CONTINUING EDUCATION
for Occupational Therapists

SENSORY INTEGRATION AND AUTISM SPECTRUM DISORDER

PDH Academy Course #OT-1706 | 3 CE HOURS

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Course Abstract

This course focuses on the theory of Ayres Sensory Integration (ASI) and its application to Autism Spectrum Disorder (ASD). It opens with an overview of ASD and the central nervous system, reviews ASI, and discusses relevant Occupational Therapy assessment and intervention strategies. Case studies are provided.

Target audience: Occupational Therapists, Occupational Therapy Assistants.

NOTE: Links provided within the course material are for informational purposes only. No endorsement of processes or products is intended or implied.

Learning Objectives

By the end of this course, learners will be able to:

- ❑ Recognize elements of autism spectrum disorder and the central nervous system
- ❑ Differentiate between key sensory systems
- ❑ Identify components of Ayres Sensory Integration
- ❑ Differentiate between types of sensory integration dysfunction
- ❑ Recall assessment methods and intervention strategies pertaining to sensory integration function in children with Autism Spectrum Disorder

Timed Topic Outline

I. Autism Spectrum Disorder (5 minutes)

II. Overview of the Central Nervous System (5 minutes)

III. Key Sensory Systems: Identification, Definitions, and Function (10 minutes)
Vestibular System, Proprioceptive System, Tactile System, Somatosensory System, Other Sensory Systems

IV. Ayres Sensory Integration Theory (5 minutes)

V. Types of Sensory Integration Dysfunction (25 minutes)
Sensory Modulation Dysfunction, Sensory Discrimination and Perception Problems, Vestibular-Bilateral Problems, Praxis Problems, Sensory Seeking Behaviors

VI. Sensory Processing and Participation (5 minutes)

VII. Assessment of Sensory Integration Function in Children with Autism (20 minutes)

VIII. Sensory Integration (SI) Intervention Strategies for Children with Autism (45 minutes)
Tactile Defensiveness, Gravitational Insecurity, Tactile Discrimination, Proprioception, Visual Perceptual, Praxis; Using Sensory Equipment

IX. Case Studies (45 minutes)

X. Conclusion, Additional Resources, References, and Exam (15 minutes)

Delivery & Instructional Method

Distance Learning – Independent. Correspondence/internet text-based self-study, including a provider-graded multiple choice final exam. *To earn continuing education credit for this course, you must achieve a passing score of 80% on the final exam.*

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Course Author Bio & Disclosure

Jeryl D. Benson, EdD, OTR/L, earned a BS in Occupational Therapy and a MS in Motor Development from the University of Pittsburgh. She earned her doctorate in Education from Duquesne University. She has over 25 years of clinical experience in the area of pediatrics and school based occupational therapy practice. She has worked with a variety of disabilities including autism/PDD, cerebral palsy, learning disabilities, and intellectual developmental disabilities in both public and private schools, as well as outpatient practice. She has advanced training in the Neurodevelopmental Treatment Approach, certification to administer the Sensory Integration & Praxis Test, is a certified infant massage instructor, is TEACCH trained, and has been Board Certified in Pediatrics through AOTA.

DISCLOSURES: Financial – Jeryl D. Benson received a stipend as the author of this course. Nonfinancial – No relevant nonfinancial relationship exists.

I. Autism Spectrum Disorder

According to the American Psychiatric Association (APA) as indicated in the Diagnostic and Statistical Manual-5th edition (DSM-5), Autism Spectrum Disorder (ASD) is classified as a neurodevelopmental disorder (APA, 2013).

This new edition of the DSM made changes to the criteria used for an ASD diagnosis. The changes in criteria have resulted in the elimination of Asperger's disorder and Pervasive Developmental Disorder (PDD) and now present one diagnosis, ASD, with two primary categories: 1. Social Communication and Interaction (SCI) and 2. Restrictive, repetitive behaviors (RRP). The diagnostic criteria for ASD include social and communication difficulties, stereotype and/or repetitive behaviors, sensory issues, and in some cases, a cognitive delay (APA, 2013).

