser long-range connections. This could explain enhanced local processing taking place within distinct perceptual areas, e.g. pitch of sound, colours in a scene. Conversely, global processing, such as integration between predictions and new information would be reduced due to fewer available connections. Reduced crosstalk between perceptual areas and “high level” areas – such as prefrontal cortex and anterior cingulate cortex – would account for the decreased neural response to expectancy violations.



## **Conclusions**

This integrative account offers a potentially powerful new way of thinking about ASD in terms of unusual predicting abilities due to a brain connectivity bias (towards local connections). Also, it shows a way for rethinking social difficulties in ASD in terms of inflexible predictions which render social interactions overwhelming, and lead to social disengagement in favour of more predictable activities.

## Sensory abnormalities in autism: A brief report

*L.Klintwall, A. Holm, M. Erikson, L.H.. Clarsson, M.B. Olsson, A. Hedwall, C. Gillberg, E. Fernell*

Research in Developmental Disabilities (2011)

### Introduction

There is a growing recognition in research on children with Autism Spectrum Conditions (ASC), which suggests that abnormal responses to sensory stimuli in the first two years of life, represent the class of symptoms that most clearly distinguishes ASC from learning disabilities (LD), pervasive developmental disorder (PDD) and other developmental delays. Although such sensory responses may constitute a clear sign of ASC, they have not been included so far in diagnostic manuals such as the Diagnostic and Statistical Manual of Mental Disorder (DSM).

### The Study

The purpose of this study was to describe Sensory Abnormalities in preschool children with an ASC diagnosis, compare different subgroups within the autism spectrum, and relate the findings to other clinically symptoms. A total of 208 20-54 months old children (176 boys and 32 girls) took part in the study. They all received intervention from a specialized habilitation centre, the "Autism Centre for Young Children" (ACYC), in the county of Stockholm. The 208 children were divided into eight subgroups based upon degree of autistic symptoms, intelligence and language level. The parental interview included questions about abnormal sensory reactions, over-reactivity to sound, abnormal reactions to visual stimuli, over-reactivity to smell, over-reactivity to touch, under-reactivity to pain, under-reactivity to heat and under-reactivity to cold.

### Findings

Results show that the parents of three quarters (76%) of the children with ASD (158) reported at least one type of the sensory abnormality. The most commonly type of abnormalities were over-reactivity to sound (44%) and under-reactivity to pain (40%).

In relation to subgroups within the autism spectrum, children with Nuclear Autism without Learning Disabilities and children with Asperger Syndrome had significantly more affected modalities than other groups. There were no group differences in the number of affected sensory modalities between groups of different levels of expressive language.



### Conclusion

In summary, this study showed that sensory abnormalities differed among children with ASD, according to subgroups, and provides support for the notion that sensory issues is very common in young children with autism. The authors recommend that further research is needed to replicate and to extend these findings. They highlight how important it is that families and staff receive information about how to create an environment that takes these problems into consideration.

## Emotional and behavioural problems in preschool, children with autism: Relationship with sensory processing dysfunction

*Mei-Hui. Tseng, Cheng -Pei Fu, S. A. Cermak, Lu Lu & Jeng-Yi Shieh*

Research in Autism Spectrum Disorders (2011)

### Introduction

Emotional and behavioural problems often present at a higher rate or with greater severity in children with autism than typically developing children. These problems often affect the parent-child relationship, interfere with interventions and increase parental distress and quality of life and. Some problems of sensory processing include hyperactivity, poor organizational skills, and distractibility, as well as social and behavioural difficulties, which often impair a child's ability to explore and interact with physical and social environment.

### The study

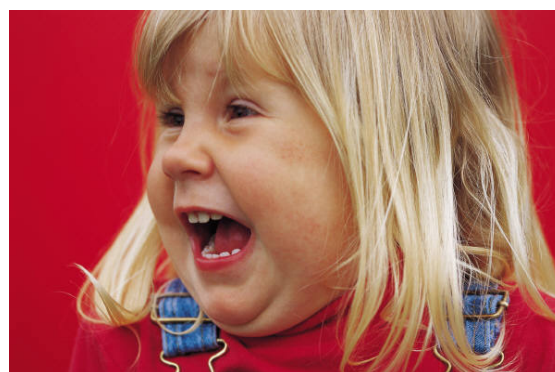
The aims of the study were first, to investigate the rate of sensory problems in preschool children with autism who manifested emotional and behavioural problems and second, to examine the relationship between sensory problems and emotional and behavioural problems in preschool children with autism and typically developing children.

