



SENSORY INTEGRATION: A Practical Look at the Theory and Model for Intervention

By Megan Carrick, MOTR/L

INTRODUCTION

How are we able to react so quickly, unconsciously for that matter, when we start to experience a fall? Why is it that we can ride a bike without much thought of what our feet, hands, eyes, and ears are doing or how they work together? How is it that we can learn new dance steps just by watching others and following their lead? When our nervous system and brain work together, we can engage in a dialogue with our environment. It is the function of the brain and nervous system working together that allows us to experience and communicate with our world, for example, engaging in things as simple as a smile or as complex as a double backflip off a diving board. This concept of a body-environment dialogue is best known as the theory of sensory integration. It is the unconscious process by which we “organize sensation for use” (Ayres, 2005). Effective sensory integration gives meaning to our experiences by tuning into the important information and dismissing or filtering out the unimportant. It allows us to respond to the world around us both purposely and successfully with what is referred to as an adaptive response (Ayres, 2005).

Efficient sensory integration allows us to reach and sustain a state of physiological

and emotional homeostasis that we call regulation. While the environment can often inundate us with sensory stimuli, we learn what sensory inputs help us feel good, what sensory information to tune into, and what sensory information to filter out. This process is necessary to reach and sustain the state of arousal that is organizing, calming and, therefore, regulating, (Greenspan & Wieder, 1998). No two people experience sensory information the same way; rather, each person has a unique sensory profile. Therefore, by providing our nervous system with the right types of sensory stimuli, we can become calm and stay that way, for the most part. When we are calm and regulated, we can attend to the world around us and take interest in people, objects, and experiences. Sensory and motor experience, or lack thereof, can cause us to become dysregulated. If we experience too much sensory stimuli or too little, we may become overly excited or shut down. These arousal states, overly excited and shutdown, are forms of dysregulation. When we are in these states, we need to nourish our arousal via sensory information and sensory motor experiences. Children and adults who suffer from sensory integration challenges lack the efficient processing of sensory information,



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Because we all have a unique sensory profile, our perceptions truly are our own. While we may experience many similarities in our perceptions, when comparing them to others, we will never experience a situation in the exact same manner as any other person. This is important to remember as we think about people with challenges in processing and integrating sensory information. What feels good to us does not feel good to everyone; what bothers us will not necessarily bother others; and what helps us become regulated will not work for all. Essentially, it is impossible to experience the world like any other person. Therefore, as professionals and family members working with children, it is imperative that we gain a true sense of these differences to promote the most effective supports and the highest quality of care for each child.

HISTORY

In the 1950s, Dr. A. Jean Ayres began her work defining the model of sensory integration theory, evaluation, and intervention. She published *Sensory Integration and the Child* in the

late 1970s and published a great deal of research throughout her career (Ayres, 2005). The theory of sensory integration has been a staple in pediatric occupational therapy evaluation and intervention for many years and continues to be a much researched and implemented model.