To receive a diagnosis of ASD a child must meet four criteria with specific distinctions related to each criterion. 1. Deficits in social communication and interaction (SCI) has three distinctions that must be met, such as deficits in social-emotional reciprocity, nonverbal communication, and deficits in developing, maintaining, and understanding relationships. 2. Restrictive, repetitive behaviors (RRP): the child must meet two out of four of the distinctions which include stereotyped or repetitive movements, inflexible adherence to routines, highly fixated interests that are abnormal in intensity, and hyper- or hyporeactivity to sensory input. 3. Symptoms must be present in the early stages of development. 4. Symptoms cause impairment in "social, occupational or other important areas" of function. (An intellectual developmental disability is not a criterion for an ASD diagnosis but can co-occur.)

Children are also diagnosed with a severity level from level 1 to level 3, with level 3 being the most severe. With symptoms ranging from mild to severe, the behaviors associated with autism can be very different among the different children who share the same diagnosis. Even the same child may present somewhat differently day to day, as the context and sensory information from the environment can alter their behaviors and responses.

The addition of response to "sensory input" as an indicator for an ASD diagnosis recognizes the role of sensory processing within this population: current evidence reports that 80-90% of children with an ASD diagnosis also have an abnormal response to sensory stimuli (Tomchek & Dunn, 2007). It has been suggested that 62% of children with Autism have poor registration of sensory input (Watling, Dietz, & White, 2001). In addition, Williamson & Anzalone (2001) found that children with autism often present with mixed patterns of sensory responsivity: for example, a child may be hyper-responsive to tactile stimuli and hypo-responsive to vestibular stimuli.

The following behaviors related to sensory processing may be present in children with a diagnosis of autism: difficulty with social interactions/developing friendships, difficulty with communication including delayed verbal communication and trouble understanding body language such as posturing and/or facial expressions, repetitive play behaviors, self-stimulatory behaviors, difficulty regulating arousal levels, and a decreased understanding of the result of their actions and behaviors.

This supports the increased role of occupational therapy in interventions for ASD, as the occupational therapy profession has traditionally played a large role in the promotion of sensory development.

II. Overview of the Central Nervous System

The nervous system has two parts: the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS is a complex system that, in part, makes up the communication network in the human body. The CNS is thought to be a hierarchical system, albeit a very complex hierarchy that often has heterarchical interactions (Bear, Connors, Paradiso, 2016).

The CNS is the processor of information as a stimulus is introduced: a stimulus from the environment presents itself, the sensory receptors respond to the stimulus and convey the message to the CNS, and the information is processed (Bear, Connors, Paradiso, 2016).

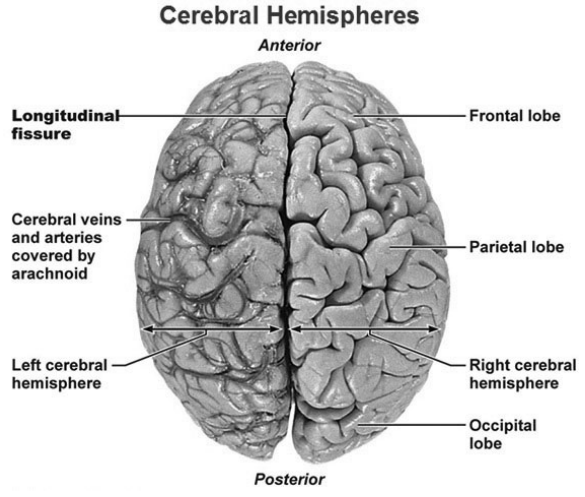
In the simplest form, the CNS is comprised of the spinal cord and the brain. The brain can be broken down into the cerebrum, the cerebellum, the brainstem, and the spinal cord (Bear, Connors, Paradiso, 2016).

The brainstem is responsible for delivering messages between the cerebrum and the cerebellum. It controls basic functions such as heart rate, breathing, and consciousness; in addition, it is responsible for the sensory pathways (Bear, Connors, Paradiso, 2016).

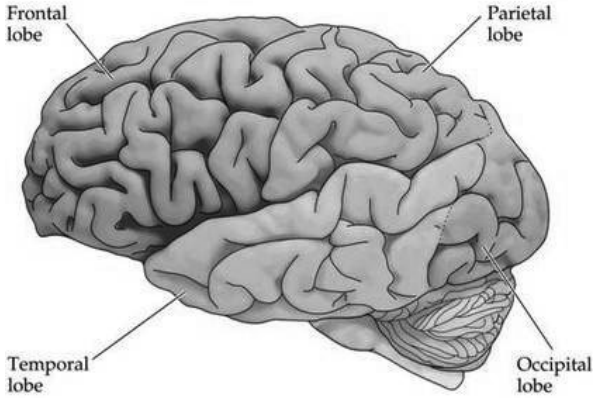
The cerebellum is the receiver of information from the brain stem, spinal cord and various parts of the brain. The cerebellum takes in the information and uses it to regulate movement such as posture and coordination (Bear, Connors, Paradiso, 2016).

