

## OUR SENSES AND SENSORY PROCESSING DISORDER (SPD) IN INDIVIDUALS WITH AUTISM

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### Abstract

Sensory integration (SI) is the foundation that allows for complex learning and behaviour. There are now eight sense organs as compared to the earlier traditional five senses. In this paper the new sense organs as well as the traditional ones are described. The importance of sensory integration and how assessment tools help is also discussed.

**Keywords:** Sensory Processing Disorder, Sensory integration, autism, assessment tool

### Introduction

**Sensory integration (SI)** is the foundation that allows for complex learning and behaviour. Sensory integration is a term that has been used to describe processes in the brain that allow us to take information we receive from our 5 senses, organize it, and respond appropriately. We are all familiar with the five senses that humans have. These sense organs help us in every aspect of our daily life. The sensing organs associated with each sense send information to the brain to help us understand and perceive the world around us. They are instrumental in our learning process too. These sense organs seem to work seamlessly and most of the time automatically without the conscious human effort. The importance of the sense organs is appreciated by the general public usually when something is wrong in one or more sense organs.

### The traditional five sense organs

1. **Sight or vision** is the capability of the eyes to focus and detect images of visible light and generate electrical nerve impulses for varying colors, hues, and brightness. Visual perception is how the brain processes these impulses viz.

recognising, differentiating and interpreting visual stimuli through comparison with experiences made earlier in life.

2. **Smell or olfaction** is our ability to detect scent like chemicals, odour molecules in the air. Our olfactory system begins in our nose which has hundreds of olfactory receptors. Odour molecules possess a variety of features and, thus, excite specific receptors more or less strongly. This combination of excitement is interpreted by the brain to perceive the 'smell'. How olfactory information is coded in the brain to allow for proper perception is still being researched and the process is not completely understood, however, what is known is that the chemical nature of the odorant is particularly important, as there may be a chemotopic map in the brain.
3. **Taste or gustation**, refers to the capability to detect the taste of substances such as food, certain minerals, and poisons, etc. The sense of taste is often confused with the "sense" of flavour, which is a combination of taste and smell perception. Humans receive tastes through sensory organs called taste buds concentrated on the upper surface of the tongue. There are five basic tastes: sweet, bitter, sour, salty and umami.
4. **Hearing or audition**, is the ability to perceive sound by detecting vibrations, changes in the pressure of the surrounding medium through time, through an organ such as the ear. As with sight, auditory processing relies on how the brain interprets, recognises and differentiates sound stimuli.
5. **Touch:** Touch is thought to be the first sense that humans develop. Touch consists of several distinct sensations communicated to the brain through specialized neurons in the skin. Pressure, temperature, light touch, vibration, pain and other sensations are all part of the touch sense and are all attributed to different receptors in the skin.

Recent studies have shown that humans possess more than five sense organs of vision, hearing, smell, taste, and touch. Three more sense organs are there in each human viz. proprioception, vestibular system and interoception.

6. **Proprioception:** Proprioceptive sense reports on sensations from muscles, ligaments and joints, providing information about the compression and stretching of muscles and joints. Proprioception and touch together form the somatosensory pathway, considered essential for praxis and movement [1]. Proprioception is the sense of the relative position of neighbouring parts of the body and strength of effort being employed in movement. This sense is very important as it lets us know exactly where our body parts are, how we are positioned in space and to plan our movements. Examples of our proprioception in practice include being able to clap our hands together with our eyes closed, write with a pencil and apply with correct pressure, and navigate through a narrow space.
7. The **vestibular system** provides information on movement, gravity and balance, so it is crucial for the building of spatial and temporal relationships [2] It also provides information about the speed and the direction of the head movement and our position with relation to gravity [3]. The vestibular system explains the perception of our body in relation to gravity, movement and balance. The vestibular system measures acceleration, g-force, body movements and head position. Examples of the vestibular system in practice include knowing that you are moving when you are in an elevator,

knowing whether you are lying down or sat up, and being able to walk along a balance beam.

8. **Interoception** sense processes sensory stimuli within the body, including body sensations (hunger, thirst, body temperature, heart, breathing rate, etc.) and emotional states (happiness, sadness, shame, anger), being intimately related to self-regulation and well-being [4,5].

### **Sensory integration (SI)**

**Sensory integration (SI)** is the neurological process that organizes sensation from one's own body and the environment and makes it possible to use the body effectively within the environment.

Though similar these two terms Sensory integration and Sensory processing are different in their meaning.

**Sensory processing** is the brain receiving, interpreting, and organizing input from all of the active senses at any given moment.

