

Atypical sensory responses of children with ASD include:

Sensory over-reactivity

Sensory under-reactivity

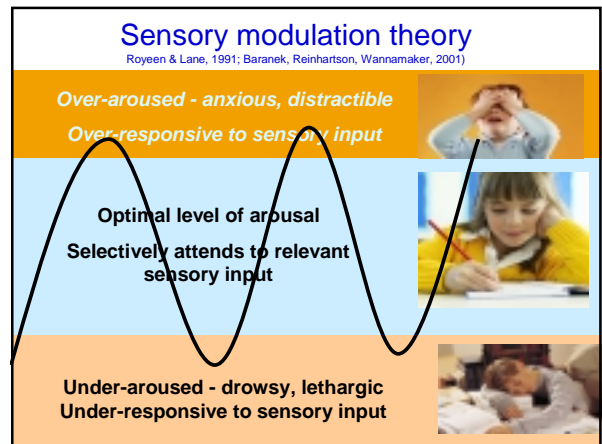
Sensory seeking behaviours

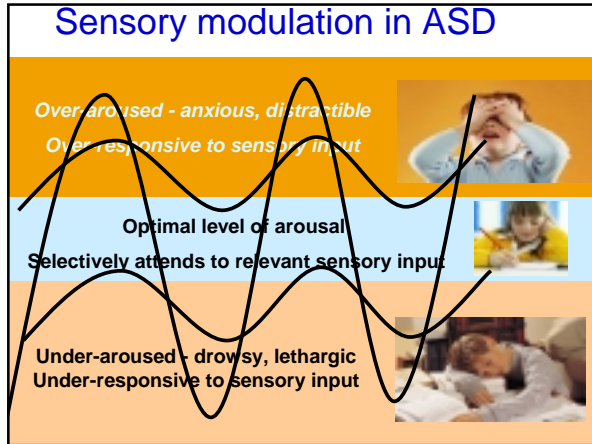
Sensory issues in children with ASD

- Sensory issues are highly prevalent in children with ASD (70-100%).
- Across the spectrum from mild to severe (Dunn et al. 2002; Myles et al., 2004)

Theories used to explain atypical sensory processing in ASD

- Sensory modulation theory** (Royeen & Lane, 1991; Baranek, Reinhartson, Wannamaker, 2001)
- Winnie Dunn's Sensory Processing Theory** (Dunn, 1999)
- Spotlight attention/ mono-processing** (Liss, Saulnier, Fein & Kinsbourne, 2006)
- Enhanced Perceptual Functioning Theory** (Motttron et al., 2006)





Dunn's Model of Sensory Processing (Dunn, 1997)

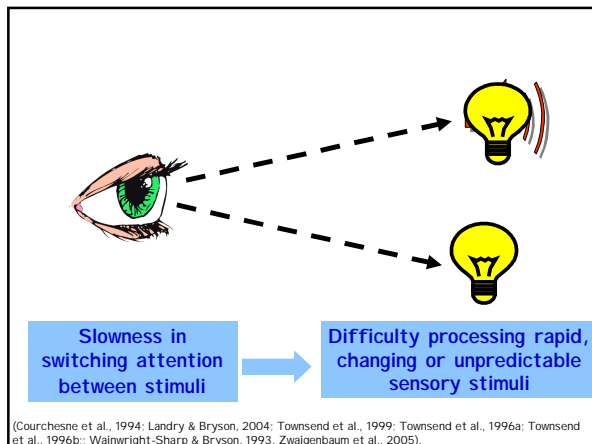
| Neurological threshold | Behavioural response | |
|------------------------|--------------------------------|-------------------------------|
| | Passive | Active |
| High threshold | Low Registration | Sensation seeking |
| Low Threshold | Sensory Sensitivity | Sensation Avoiding |



Spotlight attention / mono-processing

(Liss, Saulnier, Fein & Kinsbourne, 2006)

- Over focused attention is associated with sensory hypersensitivity (Liss et al. 2006)
- May explain idiosyncratic fascinations with or aversions to very specific types of sensory input.
- Unusual sensory interests = item on the Autism Diagnostic Interview






Enhanced Perceptual Functioning Theory

Individuals with ASD have some **superior** sensory/perceptual skills:

- Perception of the finer details of static visual stimuli e.g., pattern analysis, visual search tasks
(O'Riordan et al., 2001)
- Pure tones, melodies
(Bonnell et al., 2003)
- Increased sensitivity to rapidly vibrating touch
(Blakemore et al. 2006)


Enhanced Perceptual Functioning Theory

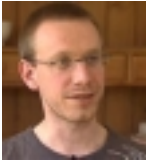
People with ASD are challenged by:

- Processing of moving stimuli 
- Sounds with complex patterns of timing and pitch e.g., speech-like sounds  (Samson et al., 2006)
- Multi-sensory input (e.g., lip movements & speech)  (Magnee et al., 2008)

What effect does this have?