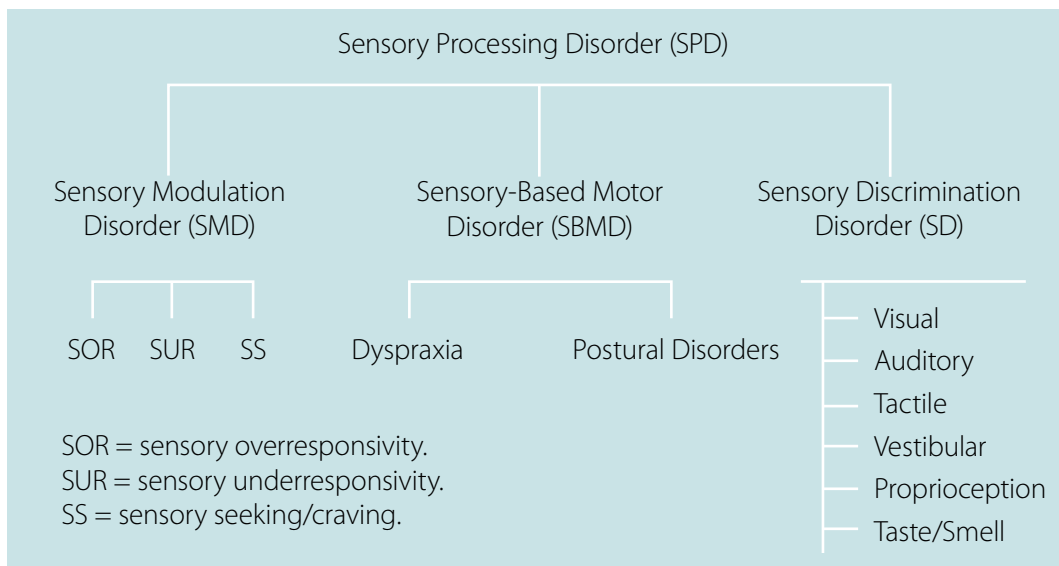
SENSORY INTEGRATION AT WORK

Sara is a 3-year-old girl attending her first ballet class. She is eager to dance and has been practicing ballet for several months as her mother has been teaching her some of the basic concepts per Sara's request. She enters the class, a drop off class with a window for her mother to watch from, and is greeted by her teacher. The teacher, Miss Mary, reaches out to touch Sara on the shoulder as she introduces herself. She asks Sara why she is taking ballet, while still placing a gentle hand on her shoulder. Sara looks to her mother and sees in her mother's face and eyes that it is safe and quite expected to respond to Miss Mary. Sara (in her very big girl voice) replies, "I want to dance like the ballerinas in my book!"

Miss Mary smiles and responds quite pleased, "That is good news because here we learn how to dance like real ballerinas." Miss Mary then gently leads Sara into the classroom with the hand placed on her shoulder, and Sara turns to

wave at her mother through the observation window.

In this example, Sara relies on her visual, tactile, auditory, vestibular, and proprioceptive systems to support her adaptive responses. She first relies on the visual and auditory systems to take in the setting, the words of her teacher, and the expression on her teacher's face. She listens for tone of voice and volume, and she looks for affective cues in the teacher and her mother's facial expressions as she works to gain a sense of the new adult's intentions based on how she is communicating to Sara. Sara relies on her tactile system to perceive, discriminate, and accurately interpret the hand on her shoulder. She then relies on her proprioceptive (sensations of the muscles and joints) and vestibular (sensation of head and



neck movement in any direction) systems in concert with her visual, tactile, and auditory systems to allow her to move across the room given a subtle tactile cue from her teacher. Sara's nervous system sends rapid electrical impulses to the brain where many centers are involved in quickly distributing, sharing, and essentially integrating the multitude of information. Because Sara can gain an accurate read on her environment quickly, she is able to respond adaptively by engaging in a way that demonstrates her intention while meeting the demands of the immediate situation.

If in fact Sara were a child with a sensory processing disorder, she would likely have a very different experience. The ability to meet environmental expectations and demands may be compromised by poor processing and poor integration; this leads to maladaptive responses to many daily situations – even those that are quite routine.

DIAGNOSIS

The theory of sensory integration has led to the use of assessment tools and intervention to promote qualitative changes in a child's regulatory capacities and observable behaviors in their daily life. Recent literature suggests a new system for classification of *sensory processing disorders* (SPD) to help provide greater diagnostic specificity (Miller, Anzalene, Lane, Cermak, & Osten, 2007).

Miller and colleagues have proposed a new nosology for diagnosing sensory processing disorders as illustrated in figure 1 above.

NOSOLOGY DEFINITIONS

The proposed nosology suggests three patterns including sensory modulation disorders, sensory-based motor disorders and sensory discrimination disorders. Each pattern then has greater definition in varying subtypes. It is often the case that many of these subtypes

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are concomitant with other subtypes, further evidence of the unique sensory profile differences among individuals (Miller et al., 2007).

Pattern 1 – Sensory Modulation Disorders (SMD)

This pattern is intended to help us better identify children who struggle with a difficulty responding to sensory input with adequately graded responses in relation to the stimulus. Children with modulation disorders will often respond inconsistently and demonstrate some inflexibility adapting to their immediate environment (Miller et al., 2007).

