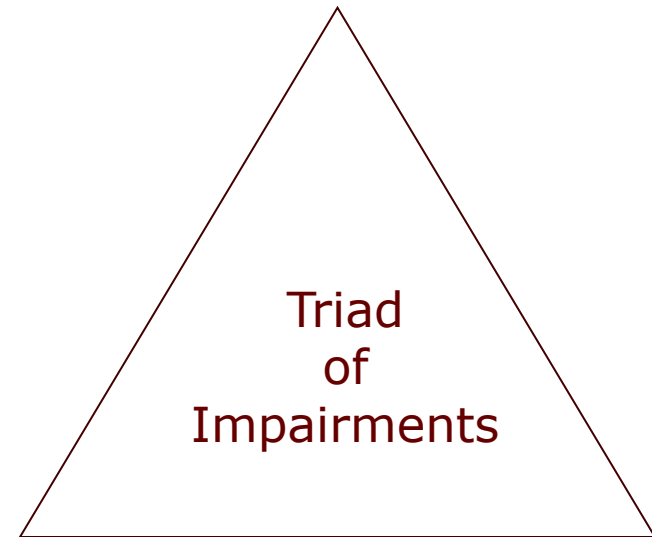


Sensory Perception in Autism

Olga Bogdashina

The diagnosis of autism is based on behaviours


- Impairments in social interaction
- Impairments in communication
- Rigidity of thoughts and activities





What role do sensory perceptual issues play in autism?

- ‘Secondary characteristics, which are common *but* not essential for diagnosis’?



So many professionals and nonprofessionals have ignored sensory issues because some people just can't imagine that an alternate sensory reality exists if they have not experienced it personally... That type of narrow perception, however, does nothing to help individuals who do have these very real issues in their lives. Even if they don't understand it on a personal level, it's time they put aside their personal ideas (Grandin)



At present, when sensory perceptual issues in autism are recognised...


they are often
oversimplified -

Hypersensitivities




Hypersensitivities

If we identify hypersensitivities of each individual and adjust the environment to his needs, does it mean all the problems will be solved?




“To me, the outside world is a confusing mass of sights and sounds. It is totally baffling and incomprehensible” (*Ros Blackburn*)


“I believe sensory anomalies may be at the root of many if not all behaviours that seem inappropriate and bizarre” (*McKean*)




There is some evidence from recent research that does indicate that sensory perceptual differences may be among the first signs of autism in young children:


- Problems in attention and arousal;
- They orient less to visual information;
(Baranek 1999)


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- Put objects in their mouths more often;
 - Need more cues before they look when someone calls their names; (*Baranek 1999*)


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- Pull away from social touch (*Baranek, 1999*);

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- Lack of responsiveness to certain sounds; hypersensitivity to certain foods; insensitivities to pain (*Hoshino et al. 1982*);
 - Atypical interest in visual stimuli, overexcitement when tickled, play limited to hard objects (*Gillberg et al. 1990*)

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- Hand-finger mannerisms, whole body mannerisms, unusual sensory interests (*Le Couteur et al. 1989; Lord et al. 1994*)

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- Unusual reactions to vestibular tasks
(Gepner et al. 1995; Kohen-Raz et al. 1992);
 - Stereotyped behaviours, under- and overreaction to auditory stimuli, unusual postures and unstable visual attention

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- Watching hands and fingers, and arm flapping (*Volkmar et al. 1986*);



The autistic ‘sensory’ symptoms observed during the first year seem to persist into the second year of life (*Adrien et al. 1992; 1993*).

Autistic toddlers and pre-school children display atypical sensorimotor behaviours at some point of their development (*Ermer & Dunn, 1998; Kientz & Dunn, 1997; Rapin, 1996*).

The Triad of Impairments

Lack of ToM,
WCC, etc.

Systems of
Thinking

Abilities

Perceptions

Senses

???????