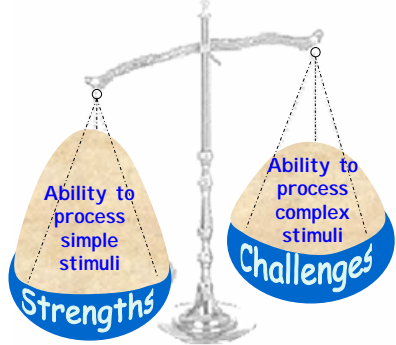
(Mottron et al., 2006)

- People with ASD may be overloaded by heightened perception of **detailed sensory input** & difficulty processing **fast, unpredictable multi-sensory input**. 
- Disrupts development of other behaviours and abilities



Daniel Tammet

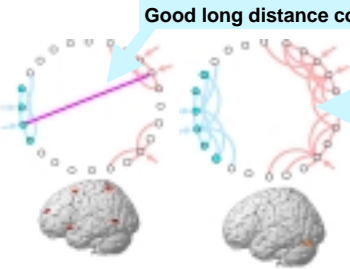
'Trips to the supermarket are always a chore. There's too much mental stimulus. I have to look at every shape and texture. Every price, and every arrangement of fruit and vegetables.... I'm just really uncomfortable.'



(Mottron, Dawson, Soulières, Hubert & Burack, 2006)

Abnormal Connectivity in ASD

Good long distance connectivity



Normal **ASD**

The sensory cortices:

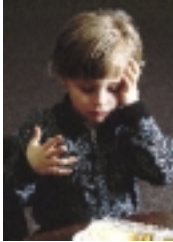
- receive input normally but
- fail to send & receive input from higher order association regions
- difficulty processing **complex sensory input**

(Belmonte, Allen, Bechel-Mitchener, Boulanger, Carper & Webb, 2004; Courchesne, Redcay, Morgan & Kennedy, 2005)


Children with ASD aim to keep the environment predictable

Seeking of predictable, repetitive sensory input

(Gomot, Bernard, Davis, Belmonte, Ashwin, Bullmore et al., 2006)



Children with ASD aim to keep the environment predictable

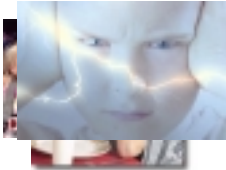


Gunilla Gerland

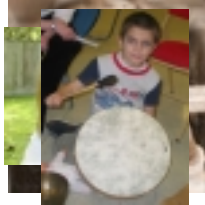
I didn't find it dull eating the same thing all the time, though should it start to become so, that was nothing compared to the mortal danger of risking unknown food.

My teeth were very sensitive and the inside of my mouth – the consistency of some foods could be unpleasant, giving me a horrible feeling all over. With unknown food you never knew what might happen. (Gerland 1997)

Dislikes rapid, changing or unpredictable input sensory input




Likes predictable, repetitive sensory input



Auditory filtering deficits

- Difficulty processing auditory stimuli in the presence of **competing** background noise




(Alcantara, Weisblatt, Moore and Bolton, 2004; Teder-Salajarvi, Pierce, Courchesne, Hilliard, 2005)

Auditory processing difficulties in ASD

Baranek, 1999, Osterling 2002; Werner et al. 2000; Wetherby et al, 2004


Consistent early indicators of autism
(Baranek, 1999, Osterling 2002; Werner et al. 2000; Wetherby et al, 2004)


- Lack of response to name being called
- Lack of attention to voice




- Auditory filtering = most consistently atypical Short Sensory Profile Scores (Adamson et. al. 2006; Ashburner, Ziviani & Rodger, 2008; Rogers et al., 2003; Tomchek & Dunn, 2007)
- Sensitivity to noise = item on the Autism Diagnostic Interview


Why auditory input is difficult to process..

Unpredictable touch can be avoided by avoiding others 

Rapid or unpredictable visual input can be avoided by looking away or focusing on something else 

Environmental noise is almost impossible to escape. 