Pattern 1, Subtype 1: Sensory Overresponsivity (SOR)

Miller and colleagues suggest these children may:

- Be faster than peers.
- Demonstrate an overall greater intensity.
- Sustain intensity for longer periods of time.
- Struggle with modulation in one or more systems.
- Struggle in novel situations or with transitions.
- Exhibit more intense responses to stimuli; this may occur when unexpected stimuli is presented.
- Experience sensory input as having a summative effect; responses are linked to accumulated events of the day.
- Demonstrate behaviors that include a wide range from active and intense to more passive and withdrawn.

Pattern 1, Subtype 2: Sensory underresponsivity (SUR)

Miller and colleagues suggest these children may:

- Experience difficulty responding to stimuli in changing environments.
- Demonstrate lack of awareness of sensory stimuli, which may then lead to a lack of interest or the ability to initiate motor exploration and interactions with others.
- Have a tendency to be withdrawn, apathetic, and difficult to engage or disinterested in their immediate environment.
- Have limited reaction or response to pain, temperature, or other intense stimuli.

Pattern 1, Subtype 3: Sensory Seeking (SS)

Miller and colleagues suggest these children may:

- Crave a great deal of sensory stimuli across environments.
- Have intense preferences (e.g., movement, food, auditory, visual, etc.).
- Engage in an inappropriate social mannerisms and sometimes demonstrate poor safety awareness across environments.
- Struggle completing expected tasks, especially those that are not of his/her own volition.
- Appear impulsive and disorganized.

Pattern 2 – Sensory Discrimination Disorder (SDD)

SDD highlights patterns of sensory processing that are disrupted in the interpretation of the quality of sensory stimuli. Sensory discrimination challenges may occur in one or more than one system. In addition, the discrimination challenges impair the ability to identify the similarities and differences among stimuli. When someone struggles with discrimination, they may experience difficulty in identifying the *what* and *where* of the stimuli. Their response time may be slower as they require more time to make sense of the meaning, and this then leads to often slower planning and sequencing. Children with SDD can demonstrate awkward motor planning and praxis abilities (learning a new motor plan or sequence, such as riding a bike, skiing, dancing etc.), challenges with learning, compromised self-confidence and poor body scheme. It is important to keep in mind that this may also be concomitant with one or more sensory processing disorders, as well (Miller et al., 2007).

Pattern 3 – Sensory-Based Motor Disorder (SBMD)

The two subtypes presented here, dyspraxia and postural disorders, suggest difficulty with planning, praxis, sequencing, fluidity, and control of movement as a result of sensory challenges (Miller et al., 2007).

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Pattern 3, Subtype 1: Postural Disorders (PD)

People with PD may prefer a more passive sedentary lifestyle, avoiding movement, or a more active lifestyle with a lack of postural control leading to unsafe movements (Miller et al., 2007). Miller and colleagues suggest these children may exhibit:

- Difficulty maintaining postural stability necessary to meet the demands of both static and dynamic movement.
- Inappropriate muscle tone, either hypotonic or hypertonic tone.
- Insufficient muscle activation.
- Insufficient control during movement.
- Poor righting and equilibrium reactions.
- Inefficient weight shifting and trunk rotation capacities.
- Insufficient balance between the flexion and extension patterns of body parts.
- May demonstrate inefficient execution of motor tasks.

Pattern 3, Subtype 2: Dyspraxia

Miller and colleagues suggest that these children may:

- Seem unsure of where they are in space.
- Be accident prone.
- Experience difficulty with projected action sequences that require timing.
- Demonstrate difficulty grading force of movement
- Have challenges related to ideation of movement.
- Require more time and practice to learn a new skill and struggle with their ability to generalize the new skills to other motor tasks.
- Have difficulty with complex motor task execution, even those that are very familiar and routine.
- Prefer fantasy games and activities to actual doing and execution of activities.
- Prefer sedentary activities requiring only limited movement (however, some children exhibit a preference for movement, though it can be uncoordinated and unsafe).

This nosology was presented in an effort to provide homogeneity for sample selections in research and to support the planning of intervention (Miller et al., 2007). It is important to remember that these patterns may be concomitant with other identified patterns as well as other related disorders such as attention deficit hyperactivity disorder, attention deficit disorder, autism spectrum disorder, anxiety disorder, and others (Miller et al., 2007). Assessing a child's sensory processing challenges should be conducted by a licensed occupational therapist trained in the theory and



intervention of sensory integration and sensory processing disorders. This information can be used to guide understanding of the individual differences of the child as well as plans for intervention.