Perception

Stimulus → Sensation → Interpretation
→ Comprehension

- Vision
- Hearing
- Tactility
- Olfaction
- Gustation
- Proprioception
- Vestibular system



Senses

‘deliver the information’ about the environment and ‘inner feelings’ to the brain where this ‘raw’ information is processed, interpreted (and stored for a future reference), and our perceptual world is created, interpreted and comprehended, that, in turn, provides us with ways to act.

This process is very complicated and differs greatly from species to species.



That is why:

- The real world and our mental image of the world differ
- Information from the senses is influenced by the ‘inside information’
- Our interpretation of the world is based on our memory and experience



Perception

“Perception is much more than simply sensing stimuli from the outside world... The plain fact is that the way information enters the brain affects the final state as much as any other step in cognition” (Ratey 2001)

Stimulus → Sensation → Interpretation → Comprehension
(Percept) (Concept)

□ **Blindness:**

Recognition through touch → a book → can read it in Braille


□ **Autism:**

“When I pick up a book, I might turn the pages and sniff each page first before looking at the pictures in it... Someone else with autism may tear a page or two... Another person with autism may totally ignore [it] because his perception would be directed towards some other aspect of environment” (Tito)



Two ways to experience the world:


- The non-autistic way
- The autistic way




The problem for many autistic individuals is that they do not realize that their sensory perceptual processing is different.

A typical thought they might have is:

“There is something wrong with me. I can’t do things right. Everyone is mad at me. No matter how hard I try, something goes wrong. Other people can do things I can’t. It must be my fault that I’m having so much trouble” (Spicer)




Instructions are printed in red against a green background but you are colour-blind and cannot distinguish between red and green. Would you know what to do?



“I don’t think that what I see is what you see.
That is unless what you see are vague clouds
and shadows of substance” (*McKean*)

“Unbelievably I live in a world where the
environment of our Earth, with its consistent
gravity, sound waves and refracted light, [is]
but an invention of fiction writers” (*Blackman*)




“As people began to explain how other people experienced my behaviour, I came to learn that all behaviour had two definitions: theirs and mine. These ‘helpful’ people were trying to help me to ‘overcome my ignorance’ yet they never tried to understand the way I saw the world.” (*Donna Williams*)



Sensory dysfunction or different sensory experiences?

- Not all the differences in perception are dysfunctional and sensory differences are not necessarily problems/difficulties.
- Some difficulties may be caused by environmental factors. If they are accommodated, this particular ‘dysfunction’ would disappear.



“Learning how each individual autistic person’s senses function is one crucial key to understanding that person” *(O’Neill)*

Qualitative differences in experiencing sensations/receiving information

Possible sensory experiences in ASD


- ‘Literal’ perception
- ‘Gestalt’ perception

Gestalt perception – ‘Sensory gating deficit’

- The inability to distinguish between foreground and background information
- *“It was like having a brain with no sieve...”*
(Donna Williams)
- Neuropathology of cortical inhibitory interneurons (Casanova 2002)
- An imbalance of cortical excitation and inhibition (Rubenstein & Merzenich)
- The ‘intense world syndrome’ (Markram *et al.* 2007)

Gestalt perception/ Sensory gating deficit:

“Every corner demanded my attention... Voices competed with voices. The colors of the clothes and dresses worn by people competed with each other. Even the pictures on the walls seemed to compete with each other for my attention. What do I hear and where do I look?” (Tito)



Gestalt perception
– perception of
the whole scene as
a single entity with
all the details
perceived (but not
processed!)
simultaneously



Kanner (1943):

□ ‘The inability to experience wholes without full attention to the constituent parts’:

“a situation, a sentence is not regarded as complete if it is not made up of exactly the same elements that were present at the time the child was confronted with it.”



Kanner (1943): The insistence on sameness:

“This insistence on sameness led several of the children to become greatly disturbed upon the sight of anything broken or incomplete.”

