

What is Sensory Integration/ Sensory Processing?

Sensory Integration (SI) is the neurological process that occurs in the central nervous system and involves receiving sensory information and turning it into functional responses. **Sensory Processing Disorder (SPD)** is a diagnostic term which describes an individual who is not able to effectively process and integrate sensory information from their environment. These pages will describe in more detail why the ability to integrate sensory information is key to our development and interaction with our world and help you to identify if we at OTA The Koomar Center can help you address challenges that you or your child may be experiencing.

What is Sensory Integration (SI)?

Sensory Integration is a dynamic process that occurs in the central nervous system and involves receiving sensory information and turning it into functional responses. All day, every day, we receive sensory information through touch, hearing, sight, taste, smell, body position, and movement and balance. Sensory Integration “sorts, orders, and eventually puts all of the individual sensory inputs together into a whole brain function” (Ayres 1979). “When the functions of the brain are whole and balanced, body movements are highly adaptive, learning is easy, and good behavior is a natural outcome” (Ayres 1979), resulting in successful interaction in all aspects of daily life, at home, at school, at play, at work, and during social interactions.

Our Seven Senses

Information is received through seven primary senses that work in combination to allow us to feel safe, have fun, to learn and to interact successfully within our environment.

Touch – *The tactile system* provides information about the shape, size, and texture of objects. This information helps us to understand our surroundings, manipulate objects, and use tools proficiently. When you put your hand in your pocket and select a quarter from an assortment of change, you are using tactile discrimination.

Body Awareness - *Proprioception*, or information from the muscles and joints, contributes to the understanding of body position. This system also tells us how

much force is needed for a particular task, such as picking up a heavy object, throwing a ball, or using a tool correctly.

Movement and Balance - Located in the inner ear, the **vestibular system** is the foundation for the development of balance reactions. It provides information about the position and movement of the head in relation to gravity and, therefore, about the speed and direction of movement. The vestibular system is also closely related to postural control. For example, when the brain receives a signal that the body is falling to the side, it, in turn, sends signals that activate muscle groups to maintain balance.

Hearing - We use our **auditory system** to identify the quality and directionality of sound. Our auditory sense tells us to turn our heads and look when we hear cars approaching. It also helps us to understand speech.

Sight - Our **visual system** interprets what we see. It is critical to recognizing shapes, colors, letters, words, and numbers. It is also important in reading body language and other non-verbal cues during social interactions. Vision guides our movements, and we continually monitor our actions with our eyes in order to move safely and effectively.

Taste and Smell- The **gustatory and olfactory systems** are closely linked. They allow us to enjoy tastes and smells of foods and cause us to react negatively to unpleasant or dangerous sensations.

Integrating Information from the Senses

Considering all of the sensory modalities involved, it is truly amazing that one brain can organize all of the information flooding in simultaneously and respond to the demands of the environment. The complex nature of this interaction is illustrated in the following example:

Michael receives the instruction "Please put on your coat." In order to comply, he must

- focus his attention on the speaker and hear what that person says
- screen out incoming information about other things going on around him
- see the coat and adequately make a plan for how to begin
- see the armholes and sense muscle and joint positions in order to put his arms into the openings
- feel, with touch awareness, that the coat is on his body correctly
- use motor planning, touch awareness, and fine motor skills to zip or button the coat

In order to accomplish this seemingly simple task, the nervous system must integrate (focus, screen, sort, and respond to) sensory information from many different sources. Imagine the amount of sensory integration needed to ride a

bicycle, drive a car, participate in a soccer game, or pay attention in an active classroom. Individuals who have difficulties with all or part of this process face significant challenges when engaging in daily functional activities.

What is Sensory Processing Disorder (SPD)?

Sensory Processing Disorder (SPD) is a diagnostic term which describes an individual who is not able to effectively process and integrate sensory information from their environment. Information from one's senses (e.g. sight, sound, touch, taste, smell, movement, proprioceptive and vestibular inputs) is not organized appropriately for the individual to carry out activities and interact with the environment as we would expect. An individual may have difficulty integrating information from one sensory system or a variety of sensory systems. Which sensory systems are impacted and how an individual responds to this sensory information results in how the disorder presents itself in any given person.