The cerebrum is a large part of the brain that contains the two cerebral hemispheres as well as several smaller structures. The left hemisphere controls the right side of the body and the right hemisphere controls the left side of the body. The cerebrum is also divided into four lobes which each have a different function: the frontal lobe, the parietal lobe, the occipital lobe, and the temporal lobe. The frontal lobe is where we do our thinking and problem solving. It also controls

our movement. The parietal lobe supports sensation and feeling. It plays a role in helping us determine the safety of a situation. The occipital lobe processes visual information. And lastly, the temporal lobes (there is one in each hemisphere) support auditory processing, language, learning, and emotions (Bear, Connors, Paradiso, 2016).



Cerebral Hemispheres



Lobes

Information from the environment is transmitted to the CNS for processing via the peripheral nervous system (PNS) and the autonomic nervous system (ANS), which is a subsystem of the PNS (Bear, Connors, Paradiso, 2016).

The role of the PNS is to transmit information to the CNS to support movement and reactions. The PNS has receptors and neurons which send information to the CNS from our peripheral structures (i.e. muscles). Included in the peripheral nervous system are the cranial and spinal nerves. These nerves offer information about motor and sensory input (Bear, Connors, Paradiso, 2016).

The ANS serves to control the unconscious functions of our body by such as breathing and heart rate. The ANS has two systems, the sympathetic and parasympathetic systems. The sympathetic system protects us from injury: it is responsible for the "fight or flight response." The parasympathetic system balances the sympathetic system by doing the opposite. The sympathetic system increases our heart rate and blood pressure, and the parasympathetic system lowers our heart rate and blood pressure (Bear, Connors, Paradiso, 2016).

The CNS seeks sensory stimulation needed for organization and development (Schaaf & Mailloux, 2015). To help us understand the neural system's maturity and needs, we can observe the behaviors of the child as they interact with the environment. To better understand the observations, we need to better understand the sensory systems and their functions.

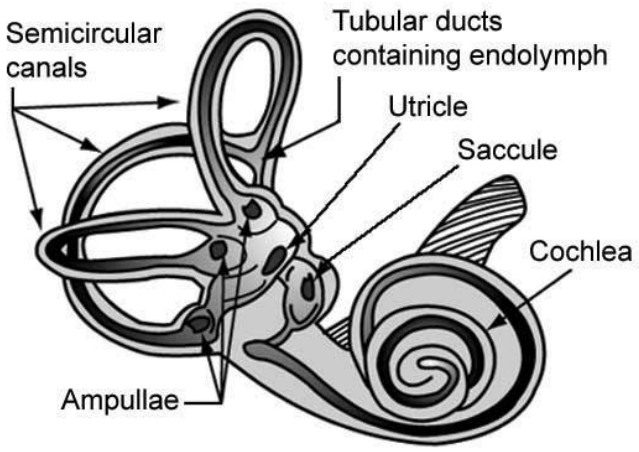
III. Key Sensory Systems: Identification, Definitions, and Function

When you think of the sensory systems most people can name the typical five: sight, sound, touch, taste, and smell. As therapists we identify those five senses as vision, auditory, tactile, gustatory, and olfactory. In addition to the typical five senses, therapists also consider the "special senses" of the vestibular and proprioceptive systems. To understand intervention related to the SI approach the therapist must have an understanding of each system and their impact on performance.

The special or hidden senses, vestibular and proprioception, and the more common tactile system are often considered the building blocks of development. Each system has characteristics important to performance.

The Vestibular System

The receptors for the vestibular system are located in the inner ear and consist of the semicircular canals and the utricle and saccule. The semicircular canals consist of three circular tubes that contain fluid. Movement of the head causes the fluid in the canal to move. The direction of movement of the body will cause fluid in the coordinating canal to move. One canal detects vertical movement, one detects horizontal movement, and one detects angular movement. The utricle and saccule are near the semicircular canals and house the hair cells. As the fluid moves through the semicircular canal it then moves over the hair cells providing more information about the speed and direction of the movement (Bear, Connors, Paradiso, 2016).



