








The Importance of Sensory Processing



What is sensory processing and why it is important?

1. Sensory processing refers to how the brain registers, interprets and uses information from the sensory systems. The sensory systems include sight, hearing, taste, touch, smell, body awareness and balance. (See Table 1)
2. Sensory input from the environment is constantly bombarding our brain through all of our senses. All sensory input except for smell is filtered by the brain stem before being sent to other areas of the brain. The sensory input is either:
 - Screened out or ignored if it is deemed to be unimportant or insignificant. Example: Dust particles in the air. They are all around us but we tend not to see them unless they are in the sunlight or for some reason there is an overabundance of them.
 - Noticed and then assigned relevant importance so that it is sent to the appropriate area of the brain for a response. Example: A car honks at us and we turn and look to see if we need to do anything further.
 - Habituated or eventually ignored if the input is constant or doesn't change much over time. Example: Wearing a watch or ring.
3. The brainstem is responsible for the regulation of many bodily functions including breathing, heart rate, swallowing and temperature. From a sensory perspective, it also controls or regulates our arousal from sleep to wakefulness. This is an important concept as we can use sensory input to change our arousal state.
4. We *need* sensory input in order for our brain to develop and to continue to function properly. Although there is still much more to learn about brain function, research suggests that we may be able to use sensory input to develop improved neural circuitry. It is also important to know that neural plasticity, the ability of the brain to form new neural connections, has been found to continue throughout our lifespan.

Table 1
Location and Functions of the Sensory Systems

| System | Location | Function |
|--|--|---|
| Tactile (touch)  | Skin – density of cell distribution varies throughout the body. Areas of greatest density include mouth, hands, and genitals. | Provides information about the environment and object qualities (touch, pressure, texture, hard, soft, sharp, dull, heat, cold, pain). |
| Vestibular (balance)  | Inner ear – stimulated by head movements and input from other senses, especially visual. | Provides information about where our body is in space, and whether or not we or our surroundings are moving. Tells about speed and direction of movement. |
| Proprioception (body awareness)  | Muscles and joints – activated by muscle contractions and movement. | Provides information about where a certain body part is and how it is moving. |
| Visual (sight)  | Retina of the eye – stimulated by light. | Provides information about objects and persons. Helps us define boundaries as we move through time and space. |
| Auditory (hearing)  | Inner ear – stimulated by air/sound waves. | Provides information about sounds in the environment (loud, soft, high, low, near, far). |
| Gustatory (taste)  | Chemical receptors in the tongue – closely entwined with the olfactory (smell) system. | Provides information about different types of taste (sweet, sour, bitter, salty, spicy). |
| Olfactory (smell)  | Chemical receptors in the nasal structure – closely associated with the gustatory system. | Provides information about different types of smell (musty, acrid, putrid, flowery, pungent). |

Excerpted from: Asperger Syndrome and Sensory Issues – Brenda Smith Myles et al.

Brain research has shown us that:

- Touch input stimulates the release of nerve growth factor, which acts as a fertilizer for developing neurons in the brain. Soothing, comforting touch or “pressure touch”, helps to develop “relaxed brain chemistry” so that we can focus and attend. (Light touch is alerting and tends to cause a “fight/fright/flight” reaction in some individuals.)
- We need to “use it or lose it” – neural plasticity allows us to form new neural circuits but we need to use and reuse these circuits so that they can become engrained (strengthened). Otherwise, unused neurons are “pruned” away or are recruited for use in other circuits.
- Heavy work (such as exercise) or activities that stimulate the proprioceptive system (body awareness) impact on serotonin levels in our brain. Serotonin helps to regulate our level of arousal/alertness (it is often called the “master modulator”) and gives us a feeling that “all is well with the world”. Serotonin also helps regulate the levels of other brain chemicals such as dopamine and norepinephrine which are also important for memory, concentration, and for motivating us. John J. Ratey, M.D., associate professor at Harvard and author, says “exercise is like taking a little Prozac or a little Ritalin at the right moment”.