Most of us carry out our daily activities with ease, often without even thinking about them. We constantly detect, regulate, interpret and respond to sensory input. Through no fault of their own, individuals with SPD are not able to do this successfully. They consequently often have immense difficulty with the simplest daily task and need to exert much effort throughout their day to carry out the demands that are placed on them. This may be a child attending a playgroup who has difficulty engaging in exploration and social interaction; to an adult who struggles to function in her office environment and meet the work and social demands faced each day. Imagine yourself in a world where something as basic as the pull of gravity or the touch of other people is perceived as unreliable, inconsistent, or threatening. You would not feel secure and safe, you might not be able to have fun, and your self-esteem might be compromised as you realized that you were not able to do things as well as your peers.

As individuals we all like different things, dislike some other things, and avoid certain things, but for individuals with SPD their difficulty integrating sensory information often leads to feeling of discomfort and fear, or may lead to a need to seek out more sensory experiences to feel organized and able to engage. SPD can result in delays in motor skills and problems with self-regulation, attention, and behavior that can affect performance in school, at home, with peers, and during leisure and work activities. The diagnosis of SPD should only be made if the sensory processing difficulties impair daily routines, roles or functional skilled performance.

Diagnosing SPD can be challenging as this disorder includes a variety of different manifestations. Areas of difficulty include sensory modulation dysfunction (also known as sensory defensiveness), sensory discrimination difficulties, praxis disorders and postural-ocular challenges. These are not clear cut subgroups and many individuals experience difficulties in a number of these areas. Many researchers and clinicians are involved in identifying subgroups of Sensory Processing Dysfunction to aid in its recognition and to establish the most effective treatment models.

Sensory modulation is the ability to assign meaning and value to sensory experiences in order to screen out irrelevant sensory information and to respond appropriately to meaningful sensory input. It also involves the ability to habituate quickly following a sensory input that is arousing, so that the individual can rapidly return to involvement in age appropriate activities. An individual who attaches too much relevance to non-essential input, is over-sensitive to sensory inputs, or perceives inputs others typically find benign or pleasurable as negative or painful is considered to be sensory defensive. Often individuals will have problems with modulation of several sensory inputs such as touch and auditory inputs. They may respond to these inputs with distractibility or defensiveness resulting in flight, fright or fight behaviors.

Sensory discrimination is the ability to accurately identify and understand the specific types and qualities of sensory input and then interpret the information for skill development. Problems with discrimination may be exhibited as gross and fine motor skill delays, postural control, difficulties in motor planning and coordination, and contribute to problems in social interactions. Discrimination difficulties may also impact an individual's arousal level, especially when encountering a challenging skillful activity. Problems in sensory discrimination are usually sensory specific, although an individual may demonstrate problems in more than one sensory area. Individuals typically respond to problems in discrimination with decreased functional skill performance and decreased self-esteem.

Postural-ocular control is the ability to stabilize the trunk and proximal joints during motor action. It is the foundation for development of both gross and fine motor skill and allows for safety and security while moving. It allows one to have a stable base of support for functional activities and skills, including the ability to use the eyes to gather information from the environment.

Praxis disorders refer to the ability to generate, organize, sequence, and execute motor activities. Praxis is necessary to respond adaptively and effectively to changes in the environment. It is essential for planning motor actions, exploratory play, and problem solving interactions with the physical and social environment.

Effective praxis results from efficient sensory discrimination since the body must have appropriate sensory information to interact with the environment.

What does SPD look like?

SPD can manifest in many different ways depending on the sensory systems that are impacted and how information is processed. The age of an individual will impact behaviors and performance as different expectations and demands are placed on individuals depending on age and developmental level. Some forms of SPD, particularly those that are classified as modulation difficulties, can result in inconsistent behaviors and responses which can be difficult for a parent or caregiver to understand. An individual may need a referral for an occupational therapy evaluation if difficulties are seen in several of the areas listed below or if one area causes major functional problems.

An infant or toddler may:

- Have difficulty consoling self and/or be unusually fussy
- Be unable to bring hands together and bang toys
- Be slow to roll over, creep, sit or stand
- Cry or becomes tense when moved through space
- Have difficulty tolerating tummy time
- Be overly active, seeking excessive movement
- Be unable to settle down and/or have sleep difficulties

A preschool child (3 to 5 years) may:

- Appear clumsy and fall frequently
- Break toys and crayons easily
- Not enjoy jumping, swings or having feet off the ground
- Appear overly active, unable to slow down, move quickly from one thing to another
- Dislikes bathing, cuddling, or haircuts
- Avoids playground activities
- Needs more practice than other children to learn new skills

A school aged child may:

- Have difficulty focusing attention or be over-focused and unable to shift to the next task.
- Need more practice than other children to learn new skills
- Break their pencil frequently and writes with heavy pressure
- Not enjoy jumping, swings or having feet off the ground
- Dislike handwriting and tire quickly during written tasks
- Appear overly active and unable to slow down
- Present with poor self esteem and lack confidence
- Over-react to touch, taste, sounds or odors
- Avoid physical education or sports activity
- Find it difficult to make friends with peers the same age and prefer to play with adults or younger peer
- Have difficulty following several step instructions for motor tasks

An adult may:

- Have difficulty with balance, become disorientated and/or fearful on escalators or elevators
- Fatigue easily
- Be accident-prone, clumsy or awkward in daily activities
- Dislike crowds or accidental jostling in public situations
- Have difficulty maintaining intimate relationships, have difficulty with physical closeness, hugs or cuddling
- Become easily disorganized in work or home activities
- Have difficulty driving, parking, shifting gears or entering freeway
- Have poor self esteem and lack confidence

Terminology

The term sensory integration dysfunction (DSI) was first used in 1963 by Dr. A. Jean Ayres, an occupational therapist and developmental psychologist who also had postdoctoral training in neuroscience. She explored and researched the association between sensory processing and the behavior of children with learning, developmental, emotional, and other disabilities which she reported in numerous scientific journals and later in her groundbreaking book, ***Sensory Integration and Learning Disorders***. Ayres theorized that impaired sensory processing might result in various functional problems, which she labeled *sensory integration dysfunction*. The condition was initially based on studies using the Southern California Sensory Integration Tests and later from studies

using the Sensory Integration and Praxis Tests (SIPT) and related clinical observations.

Since Dr. Ayres first proposed the theory of sensory integration, many theorists, researchers and clinicians have further developed her theory. Ayres's original term, **sensory integration dysfunction (DSI)**, was previously used to refer to the disorder of sensory processing and sensory integration. However, this term was often confused with the theoretical frame of reference, assessment process and intervention model used with this problem. Thus, as information on sensory processing grew it became evident that it was important to differentiate the terminology for diagnosis of problems associated with sensory integration deficits from that associated with intervention theory and techniques. Sensory Processing Disorder was therefore proposed as a diagnostic term which refers to the disorders resulting from poor sensory processing and sensory integration. This new diagnostic terminology, along with a diagnostic typology, was proposed and submitted for inclusion into the *Diagnostic and Statistical Manual of Mental Disorders IV-TR* of the American Psychiatric Association (2000), due out in 2012. The hope is that recognition of SPD as a formal diagnosis will lead to more opportunities for funding for research, more effective interventions and more comprehensive insurance coverage.

Because of the evolving nature of sensory integration theory and practice, other terms related to SPD may be familiar and found in the literature.

Sensory integration theory refers to the theoretical neurologically-based constructs that discuss how the brain processes sensation and impacts on motor, behavior, emotion, and attention responses. This is a brain-behavior theory.

Sensory integration assessment is a specialized occupational therapy assessment which is conducted from a sensory integration theory frame of reference. The evaluation process assesses how a person processes (discriminates and modulates) sensory information; how that sensory processing impacts on foundational mechanisms such as postural-ocular skills, visual perceptual skills, hand skills and handwriting; and how it affects fine and gross motor skills, as well as praxis abilities for daily life functioning.

Sensory integration intervention is a specific intervention model based on sensory integration theory whereby the provision of enhanced sensory information, in the context of meaningful and purposeful activities is believed to enhance the development of an individual's nervous system functioning. Ayres® Sensory Integration intervention is a unique intervention that is child/ person directed and takes place in a playful, loving and fun environment.

Developmental Coordination Disorder (DCD) is a DSM-IV diagnosis for a motor coordination disorder. This term is used frequently in research on motor coordination problems in children and is increasingly used by physicians. It is very commonly used in Great Britain and in Europe. DCD is characterized by a motor coordination problem which results in functional difficulties. Currently, this diagnosis cannot be given in conjunction with autism spectrum disorder. Within the sensory integration framework, DCD is viewed as an umbrella term which includes praxis disorders of motor planning, bilateral coordination and projected action sequences.

Proprioception is the sensory information generated by a person's joints and muscles. It tells a person where their body parts are in space. It is important for force regulation, control of posture and body awareness. It is also an important sensory input for promoting self-regulation. Proprioception works in conjunction with both the tactile and the vestibular sensory systems.

Vestibular sensory inputs refer to a person's movement sense. This is sensory information from the inner ear that is responsible for balance. It detects and processes information in all planes of movement. In addition to balance, the vestibular system controls one's protective responses, one's posture, and works in tandem with one's visual system. It also has a strong influence on emotions and self-regulation