The Vestibular Receptors:
Semicircular Canals, Utricle, and Saccule

The function of the vestibular system is to provide the CNS with information about where our body is in space. The vestibular system plays a role in attention, balance, muscle tone, bilateral integration, ocular motor control and visual perception.

Disrupted vestibular processing can impact the person's performance in typical occupations. For example, a child with poor balance and bilateral integration may have difficulty riding a bike. Challenges with muscle tone and bilateral integration may impact the child's ability to participate in typical childhood occupations such as using scissors to cut, managing fasteners on clothing, or crossing the monkey bars.

Because of the spatial role of the vestibular system, visual perceptual skills are often impacted by a vestibular processing problem. Visual perceptual outcomes can be used as a clinical indicator of vestibular processing. Visual perception is required in most daily living tasks and has a large role in the school skills of a student. The spatial component of this function has a contribution to our organization of self in space in daily life. For example, sizing and spacing of letters, avoiding reversals and orientation errors during handwriting, left/right discrimination, directionality, and fine motor tasks that have a spatial component such as cutting and pasting all rely on spatial awareness.

The Proprioceptive System

The receptors for the proprioceptive system are located in our muscles and joints. Our muscles detect pressure and we receive proprioceptive information from the position of our joints: for example, if you have a pebble in your shoe, the proprioceptive system makes you aware of it (Bear, Connors, Paradiso, 2016).

A child with poor proprioceptive function doesn't get enough information from the muscles and joints. Going back to the pebble example, if you have a pebble in your shoe you can feel the pressure of the pebble digging into your muscle. Your proprioceptive system detects the stimulus (the pebble), alerts to it, and responds. Children with decreased proprioceptive function would remain unaware of the pebble, not noticing it until they removed their shoe and saw the impression it left.

These children may have limited awareness of where their body parts are in relationship to the environment. They may present as uncoordinated and stiff or they may be clumsy and report frequent falls. They seek proprioceptive information so they can function, but with a decrease in reception of the stimulus they seek increased amounts of information. This presents itself clinically as being very heavy handed or footed. In another example, when you are using a pencil to write you can feel the resistance of the pencil against the paper. The resistance gives you information about the direction of the pencil. You are aware of what letter you have produced even without looking. A child with poor proprioception may need to press the pencil to the paper very hard to get the same feedback. This often results in broken pencil points, holes in the paper, or sloppy written work.

Proprioception is a large contributor to gross motor movement also. When you are walking your body continually makes adjustments to your pattern of movement based on the proprioceptive information detected from the soles of the feet – the pressure of the foot on the surface. If the surface changes, for example you walk from a room with carpeting into a room with hardwood floors, your proprioceptive system will detect the change and send a signal to the CNS to modify your movement patterns for continued success. Under the same circumstances a child with poor proprioception may fall, appearing clumsy.

The role of the proprioceptive system in regulation and arousal appears to support organization of the overall system (Bundy, Lane, & Murray, 2002). For example, when a newborn is crying we will swaddle them and hold them: here the proprioceptive input appears to support regulation (in this case a decrease) in arousal level, and the response of the newborn is to calm down. In addition, the proprioceptive system appears to support regulation of both the tactile and vestibular system. Use of proprioceptive input prior to or in combination with tactile input for a child who is sensitive may help the child accept the tactile input.

The proprioceptive system also supports our ability to regulate the amount of force we use when interacting with our environment (Cronin, 2016). For example, when small children hold a pet, if they are unable to use discriminative proprioception, they may squeeze the pet too tightly. As their system matures, the proprioceptive system will contribute to their ability to

calibrate the correct amount of pressure on the pet so they can hold the pet comfortably.

The proprioceptive system works very closely with the tactile and vestibular systems, and these three systems will often be considered together. For example, the tactile system (discussed next) provides information about the external environment as we touch and feel things. The proprioceptive system responds to information that is internal from our muscles and joints. Together the proprioceptive and tactile systems are often referred to as the somatosensory system.