“Every... activity had to be completed from beginning to end in the manner in which it had been started originally. It was impossible to return from a walk without having covered the same ground as had been covered before.”

Gestalt perception

- Every situation is unique:

“Moments with their own uniqueness challenged me so much that I began to fear all those unknown paths, clothes, food, shoes, chairs and strange human voices. Each one challenged me by putting in front of me a new situation for me to face and understand” (Tito)

- Any change destroys Gestalt and brings confusion and fear



Gestalt perception → Resistance to change/ Insistence on sameness

“I cannot tolerate any kind of [change]... If a chair or a table was out of place, I would immediately place it where it is supposed to be... It would distress me to find someone had picked up a magazine from the coffee table because I had arranged them in a certain way. So guests would be very surprised to find me taking the magazines from their hands and putting them back where I thought they should be.” (Tito)




Any difference?

Mental map (Tito, 2008)

“A mental map is a mental picture I form, which I expect to face in the process of events, so that I am not surprised or shocked by any sudden situation...

I have a mental map of how things should happen around me. When they do not take place as expected, the anxiety is no less than any physical pain. It produces an amplified sensation throughout my gut.”



“Every experience settled in my mind as... a natural phenomenon, which laid down the rules of the world. E.g., if I saw a bird on a tree, and, at that very moment, I saw someone walking across the street in front of our gate, I concluded that every time a bird sits on a tree, someone needs to walk across the street.

[If this didn't happen] I would panic and get so anxious that I would scream.” (*Tito*)

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- They make their own connections and create new Gestalts
 - Gestalt behaviours – rituals and routines

Gestalt → lack of generalisation

“I would learn how to tackle a given situation in one context but be lost when confronted by the same situation in another context. Things just didn’t translate. If I learned something while I was standing with a woman in a kitchen and it was summer and it was daytime, the lesson wouldn’t be triggered in a similar situation if I was standing with a man in another room and it was winter and it was night-time. Things were stored but the compulsive overcategorisation of them was so refined that events had to be close to identical to be considered comparable” (Williams)




What we can do to help (Gestalt perception):


- We should find out which modality does not filter information and make the environment ‘visually/auditorily, etc. simple’.



Ctd.

- Structure and routine make understanding of everyday activities easier and provide feeling of safety and trust.
- Always communicate to the person beforehand, in a way he can understand (e.g., using verbal, visual or tactile means) what will be changed and why. Changes should be gradual, with his active participation.

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- Let them have a ‘safety object’ (a toy, a piece of string, etc.) when they go to unfamiliar places or face an unfamiliar situation



Another reason to “insist on sameness” –
the inability/difficulty to ‘stop feeling the change’,
leading, in turn, to overload
and/or hypersensitivity

- Rubenstein, J.L.R. & Merzenich, M.M. (2003): *Increased ratio of excitation/inhibition in key neural systems*
- Casanova, M. (2002; 2005): *Minicolumns in autism*



Gestalt perception may result in different experiences, compensatory strategies and perceptual styles:

- ❑ Fragmented perception
- ❑ Distorted perception
- ❑ Delayed processing
- ❑ Hyper-/hyposensitivity
- ❑ Mono-processing
- ❑ Peripheral perception



Fragmented perception

“I had always known that the world was fragmented. My mother was a smell, my father was a tone, and my older brother was something which was moving about”
(Donna Williams)




Fragmented perception

“I had a fragmented perception of things at the best of times, seeing eyes or a nose or whiskers or a mouth but mostly putting the bits together in my head.” *(Williams)*



Proprioceptive and tactile fragmentation

“My perception of a whole body was in bits. I was an arm or a leg or a nose. Sometimes one part would be very much there but the bit it was jointed to felt as wooden as a table leg and just as dead” (*Williams*)



“You may observe the autistic person rubbing sandpaper on his bare arm, or banging his knuckles sharply into a solid wooden dresser, then peering at them as if to say, ‘Oh, hello, hand. So you do belong to me, then’. Sometimes, the body feels fragmented, so it appears to be suspended or floating in pieces.” *(O’Neill)*



Distorted perception

E.g., in the field of vision:

- Poor/distorted depth and space perception
- Seeing 2D world
- Double vision
- Distortions of shape, size, movement, etc.