Sensory Processing Difficulties:



- Most of us tend to take care of our sensory needs without even thinking about it and it is usually just part of our day to day functioning. We also tend to have our own sensory preferences, that is, we engage in activities that we like to help us to maintain an optimal level of arousal and keep us feeling “just right”. Understanding our own sensory preferences can help us to better understand the needs of others. (For “homework” you can complete the Sensory Motor Preference Checklist & Parent Sensory Tools Survey attached to this handout).
- Sensory processing difficulties *may affect anybody* and they can range from mild to severe. They tend to be more common and/or severe in those who have such conditions as autism, Tourette syndrome, Fragile X, learning disabilities etc.
- Difficulties with sensory processing can impact on one’s productivity and it can severely restrict and limit one’s enjoyment and participation in life. In children, it can result in poor self esteem, avoidance behaviours & unexplained outbursts, decreased social skills & participation in play, difficulties with daily life skills at home & school, anxiety, poor attention, poor regulation of reactions to others, and poor motor skill development.
- Many children with sensory processing difficulties have difficulty modulating (regulating) their responses to sensory input and may not be able to maintain a calm, alert state. Sensory modulation refers to the ability of the nervous system to have a “middle ground” or “comfort zone” of regulation as the person interacts with the challenges of daily life. A child with a sensory processing problem may have poor modulation with a narrow “comfort zone”. (See Figure 1 – Response to Sensory Events over Time).

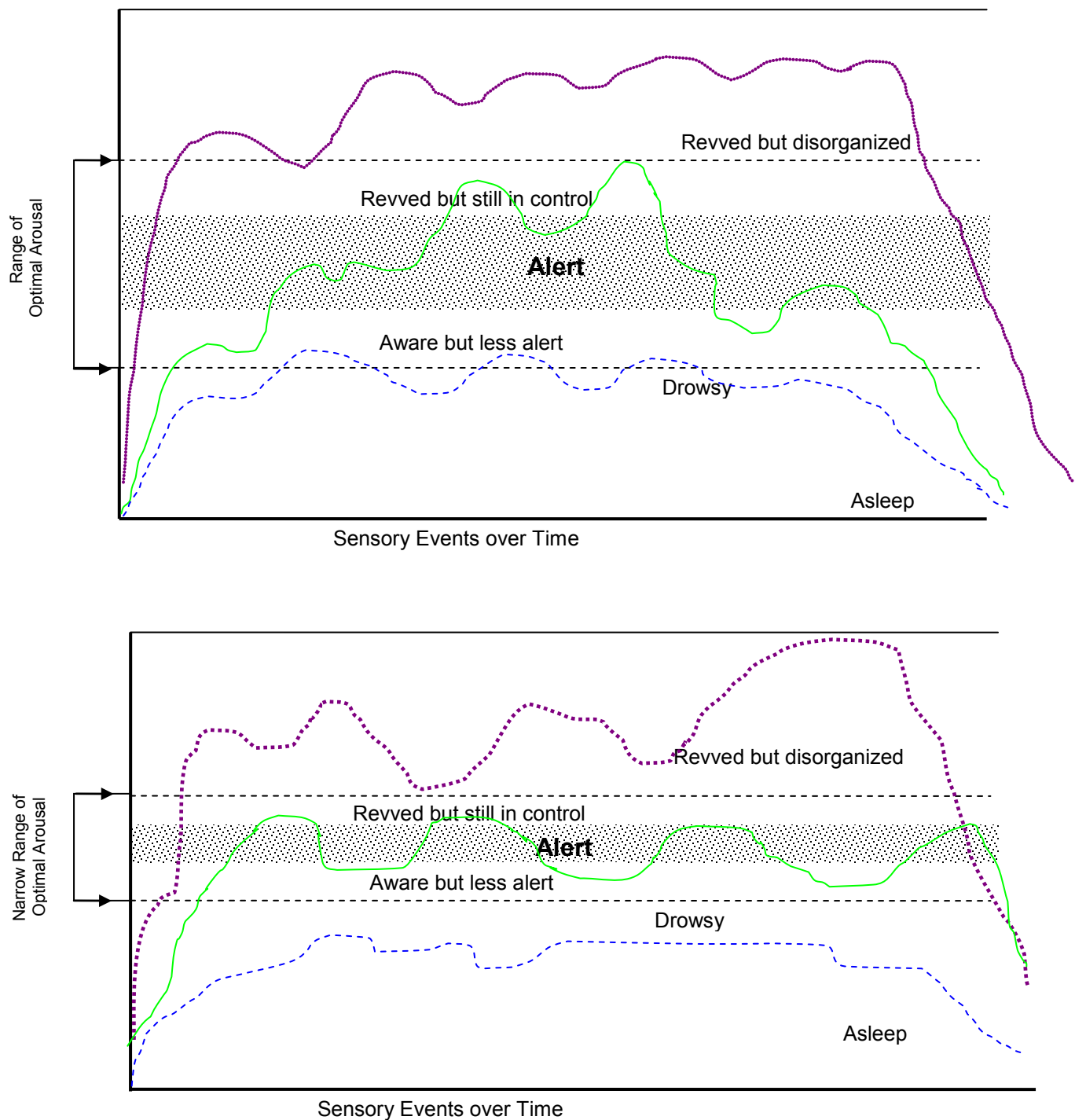
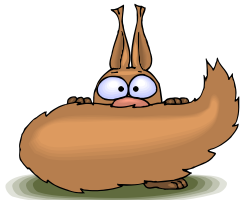