A total of 112 children from the greater Taipei area (Taiwan), 67 autistic children and 45 age-matched typically developing children participated in this study. These children ranged in age between 48 and 84 months.

### Findings

Consistent with previous findings the results showed that autistic children displayed a higher rate of sensory problems whether they had emotional and behavioural problems or not.

The results also indicated that sensory problems were associated with both emotional and behavioural problems in both autistic children and age-matched non-autistic children although with different patterns noted in the two groups.



### Conclusions

Three main conclusions can be drawn from this study. First, clinicians working with children with emotional and behavioural problems might want to assess sensory behaviours in addition to their emotional and behavioural problems. Second, when managing problem behaviours in autistic children, parents and clinicians might want to provide them with firm touch-pressure, linear patterns of movement and predictable sensory cues. This could support their ability to focus on the task at hand. Finally, researchers and clinicians should recognise the need for assessing sensory processing, and the need for setting appropriate treatment goals and intervention programs to for both sensory processing and emotional and behaviour problems.

# Sensory Responsiveness as a Predictor of Social Severity in Children with High Functioning Autism Spectrum Disorders

*C. L. Hilton, J.D. Harper, R. Holmes Kueker, A. Runzi Lang, A. M.*

*Abbacchi, A. Todorov & P.D. LaVasser*

*Journal of Autism and Developmental Disorders (2010)*

## **Introduction**

Although not part of the diagnostic criteria, sensory difficulties are frequently observed in ASC. A previous study (Ben-Sasson et al., 2007) has confirmed that sensory difficulties appear in toddlers with ASC indicating that these difficulties begin to impact a child's development at an early age. Sensory difficulties are often the first signs that parents notice in their children with ASD (Baker et al. 2008).

## **The study**

This study examines the relationship between sensory responsiveness and social severity in children with high functioning autism spectrum disorders and age-matched typically developing children between 6 and 10 years of age.

Parents/teachers or caregivers were given the Social Responsiveness Scale, a 65 items questionnaire, and the Sensory Profile questionnaire, a 125-item questionnaire for children aged 3–10. The Sensory Profile questionnaire is used to assess responses to sensory events in daily life, and measures the degree to which children exhibit problems in sensory processing, modulation, behavioural and emotional responses, and responsiveness to sensory events.

## **Findings**

Significant relationships were found between social responsiveness scale scores and each of the six sensory profile sensory system scores for both typically developing children and children with autism.

The high degree of correlation between the Social Responsiveness scores and Sensory Profile scores suggests that there is a strong to moderate relationship between a child's sensory responsiveness and their social abilities, regardless of whether the child has autism or not.

The most atypical scores in the autism group were seen in the auditory category followed by multisensory, vestibular, touch, oral sensory/olfactory and visual categories in that order.



## **Conclusions**

The findings from this study suggest that sensory responsiveness and social abilities go hand in hand in autism but also in typical development. The study fails however to identify a causal relationship as it reports a mere association. The remaining question is whether sensory processing is influencing the development of social abilities or vice versa.



# Tactile responsiveness patterns and their association with core features of autism spectrum disorders

J.H. Foss Feig, J. L. Heacock & C. J. Cascio

Research in Autism Spectrum Disorders (2011)

## Introduction

Autism spectrum conditions (ASC) are often associated with *atypical responses* to sensory stimuli, which are thought to contribute to the social, communication, and repetitive behaviour deficits that define the *triad of impairments in ASD*. In particular, autobiographical accounts and research show unusual responses to tactile stimuli. Tactile information includes light touch, pain, temperature, and pressure. Unusual responses to tactile information can be seen in behaviours such as withdrawing when being touched, refusing to eat certain 'textured' foods, and to wear certain types of clothing. These patterns of symptoms may also lead to self-imposed isolation, general irritability, distractibility, hyperactivity and, above all, may exacerbate the developmental problems in social interaction and communication.