Distorted perception

“To some [autistic] individuals the world looks like it is viewed through a kaleidoscope: flat, without depth perception, and broken into pieces” (*Grandin*)

“I sometimes was seeing my hands and the things I was touching as if they were multiples... The image was either multiplied, or overlaid by similar reproductions of itself in duplicate” (*Blackman*)

Distortions

“My enchanted world of light and sudden gaps into which people and objects moved, affected the way that I processed my fellow human beings... I basically emphasised folds and depths... So I perceived people... as slightly distorted. This was not only in shape, but also in the composition of the components of their bodies in my visual imagination” (Blackman)

Auditory distortions

- “A child with poor auditory perception may hear sound like a bad mobile phone connection, where the voice fades in and out or entire parts of the communication are missing.” (Grandin 2008)
- *“My brain had processed the sound so differently that the human voice was continually distorted... I had heard in surges and troughs, which were further distorted by the intrusion of background noise”* (Blackman 1999)



Delayed perception

Do we live in the same time zone?



Delayed perception

“As a child,.. it appeared as though I didn’t feel pain or discomfort, didn’t want help, didn’t listen or didn’t watch. By the time some of these sensations, responses or comprehensions were decoded and processed for meaning and personal significance, and I’d accessed the means of responding, I was fifteen minutes, one day, a week, a month, even a year away from the context in which the experience happened” (*Donna Williams*)



Delayed perception

“Some people think I am not paying attention when am asked a question, because of the pause I often need to process the question and my response, and the blank look I often have when concentrating on such processing. When people try to get my attention, they actually just distract me, slow me down, and annoy me horribly with their impatience.” (Jared Blackburn)



What we can do to help:

Give them time to take in your question/
instruction and to work out their response.
Be aware that autistic individuals often
require more time than others to shift their
attention between stimuli of different
modalities and they find it extremely
difficult to follow rapidly changing social
interactions



Intensity with which the senses work

- Hypersensitivity
- Hyposensitivity
- Fluctuation (Inconsistency of perception)

Hypersensitivity

“I appear to have very sensitive ears, eyes and skin.

— ~~Certain noises very definitely ‘hurt’ my ears and~~
certain lights ‘hurt’ my eyes.” (*Wendy Lawson*)

“My hearing is like having a sound amplifier set on a maximum loudness. My ears are like a microphone that picks up and amplifies sound” (*Temple Grandin*)

“I have an acute sense of color. I see rainbows in a piece of ice, some colors and lights have sent me into manic and euphoric episodes and giggle fits.” (*Donna Williams*)

“Fluorescent light bulbs have such a high degree of flicker that ...some people on the spectrum feel like they are standing in the middle of a disco nightclub” (*Temple Grandin*)

Hyposensitivity

“My senses would sometimes become dull to the point that I could not clearly see or hear, and the world around me would seemingly cease to exist...” (*Hawthorne*)

“I had no concept of my body... and I never experienced it... My body was a mere reflection in front of the mirror... I never felt any pain” (*Tito*)

What we can do to help:

Hypersensitivities:

- ❑ *Identify which stimuli the person finds disturbing and either eliminate them (e.g., use natural lighting instead of fluorescent lights) or, if impossible, provide the person with 'sensory aids' (tinted glasses, earplugs, etc.)*
- ❑ *Desensitize the person to tolerate the stimuli via sensory diet*
- ❑ *Monitor a number of simultaneous stimuli; reduce irrelevant stimuli*
- ❑ *If possible, warn the person about fire alarms, bells, etc.*

Hyposensitivities:

- ❑ *Provide extra stimulation through the channels that work in 'hypo'*



Hypersensitivity

Disturbance by

Fascination by

certain sensory stimuli

Sensitivity to (disturbance by) certain stimuli

“The buzzer on the microwave oven, children’s voices, car horns, the bus bell people activate to tell the driver they want to get off, a kettle whistling... these are just some of the sounds I find unbearable” (*Wendy Lawson*)

“Sudden loud noises hurt my ears – like a dentist’s drill hitting a nerve” (*Temple Grandin*)



Disturbance by

- ~~□ Certain stimuli~~
 - Too many stimuli
 - Any sudden unpredictable stimuli
-


Challenging behaviours caused by either


- ‘present but invisible’ antecedent, or
- ‘past’ antecedent, or
- ‘probable future’ antecedents
- ‘last straw’ antecedents



What we can do to help:

- Remember, what we think is enjoyable (e.g., fireworks) may be fearful or overwhelming to an autistic individual.
- Be aware of the colours and patterns of the clothes you are wearing and of your perfume.
- Always warn a person about the possibility of the stimulus he is fearful of and show the source of it

- 
-
- Strategies to cope with light sensitivity are turning off any unnecessary lighting (esp. fluorescent lighting), using lamps rather than overhead lights, low wattage bulbs and tinted lenses.



~~As each individual is unique in their sensory~~ profile, it is very difficult to adapt the environment for each individual's sensitivities. Often it is not the stimulus itself that can trigger what we call difficult behaviours, but rather the inability to control or predict it. The understanding of each individual's sensitivities is vital, or any intervention becomes a nightmare for both the person and those who work with him.

Inconsistency of perception

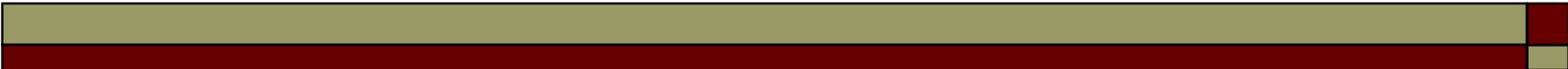
Fluctuation

“Skin sensation was so unbearable one minute and yet completely unfelt next” (*Blackman*)

“ It is well documented that there are certain textures and patterns that are painful or displeasing to the touch of the person with autism. This is true from my own experience, but I am not able to tell you what they are because they are always changing. Day to day, hour to hour, sometimes even minute to minute. This can be very frustrating” (*McKean*)

What we can do to help:

- It is important to recognize the first signs of sensory overload. It is better to prevent it than to ‘deal with the consequences’
- As soon as you notice early signs of coming sensory overload (which are different for different individuals), stop the activity and provide time and space to recover
- Teach the individual how to recognize the internal signs and ask for help or use different strategies (e.g., relaxation) to prevent the problem
- ‘First Aid Kit’ should be always at hand (sunglasses, ear plugs, squeazy toys, favourite objects, ‘I need help’ card, etc.)



The overload can lead to several different routes they can (are forced) to take and may result in:

- If they continue to try to process all the information coming in, despite their inability to keep up with it, it may result in hypersensitivity and/or fragmentation, that eventually bring anxiety, confusion, frustration and stress, that, in turn, leads to tantrums and difficult behaviours

- 
- Sensory agnosia (difficulty interpreting a sense):
-

“I looked at the beige-colored blob in front of me. Meaning had shut down not only through my ears but now through my eyes, too. I could see it but I had absolutely no idea what it was any more” (*Williams*)



Adaptations and compensations

Perceptual Styles:

- Systems shutdowns
- Mono-processing
- Peripheral perception
- Compensating for unreliable sense with other senses



Adaptations and compensations:

□ System shutdown

If early in life – ‘self-imposed sensory deprivation’:

‘When sensory stimulation became too intense, I was able to shut off my hearing and retreat into my own world... In pulling away, I may not have received stimulation that was required for normal development’ (Grandin)