Figure 1 – Response to Sensory Events over Time.

These graphs represent arousal levels over the course of a day. The top graph encompasses a typical zone of alertness and allows for greater fluctuations and recovery from events. The bottom graph represents a narrow comfort zone that doesn't allow for much flexibility in responses.

Types of Sensory Processing Difficulties:

** These sensory processing difficulties do not necessarily occur in isolation. An individual may have a combination of these processing difficulties in response to different types of sensory input. They are described separately to illustrate the different ways that an individual may respond to sensory information.*



- The child who is a **sensory avoider** is easily over aroused but he takes action to try and keep this from happening. This child may appear to be quiet and withdrawn. He keeps an open eye on all that is happening around him and thus has difficulty concentrating or focusing for learning. He may appear to be fearful or at times uncooperative. This child needs predictability and consistency to help him cope. Calming vestibular activities and proprioception throughout his day will help him to be more relaxed and able to focus. Honour his feelings and encourage more gradual involvement in activities.



- The child who is a **sensory seeker** may always seem to be in motion. He will have difficulty attending and may be impulsive in his actions. He needs the extra sensory input to be focused and on task but can become over aroused. This child tends to take a lot of risks and may be somewhat uncoordinated and clumsy. He needs to have scheduled activities that modulate – heavy work, aerobic exercise, use of hand fidgets, keeping a water bottle with a straw on his desk.



- It doesn't take much to send the **sensory sensitive** child into over arousal. He may be said to have a low threshold for sensory input. This child has difficulty focusing and is easily distracted. He may appear to react negatively to situations and his reactions may appear to be out of context to the situation. For this child, it is important to provide sensory input that is calming and soothing. Lower the lighting, talk softly, provide pressure touch, play relaxing music and provide a safe place for this child to retreat to when he needs to lower his arousal. Consistency in routine, preteaching and preparation for change will help this child to cope better.

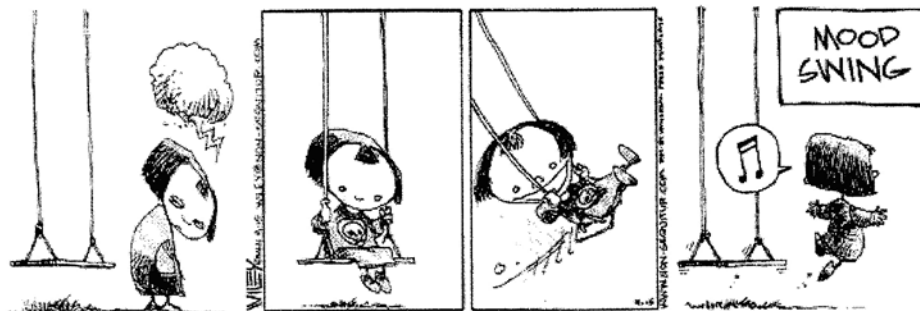


- The child who has **low registration of sensory input** may appear lethargic or seem to “let the world pass him by”. He may need more intense and varied sensory input to achieve a just right state for learning. This child generally appears to be uninterested or to have difficulty attending. It takes a lot of input to keep this child at an optimal arousal level. Novelty will also help him to be more alert and focused. You may want to increase the intensity of sensory input that this child receives – use movement activities such as aerobic exercise to start the day, movement breaks such as walking to get a drink or deliver a note to the office, brighter lighting, highlighting of important information on the workpage, upbeat background music.