## The Study

The purpose of this study was to evaluate the association between three *atypical patterns* of tactile responsiveness -hypo -responsiveness, sensory seeking, hyper-responsiveness- and core symptoms of ASD. Thirty-four children with ASC (29 male, 5 female) between the ages of 5 and 8 years were included in the study. Both sensory and core features were measured with various methods including both parent-report and direct observation.

To obtain information regarding children's sensory functioning in the context of every-day life, parents completed the *Sensory Profile* and the *Sensory Experiences Questionnaire*. Children were also administered the *Tactile Defensiveness and Discrimination*

*Test-Revised*, which is a structured observational assessment that includes self-directed tactile activities using materials such as sand, putty, textured surfaces, and vibrating toys.



## Findings

The results showed that for the tactile modality, both *sensory hypo-responsiveness* and *tactile seeking behaviours* correlated with increased social impairments, increased non-verbal communication impairments and increased repetitive behaviours, across all children. Surprisingly, *tactile hyper-responsiveness* did not correlate with any core ASD symptom domains.

## Conclusions

Despite that previous findings and autobiographical reports which suggest a strong link between tactile *hyper-responsiveness* in individuals with ASD (not hypo-responsiveness) and autistic symptoms, the data of this study suggest that this is not the case. Thus, further research needs to examine specifically how atypical modality-specific sensory behaviours may drive core social, communicative, and behavioural difficulties linked with ASD.

# Effectiveness of sensory integration interventions in children with Autism Spectrum Disorders: A pilot study

*B. A. Pfeiffer, K. Koenig, M. Kinnealey & M. Sheppard,*  
American Journal of Occupational Therapy (2011)

## **Introduction**

Autistic children have problems processing sensory information. As a result they often resort to self-stimulation behaviours ("stimming") to calm down and help regulate their sensory experiences. These underlying sensory problems and compensatory behaviours can impair attention, communication and social interaction, and disturb the production of meaningful and adaptive behaviours.

Sensory integration therapy (SIT) attempts to provide an environment where sensory information from the environment is carefully controlled and where the children are helped to learn to make adaptive responses. The therapy encourages better sensory integration to help children control their behaviour and attention and therefore to improve academic skills and social interaction. This study aimed to evaluate this intervention.

## **The Study**

Two groups of autistic children aged from 6-12 took part in the study. The therapeutic group received SIT therapy and the control group an alternative therapy

## **Findings**

The SIT therapeutic group achieved a significantly greater reduction in autistic symptoms than the control group, suggesting that the therapy did help children to control their symptoms. Parents of the children in the SIT group also suggested they were significantly more likely to successfully achieve their own personal goals regarding sensory processing, motor skills and social functioning.

No group differences were found, however, for improvements in general sensory processing, social interaction or neurological function in areas such as movement, perception and spatial skills.



## **Conclusions**

SIT therapy does appear to be effective in reducing autistic mannerisms like self-stimulation behaviours and restricted interests. As stimulating behaviours are often socially-inappropriate, SIT is therefore likely to help autistic people interact in the world in a more appropriate way, and has been shown by previous research to improve engagement with others. The attainment of individually-tailored goals, set by parents and therapists, did show that the SIT group were more likely to reach their targets in fine motor skills, sensory processing and social and emotional development.

Overall, SIT does seem to help reduction of autistic symptoms and attainment of set goals in several areas. Improvements might be even more marked if SIT therapy was continued at home and in daily routines, but more research is needed to confirm this.

# Association of sensory processing and eating problems in children with autism spectrum disorders

G. Nadon, D. Ehrmann freeman, W. Dunn & E. Gisel  
Autism Research and Treatment (2011)

## **Introduction**

"Selective" or "picky" eating is a problem which affects a much higher proportion of children with Autistic Spectrum Disorders (ASD) than typically developing children. These children may eat few vegetables, rarely eat the same meal as the rest of the family, do not want different foods to touch each other, dislike certain textures and tastes, refuse some foods due to their smell, and do not like extremes of temperature for example. Many children with ASD also have sensory processing problems (around 90%). This study explored whether there was a relationship between sensory processing and eating problems in children with ASD.