Case Illustration (this is the true story of a little girl and her family; the names have been to changed for the purpose of confidentiality)

Elle is a 4-year-old girl living with her parents and younger sister, Claire. Elle was diagnosed with 80% hearing loss in her right ear shortly after birth. At 33 months she was talking only in one to two word utterances inconsistently, was difficult to engage, demonstrated a preference to be alone, and did not show much interest or pleasure in her immediate surroundings. She was diagnosed with autism at 35 months and her parents started working with an occupational therapist at 36 months. Elle demonstrated difficulty with ideation as well as planning and execution of motor actions, and she required assistance with sequences of more than two steps. Elle was difficult to engage in her initial sessions and did not demonstrate good initiation necessary to engage in play schemes or motor exploration. Her mother reported that it was especially hard to parent Elle because she felt rejected by her and did not feel a strong bond with her. After a few sessions dedicated to clinical observations and getting to know the parents and Elle, the therapist identified the following challenges:

- Elle was unable to initiate sensory motor play, including those inputs that felt good to her.
- It was difficult for Elle to reinitiate a pleasurable sensory motor sequence a second time, but she was able to do so given a cue such as "you can do it again."
- Elle was not able to use a strong social cueing system to express her intentions or ideas. (She did not use gestures or affect cues consistently or robustly.)
- Elle appeared to maintain a state of low arousal for most of the time, which compromised her motor and social development.



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- Elle was not demonstrating good comprehension (understanding of much of the language that was being said to her) and was unable to use expressive language in a way that allowed her to sustain an interaction.
- Elle was overresponsive to visual and auditory stimuli, often startling and becoming upset when people or objects moved suddenly toward her or when surprise noises were heard.
- Elle was underresponsive to vestibular input. Because vestibular input is the primary arousing system to support regulation, Elle would become very excited, engage more easily, use more language and reinstate sensory motor play after engaging in a fair amount of swinging, sliding, jumping, etc. Participating in active vestibular-proprioceptive activities supported her regulation, and, therefore, her attention and interest in her environment and others.
- In general, life was not easy for Elle and she struggled to find easy pleasure in play, interactions and relationships, and exploration of the world.

Given the observations, the occupational therapist recommended that the parents come in twice a week to work with Elle, and goals were identified according to the aforementioned areas of challenge. The sessions were focused on helping Elle's parents read her subtle cues, model clear cues for her,

support her language development through meaningful activities including those that she demonstrated a preference for, and support her regulation by limiting the amount of auditory and visual stimuli. In addition, the following recommendations were made to Elle's parents to support her development outside the session:

- In your play with her, move slowly to better support her visual integration of your actions and better anticipate what you might do next.
- Make sure to follow her lead and be guided by her preferences. The more emotionally invested she is in the activity, the stronger her efforts will be to share the activity with others.
- Identify and implement daily opportunities for her to engage in organizing sensory motor play that supports her arousal and, therefore, her social-emotional and motor development.
- Use less language with her, model longer utterances, and limit the questions that are posed to her. This will help her more spontaneously use what language she has and build on her expressive language skills.
- Provide her with ideas for sensory motor play and slowly remove supports that are already in place so she can become more independent in the sensory motor executions as her motivation and integration improve.

Elle made rapid progress. She started to talk more robustly, first at home and then in all settings, and she was able to engage in a wider variety of conversations and play schemes. This continues to expand to this day. Elle was able to engage more robustly with others, and her social emotional development improved steadily and quickly. Most importantly, Elle and her parents fell head over heels in love with each other. Elle is now in a typical classroom, has many friends, enjoys a wide variety of sensory motor activities and play schemes, and is making steady gains all the time.

SUMMARY

The theory of sensory integration is often misunderstood, misinterpreted, and can be quite difficult to understand. Understanding this theory is critical to inform the work that is done with children in their home and in other settings. This is not the job of occupational therapists alone, but also pediatricians, teachers, and other professionals who can truly help the family better understand their child and his/her individual differences by integrating the theory of sensory integration into their work.

References

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