### **Importance of Sensory integration (SI)**

- a. SI is necessary in order to able to use the body effectively within the environment.
- b. SI is the foundation that allows for complex learning and behavior.
- c. SI is founded on the following 7 senses: Visual, auditory, touch, smell, taste, vestibular (pull of gravity) and proprioception (body awareness and movement)
- d. Our brain takes in the information from the senses and uses it to form a full picture of who we are, where we are, and what is going around us. This picture can only be formed through the critical process of SI

### **Sensory processing disorder (SPD) in individuals with ASD**

Sensory processing disorder (SPD) is a neurological disorder in which the ability to process and interpret sensory stimuli results in abnormal responses, causing a decrease in the quality of life and occupational performance. Most children with autism spectrum disorder (ASD) exhibit symptoms of SPD [6], this condition is also common in children who have other developmental disabilities and may occur in typically developing children [7].

### **Measurement of the SI in individuals with ASD**

SI issues are commonly reported in ASD, compared to their peers [8]. For the assessment of the severity of ASD should be complete and comprehensive and must include the measure of the SI and its impact in daily life.

The Autism Spectrum Disorders Inventory developed by Rivière in 2002 [9] is a widely used tool both in Spain and Latin America. Originally the tool had four groups and 12. Later it was formed by five groups and 15 dimensions, The Rivière's Inventory is useful both during the

diagnosis and intervention processes. Preferred scores for rating the Inventory are the even ones, while odd scores are used to describe intermediate stages.

### Summary of Rivière's Autism Spectrum Inventory

Disease groups	Dimensions	Levels	Scoring
I. Relationship disorders	1. Social relationship	Level 1	More difficulties
	2. Joint reference		8 points
	3. Intersubjective and mentalization		- 7 points
II. Communication disorders	4. Communication functions		6 points
	5. Receptive language	Level 2	- 5 points
	6. Expressive language	4 points	
III. Anticipation and flexibility disorders	7. Anticipation	Level 3	- 3 points
	8. Flexibility	2 points	
	9. Activity meaning	Level 4	- 1 points
IV. Symbolization disorders	10. Fiction	0 points	
	11. Imitation	Less difficulties	
	12. Suspension		
V. Sensory Integration disorders	13. Modulation		
	14. Discrimination		
	15. Sensory-based motor		

### Limitations of using Autism Spectrum Disorders Inventory developed by Rivière

Most often the parents of individuals with ASD fill up the form. Sometimes the true difficulties are not highlighted. Some parents might overestimate or underestimate the development of their children.

### Conclusion

Children with autism spectrum disorder (ASD) experience many challenges that affect their ability to function. The perception of individuals with autism is often very different from those of the neuro-typical population [10]. Their ability to function is often hampered by Sensory processing disorder. As SI is important for learning and in daily life it helps if there is a scoring system for the assessment. Rivière's Inventory is one such assessment tool.

### Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this work.

### Reference

1. Ackerley, R.; Kavounoudias, A. (2015). The role of tactile awareness in shaping motor behaviour and implications for prosthetic innovation. *Neuropsychologia*, 79, 192–205.
2. Pfeifer, C.; Serino, A.; Blanke, O. (2014). The vestibular system: A spatial reference for bodily self-consciousness. *Front. Integr. Neurosci.* 8, 31.
3. Lane, S.J.; Mailloux, Z.; Schoen, S.; Bundy, A.; May-Benson, T.A.; Parham, L.D.; Roley, S.S.; Schaaf, R.C. (2019). Neural Foundations of Ayres Sensory Integration®. *Brain Sci.*, 9, 153.
4. Mahler, K.J.; Craig, A.D. (2016). *Interoception: The Eighth Sensory System: Practical Solutions for Improving Self-Regulation, Self-Awareness and Social Understanding of Individuals with Autism Spectrum and Related Disorders*; AAPC Publishing: Shawnee Mission, KS, USA, ISBN 978-1-942197-14-0.
5. Mehling, W.E. (2015). Interoception, contemplative practice, and health. *Front. Psychol.*, 6, 763.
6. Ismael, N.; Lawson, L.M.; Hartwell, J. Relationship Between Sensory Processing and Participation in Daily Occupations for Children with Autism Spectrum Disorder: A Systematic Review of Studies That UsedDunn’s Sensory Processing Framework. *Am. J. Occup. Ther.* **2018**, 72.
7. Tomchek SD, Dunn W. (2007). Sensory processing in children with and without autism: a comparative study using the short sensory profile. *Am J Occup Ther* 2007; 61:190–200.
8. Schaaf, R.C.; Lane, A.E. (2015). Toward a Best-Practice Protocol for Assessment of Sensory Features in ASD. *J. Autism Dev. Disord.*, 45, 1380–1395.
9. Rivière, A. (2002). *IDEA Inventario de Espectro Autista*; Fundec: Buenos Aires, Argentina, 2002.
10. Dunn,W. (2001). The Sensations of Everyday Life: Empirical, Theoretical, and Pragmatic Considerations. *Am. J. Occup. Ther.*, 55, 608–620.