O'Riordan & Passetti, 2006



Gunilla Gerland


"The whole classroom was all wrong for me...The teacher prattling on was a background to other noises in my ears

- the rustle of paper, the scraping of chairs, coughing I heard everything. The sounds slid in over each other and merged together.

I couldn't shut them out and put the teacher's voice in the foreground...


The fact that on certain occasions I was actually able to listen seemed to emphasize the adult's theory that it was only laziness and disinclination on my part that made me often hear nothing at all." (Gerland, 1997)

The sensory processing issues of children with ASD may impact on...



- Emotional regulation
- Social Skills
- Activities of daily living
- School Performance


Relationship between sensory processing & emotional regulation



- Sensory hypersensitivity associated with increased anxiety (Baker et al. 2007; Ben-Sasson et al., 2008; Pfeiffer et al., 2005)
- Anxiety in children with ASD often associated with sensory input e.g.,
 - dentists (oral sensory input)
 - thunderstorms & balloons (loud unpredictable noise)

(Muris et al. 1998)

Relationship between sensory processing & social skills



(Hilton, Graver & LaVesser, 2006)

- This study has found correlations between sensory processing and social skills
- Social interactions involve fast, unpredictable, multi-sensory input including facial expressions, gestures, & competing speakers.

Sensory processing & daily living skills

(Jasmin et al. 2008; Kay, 2001; Liss, 2001; Saulnier, 2003)



- Dressing issues e.g.,
 - clothing textures
 - seasonal changes in clothing (e.g., short sleeves to long sleeves)
- Toileting issues (Wheeler, 1998) e.g.,
 - sensations of skin on toilet
 - sound of flushing



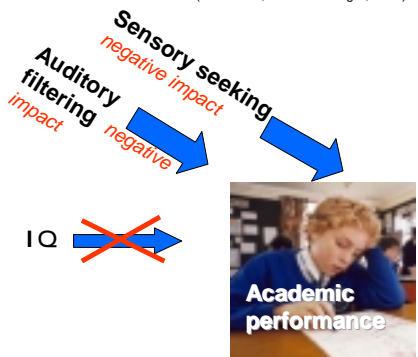
Sensory processing & daily living



- Eating issues (Keen, 2008; Lockner, 2008)
 - Resistance to trying new foods
 - Foods with unpredictable textures (e.g., food with lumps)
- Sleeping issues (Leone & Rogers, 2001)
 - Difficulty modulating arousal
 - Over-responsiveness to noise, tactile input, light may interfere with sleep




Sensory processing & school function on children with ASD (Ashburner, Ziviani & Rodger, 2008)



The diagram illustrates the following flow:


- Sensory seeking** (blue arrow) has a **negative impact** (red text) on **Academic performance**.
- Auditory filtering** (blue arrow) has a **negative impact** (red text) on **Academic performance**.
- IQ** (blue arrow) has a **positive impact** (red text) on **Academic performance**.



Sensory processing & school function on children with ASD (Ashburner, Ziviani & Rodger, 2008)

Auditory filtering
negative impact

Touch sensitivity
negative impact



Strategies to assist children with ASD with sensory processing?

- Education of child and others
- Adjustments to tasks & environments to accommodate the sensory processing style of child
- Specialist techniques aimed at modifying sensory processing

Teach Self-regulation Strategies

- Provide child with strategies to use when they find the environment overwhelming e.g., "Alert Program" "sensory stories"

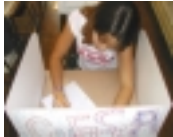


Share information with others in child's environment about sensory processing

- Child's specific sensory processing issues
- Teaching the need to respect other's sensory preferences
- Awareness raising about behavioural indicators

Modifying tasks and environment

- Respect child's sensitivity & avoid sensory overload e.g., avoid placing student with tactile sensitivity in close proximity to others
- Provide a quiet area to work free from auditory and visual distractions




Modifying tasks and environment: visual strategies

Monday schedule

| | |
|--|--|
| | |
| | |
| | |

- Visual organisers for abstract tasks
- Visual timetables
- Computer based instruction



Dr Jill Ashburner - *What Can New Research Tell Us About the Way that People with ASD Process Sensory Input*



Changing sensory processing of child?

- Techniques such as Sensory Integration Therapy & Wilbarger Protocol aim to change the way child processes sensory input
- Lack evidence to support permanent, long term change in sensory processing
- Challenges involved in implementation
 - Intensive & may interfere with other programs
 - Purpose built equipment & environments
- Important to inform others of lack of evidence and use evaluation procedures