Environmental Considerations for Enhancing Sensory Processing:

1. **Colour** – hues of blue, violet and green are generally calming and organizing (nature colours), whereas bright colours such as red, orange and yellow are alerting. Try to keep the colour scheme monochromatic and allow for blank or neutral space (beige, pale yellow, neutral colours for main wall space). Blues and greens can be used for areas that provide calming opportunities (e.g. a reading or quiet work area) and to cover busy visual areas. Bright colours can be used sparingly to draw one's attention to important details or areas of information (e.g. a red frame around the daily schedule).
2. **Visual Input** – busy cluttered environments tend to be distracting and disorganizing. Try to decrease visual clutter – put solid coloured curtains/tablecloths over shelves, take down hanging objects and artwork, simplify or organize bulletin boards, dim the lighting, use natural or incandescent lighting where possible, and use a solid wall colour instead of having “stimulating” visuals everywhere. Be aware that florescent light flickers and may be bothersome to individuals with visual sensitivity. Having plants (real or artificial) in the room can increase serotonin levels. A classroom setup with specific, well defined functional areas along with adequate space for moving around can be very organizing.
3. **Auditory input** – in general, use a quiet voice, provide relaxing music (classical, nature sounds), have headphones available and *encourage their use*, have a study carrel or similar set up available for children to work in. For children who have low registration, you may want to play more upbeat music and use a more animated voice. You also need to be aware of background noise and its effect on your child's arousal level. You may not be aware of the humming of lights or a ticking clock, but your child may be very irritated by it.
4. You can set up different **sensory spaces** for your child to help with sensory processing. At school, the classroom can also be divided into different zones or spaces as well.
 - A work space (brain power space): At home, have a specific area set up for homework that is free from distractions. Ensure easy access to all materials and tools that are required. At school, this usually is the area where the children's desks already are, and the materials they need to refer to are close by. For children who are easily distracted, a traditional classroom set up (desks in rows or in a horseshoe shape) seems to work best.
 - A quiet space (mother space) – this might be a room or area that has solid colours on the walls and cupboards, plants, cushions, headphones, books, and other quiet activities. At home, this might be in the family/rec room or the child's bedroom. At school it might be a quiet corner with pillows, books etc.
 - A place to escape when you are overwhelmed (womb space) for kids who have difficulty modulating their arousal level - at home, the child's bedroom may serve this purpose. A heavy blanket can be very calming for some children. At school – try pillows, a blanket or sheet over a table or an area that is blocked off from the rest of the class (a small children's tent works great for younger children). For older children, a “student lounge” with a comfy couch and rocking chair may work well.
 - A movement or “heavy work” space (kid power space) such as a corner with therapy balls, exercise mats, access to therapy putty, small weights etc. For older children, exercise equipment such as a treadmill, stepper or stationary bike work well. Don't forget about using the local park, community centre and playground equipment. Individual activities such as martial arts, swimming, yoga or jogging are good for overall fitness as well as maintaining a calm alert state. At school, movement and “heavy work” activities can be built into the daily schedule and are especially helpful at transition times.

Sensory Strategies for that Just Right State:



1. Implementing a “sensory diet” can help your child to achieve and maintain optimal sensory processing. The activities that are included in a sensory diet are based on assessment results (info from parents and school staff, questionnaires and clinical observations) and are tailored to your child’s specific sensory needs. They need to be implemented consistently throughout your child’s day to maintain a calm, alert state. Implementing these activities will help to prevent or reduce the chances of your child becoming too high or too low.
2. Try providing proprioceptive input – heavy work or activities that are done against resistance tend to be modulating (self-regulating) – if a child is too high or too low, it will bring him back into a calm, alert state. The effects of this type of input usually stay in the central nervous system (CNS) for up to 1 ½ - 2 hrs. These types of activities are the safest to use if you are unsure of your child’s arousal level as they are thought to enhance the release of serotonin which is the master modulator. Proprioceptive input tends to be very organizing for the central nervous system. Examples include: aerobic exercise, carrying groceries, yard work, sweeping, vacuuming, wiping tables, tug of war games, and rough housing. At school try exercise, moving desks, carrying books, animal walks (for younger students), chewy snacks, running an errand to the office (something that has some weight to it like a few books), hand presses, hand pulls, and chair pushups.
3. Movement or vestibular input can have alerting or calming effects depending on the type of movement involved. Fast movement in a variety of directions tends to be alerting, while slow, rhythmical movement tends to be calming. Vestibular input is powerful and its effects on the brain can last for 4 – 6 hrs. (Note: For some children with disordered sensory processing, the effects can be quite delayed). Examples: jumping games, bouncing on a therapy ball, using a rocking chair, sitting on a therapy ball for school or while watching TV, swinging, jumping on a mini trampoline. (Spinning is generally not recommended as it tends to be disorganizing).
4. Pressure touch tends to be calming and can enhance dopamine (pleasure chemical) which helps us to have reduced stress chemistry in our brain. This is important as increased stress chemistry interferes with learning. Examples of pressure touch input include: back rubs, pressing the child between two mats or a beanbag, rolling a therapy ball back and forth over the child with downward pressure, hand hugs, and self hugs.
5. For fidgety children – allow doodling, let them keep a fidget toy in their pocket or in their desk (one that is quiet and not distracting for other children), allow for gum chewing (with specific rules!), and provide or suggest chewy snacks. Taking a movement break or running an errand may also help. Contrary to popular belief, these types of activities can help with attention and focus in the classroom.
6. Let children keep water bottles on their desk – the sports type with straws are best as the input from sucking through a straw tends to be calming and organizing for the brain. Drinking smoothies and milkshakes through a straw provides even more oral input that can help with focus and attention.

**** These suggestions are general in nature and are not meant to replace an assessment and/or intervention by an OT.***

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Suggested Reading:

1. The Out-of-Sync Child – Carol Stock Kranowitz
2. The Out-of-Sync Child Has Fun – Carol Stock Kranowitz
3. 101 Activities for Kids in Tight Spaces - Carol Stock Kranowitz
4. Sensory Secrets – How to jumpstart learning in children – Catherine Chemin Schneider
5. Asperger's Syndrome and Sensory Issues – Brenda Smith Myles et al.
6. Smart Moves – Why Learning is Not All in Your Head – Carla Hannaford
7. Building Bridges through Sensory Integration – Ellen Yack et al.
8. How does your engine run? The Alert Program for Self Regulation – Mary Sue Williams & Sherry Shellenberger
9. The SI Toolchest for Teachers, Parents & Children – Diana Henry
10. SI Tools for Parents – Diana Henry
11. SI Tools for Teens – Diana Henry
12. The Sensory Sensitive Child: Practical Solutions for Out-of-Bounds Behaviour – Karen A. Smith & Karen R. Gouze
13. Too Loud, Too Bright, Too Fast, Too Tight: What to do if you are sensory defensive in an overstimulating world – Sharon Heller
14. Unlocking the Mysteries of Sensory Dysfunction – Elizabeth Anderson & Pauline Emmons
15. Raising a Sensory Smart Child: The Definitive Book for Helping Your Child with Sensory Integration Issues – Lindsay Biel & Nancy Peske
16. Fidget to Focus – Outwit Your Boredom: Sensory Strategies for Living with ADD – Roland Rotz & Sarah D. Wright

Online Resources:

<http://www.henryot.com/index.asp>

Sensory integration tools for home & school

<http://www.skillbuildersonline.com/SBA/Index.asp>

Articles, activities, crafts and worksheets, buying toys

<http://www.sifocus.com/>

Sensory Integration Focus Magazine

<http://www.spdnetwork.org/>

Sensory Processing Disorders Network

Very good resource and information site

<http://www.sensorysmarts.com/index.html>

Website companion to Raising a Sensory Smart Child.

Lots of good information and helpful tips

<http://www.si-challenge.org/>

SI Challenge

Parent to parent support, camps, resources

http://www.comeunity.com/disability/sensory_integration/

Children's Disabilities and Special Needs

Sensory Integration articles, prematurity and SI, feeding and SI, oral and tactile defensiveness

<http://www.pfot.com/>

Pocket Full of Therapy

Catalog of products and toys; Idea exchange

<http://www.sensorycomfort.com/>

Sensory Comfort: *Making Life More Comfortable for Children and Adults who have Sensory Processing Differences*

www.alertprogram.com

TherapyWorks: The Alert Program: How does your engine run?

www.toystoolsandtreasures.com

Toys Tools and Treasures: online store for sensory tools and more.