Adaptations and compensations: Perceptual Styles

□ *Mono-processing:*

- *using one sense at a time*

"I have noticed that when I am using a particular channel to address a task, if I attempt to introduce another channel, then I lose my place in the completion of the task and need to begin again" (*Lawson*)



Perceptual Styles

- Peripheral perception



Peripheral perception

“Autistic people often glance out of the sides of their eyes at objects or other people. They have very acute peripheral vision and a memory for details that others miss. Gazing directly at people or animals is many times too overwhelming for the autistic one... It can feel creepy to be searched with the eyes” *(O’Neill)*

What we can do to help:

- Never force eye contact
- Do not approach the person directly in his hypersensitive modalities.

When hypersensitivity of the affected sensory channel is addressed and lessened, the direct perception becomes easier



Compensating for unreliable sense by other senses

One sense is never enough




What we can do to help:

- It is important to let the individuals use the sensory modality they prefer to ‘check’ their perception.
- With appropriate treatment and environmental adjustments to decrease hypersensitivities they gradually learn to use their sense organs properly – eyes to see, ears to listen, etc.

Are 'unusual' responses to sensory stimuli 'bizarre' and 'abnormal'?

- 'Bizarre' behaviours as compensatory strategies to regulate their systems and cope with information overload
- These self-stimulatory behaviours may serve several purposes and one and the same behaviour may have different underlying causes

“A lot of self-stimulation, including rocking the body, swaying, flapping the hands, rubbing the skin and countless others, are pleasurable, soothing connections with the senses” (O’Neill)


- 
-
- Before we try to address these ‘bizarre’ and ‘abnormal’ behaviours, let’s find out their functions.
 - Sensorisms – behaviours caused by differences in sensory perception.
 - Are all ‘challenging behaviours’ really ‘challenging’?

Functions of stimming:

- **Defensive:** (to reduce pain or discomfort caused by hypersensitivity, fragmentation, overload, etc.)

*“to eliminate sensory assault that interferes with functioning”
(Shore)*

- **Self-stimulatory:** (to improve the input in case of hyposensitivity, e.g.)



□ **Compensatory:** (to interpret the environment in the case of ‘unreliable’ sensory information)

“I was coping in a world where other people effectively realised nothing of that. I reacted to all this bombardment and confusion with those physical movements, silence and strange sounds which are generally lumped together as ‘autistic behaviours’ (Blackman)

□ Out of frustration:

“Sometimes head banging and knuckle nibbling, tantrums, or outbursts happen as a way of letting someone know enough is enough!” (Lawson)

□ *Just pleasurable experiences (that help to withdraw from a confusing environment)*

“Rocking and spinning were other ways to shut out the world when I became overloaded with too much noise. Rocking made me feel calm. It was like taking an addictive drug. The more I did it the more I wanted to do it” (Grandin)



Autism Spectrum

Temple Grandin:

There is a continuum of sensory processing problems for most autistic people, which goes from fractured, disjointed images at one end to a slight abnormality at the other.



SPP

No two autistic people appear to have the exactly same patterns of sensory perceptual experiences

Rainbows and Umbrellas




No two autistic individuals have exactly the same patterns of sensory perceptual experiences




The timing of the advent of sensory processing problems:
Temple Grandin, 1996:

“The exact timing of sensory problems may determine whether the child has [HFA] or is a nonverbal, [LF] autistic...


Oversensitivity to touch and auditory scrambling prior to the age of two may cause the rigidity of thinking and lack of emotional development found in [LFA]. These children partially recover the ability to understand speech between the ages of 2 and a half and 3.



[Those] who develop normally up to 2 years of age, may be more emotionally normal because emotional centres in the brain have had an opportunity to develop before the onset of sensory processing problems. It may be that a simple difference in timing determines which type of autism develops.”



Differences in perception lead to development
of different abilities, thinking styles and
communication



“Learning how
each individual
autistic person’s
senses function is
one crucial key to
understanding
that person”

(O’Neill)