## **The study**

A sample of 95 children with confirmed ASD between the ages of 3 and 10 were studied. For each child, parents completed two questionnaires. The first questionnaire, the "Eating Profile" examined six areas: dietary history, child health, mealtime behaviours, food preferences, eating autonomy, and impact of the eating problems on daily life. The second questionnaire, the "Short Sensory Profile" was designed to identify specific sensory problems. It examined seven areas: tactile sensitivity, taste/smell sensitivity, movement sensitivity, sensation seeking

(under responsive), auditory filtering, low energy, and visual/auditory sensitivity. The questionnaires were then analysed to determine whether any patterns specific to children with ASD could be identified.

## **Findings**

Overall, children with definite sensory problems had more eating problems than those who did not. Three specific sensory problems (taste/smell sensitivity, auditory filtering, and visual/auditory sensitivity) were associated with more eating problems. Mealtimes are a multisensory experience where all senses are involved. There are many different tastes and smells which can lead to unusual food preferences for specific recipes, colours, textures, or brands of food. They can be noisy - preparation, using cutlery, conversations. Meals are also very visual and these visual aspects may be linked to unpleasant memories associated with tastes and textures making it difficult to introduce new foods.

## **Conclusion**

There is a close link between sensory processing problems and eating problems in children with ASD. Most children with ASD have sensory processing problems and consequently a very high number of these children also have eating problems. Parents are frequently left struggling to cope with these problems and their impact on daily life alone. By including an examination of mealtime behaviour and sensory profiling as part of the diagnostic process, timely guidance and help could be provided to parents and carers.



# The everyday routines of families of children with autism: Examining the impact of sensory processing difficulties on the family

R. C. Scaff, S. Toth-Cohen, S. L. Johnson, G. Outen & T.W. Benevides  
Autism (2011)

## Introduction

It is estimated that over 80 percent of people with autism show sensory processing difficulties, that may be include self-stimulation (e.g., excessive rocking), avoiding behavior (e.g. placing hands over ears), sensory seeking behaviours and "tuning out" behaviors (such as not responding to their name or other environmental cues). The purpose of this qualitative study was to explore the experience of how sensory-related behaviors of children with autism influences family everyday routines.

## The Study

Four parents were interviewed in their own home. The children were between 5 and 12 years old. A semi-structured interview was used to explore how families use routines to support participation of the child in activities inside and outside the home.

## Findings

Family spaces: Sensory stimuli and routines are often predictable and caregivers are able to anticipate how the child may be affected by certain sensory issues. For example a parent states "in a home with a child with *auditory sensitivity*, *vacuuming was done when the child was not at home*". The familiarity with established routines helped the child cope with the sensory stimuli of the clothes (e.g., "we're working on a dressing routine now, the same order everyday"). Bath time can also be modified to decrease overstimulation and add sensory activities that are calming (adjusting water temperature and pressure; limiting olfactory input from soaps).

Mealtimes: Parents reported that a reward system to incorporate new foods

into the child's diet can work. "*He has to take two bites of a non-preferred food and then reward him with a preferred food.*"

Outside the home: Caregivers reported that plane rides, sight-seeing, long car rides, and crowds all presented challenges. Unconfined and unstructured spaces are often difficult to handle for a child with autism and sensory processing difficulties because they are unable to modulate sensory information well and may over-respond to typical levels of sensation. Some parents prefer to go to smaller shops, instead of large supermarkets.



Other siblings: Participants indicated that the child with autism often monopolizes the attention of one or both parents, forcing the siblings to receive less attention from their parents and be more independent in their activity.

## Conclusion

It is important to recognize that each child has individual sensory needs and behavior. The finding of this study highlight the importance of consideration of the family routines, activities and coping strategies, as well as the child's sensory processing when working with families and children with autism.

# Altered auditory and multisensory temporal processing in ASD

*L.D. Kwakye, J. H. Foss-Feig, C. J. Cascio, W. L. Stone & M. T. Wallace*

**Frontiers in Integrative Neuroscience (2011)**

## Introduction

Previous studies on sensory processing have reported that individuals with ASC produce unusual responses to sensory information such as visual or audio information. Research also shows that people with autism have difficulties in integrating sensory information from multiple sensory modalities such as audiovisual information. Specifically, it has been suggested that children with ASC can integrate low-level audiovisual stimuli, but they need longer than typically developing children. However, it is yet unknown how difficulties in isolated sensory systems contribute to difficulties integrating information from different sensory systems. Delayed integration of multisensory information is likely to have extensive consequences for children with ASD because of the multisensory nature of language and social stimuli.

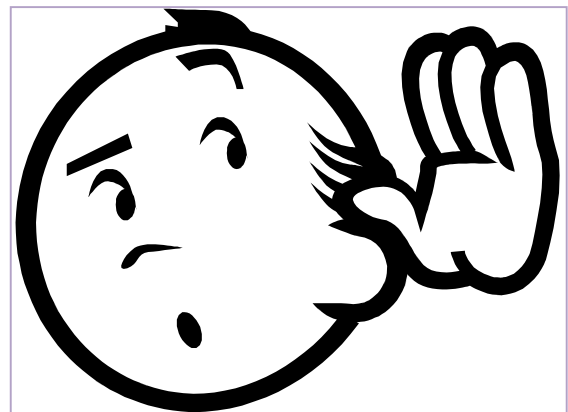
## The study

The purpose of the current study was to determine whether the processing of visual and audio temporal processing differ in children with ASC as compared to typically developing children. The study also aimed to explore if the differences in the processing of either visual or audio information have an effect in the processing of information coming from different multiple sensory modalities.

Thirty-five children with ASD ranging in age from 8 to 17, and children without ASD matched for age and intelligence, participated in this study.

## Findings

The results showed that children with ASD performed as well as typically developing children in the visual task. In contrast, there were group differences in the auditory task. Specifically, typically developing children performed better than the children with ASD. Interestingly, on the multisensory task, children with ASD showed performance improvements over a wider range of temporal intervals than TD children, indicating an extended temporal window of multisensory integration in ASD.



## Conclusions

The findings from the present study contribute to a better understanding of basic sensory processing differences in autism. These differences may be critical for understanding more complex social and cognitive difficulties in ASC, and ultimately may contribute to more effective interventional strategies.

## Talent in autism: Hypersystemizing, hyper-attention to detail and sensory hypersensitivity

S. Baron-Cohen, E. Ashwin, C. Ashwin, T. Tavassoli & B. Chakrabarti

Philosophical Transactions of the Royal Society- Biological Sciences (2009)

### Introduction

Some people with autism show special talents. In this study the authors argue that the origin of the association between autism and talent begin at sensory level. In particular the authors argue that *sensory-hypersensitivity* results in *excellent attention to detail*.

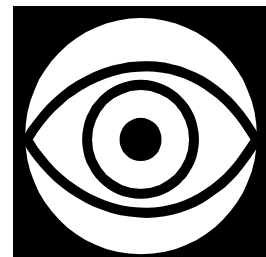
Previous studies have revealed sensory abnormalities in over 80 per cent of children with ASC across all sensory modalities. In terms of sounds, research has shown hypersensitivity to certain types of sounds such as high-pitched sounds and shrill noises. People with autism also have skin hypersensitivity for example certain soaps or shampoos or the texture of some clothes could hurt the skin and make the individual with ASC nervous. In terms of vision, individuals with ASC are more accurate at detecting small visual changes in their environment.

### The theory

In this article the authors argue that the sensory differences in functioning in ASC may be affecting how they develop in ways that could both cause distress but also predispose to unusual talent. Talent in autism comes in many forms. Savants, defined as individuals with autism characterized by prodigious talents, typically excel in numbers (e.g. spotting if a number is a prime number), calendrical calculation (e.g. telling which day of the week a given date will fall), drawing (e.g. geometrical shapes, laws of perspective, artistic technique), music (e.g. analysing the sequence of notes in a melody), memory (e.g. recalling long sequences

of digits or list of information) or even learning foreign languages (e.g. learning vocabulary or the laws of grammar).

A common characteristic of these forms of talent is that the person becomes an expert in recognising regularities or rules, what has been called systemizing. Strong systemizing is a way of explaining the non-social features of autism, narrow interests, repetitive behavior, and the resistance to change and the need for routines. This is because when one systemises, it is best to keep everything constant, and to only vary one thing at time. That way, one can see what might be causing what every time, rendering the world predictable. Strong systemizing in ASC therefore may be a result of not just excellent attention to detail but to sensory hypersensitivity.



### Conclusion

Results demonstrated greater sensory perception in ASC across multiple modalities. Hypersensitivity gives rise to the excellent attention to detail that is usually found in ASC, and which is a prerequisite for hyper-systemizing.