The Tactile System

The receptors for the tactile system are located in our skin, with the majority in the palms of our hands and the soles of our feet. The tactile system has two functions: protection and discrimination (Bear, Connors, Paradiso, 2016). The protective function of the tactile system alerts us to danger. For example, you may touch an object, immediately detect that the temperature is high, and withdraw your hand so you don't get burned. The discrimination function of the tactile system provides us with information about the property of an object. For example, when you reach in your bag for your keys, you can detect the size, weight, and texture of the objects inside, and find your keys without using your vision.

A child with tactile issues typically falls into one of two categories: a child with diminished sensitivity or a child who is very sensitive to touch.

A child with diminished sensitivity may have a decreased awareness of being touched. They may recognize that they have been touched but not know where. Children with diminished sensitivity to touch often have poor body awareness and are unable to recognize objects by touch. These are the children who, when carrying their school supplies, drop items along the way and don't realize it.

On the other end of the spectrum, a child who is very sensitive to touch may dislike unanticipated contact, messy activities such as finger painting or using paste. These children may be picky about the fabrics and tags in clothes. They are often misinterpreted as having a behavior problem. They are not good at standing in line and when bumped or touched they may respond with aggression toward the other child(ren).

The Somatosensory System

The somatosensory system is a combination of the tactile and proprioceptive systems. At times information that comes into our bodies initially may be detected by the tactile system and as the pressure of the object increases the proprioceptive system is engaged. When working together they are often referred to as the somatosensory system (Bear, Connors, & Paradiso, 2016).

The Other Sensory Systems

Our visual system supports the identification of visual stimuli in our environment. The eyes help us to interpret the properties of objects (shape, color, etc), facial expressions, body language, and guides social interaction. The information regarding the properties of objects contributes to our perceptual understanding of the environment. We use our visual system and our cognitive system to interpret the stimulus and assign a perceptual meaning.

A child with an over-responsive visual system may become easily distracted by visual input such as too many words or pictures on a page or a very busy bulletin board.

The auditory system supports the functions of hearing, speech, and language. In addition, auditory perception also is an important function of this system. Children may have under- or over responsive auditory systems, which may impact behavior.

A child with an over-responsive auditory system may be very sensitive to sound. They may have difficulty participating in environments with many different noises or loud noises, such as an assembly in school. They may also be sensitive to background noises that we typically don't attend to, such as water dripping or the motor of a fan.

The gustatory and olfactory systems provide us with information about tastes and smells in the environment. They can give us information about what to expect from our interactions. For example, when we go to the movies, we may smell the popcorn before we enter the theater.

When a child presents with hyper or hypo responsivity to sensory stimuli it often emerges as an atypical behavior, and may be misinterpreted by others. A child who is under/hypo responsive may appear to be spacey and others may interpret them as a loner or anti-social. A child who is over responsive may react with crying or aggression and others may interpret them as difficult and hard to be around. In both cases the child is reacting or not reacting to sensory input from the environment and not always the people around them. But people interpret what they see and often inaccurately label the child.

IV. Ayres Sensory Integration Theory

Overview

Ayres Sensory Integration (ASI) is a trademarked approach to occupational therapy intervention that was developed by A. Jean Ayres. The process developed by Ayres outlines the relationship among the various sensory systems. Input into the systems (vestibular, proprioceptive, tactile, auditory and visual) provides information to support participation. The systems

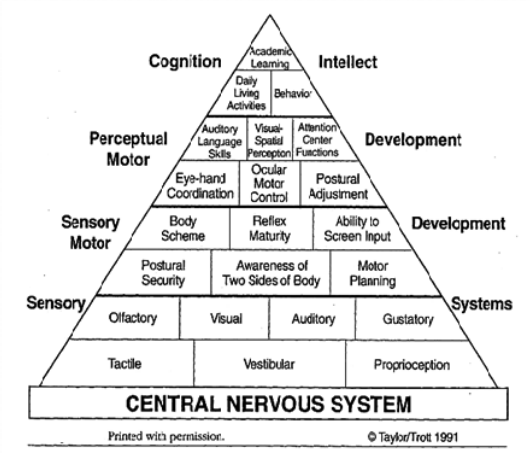
work together to advance development: for example, as the vestibular system matures it provides support for maturation of the tactile system. Maturation of each system then contributes to the development of various performance components (i.e. eye hand coordination, bilateral coordination, etc.) that support engagement in occupation.

History

A. Jean Ayres was an occupational therapist and a psychologist who used her observations during clinical practice to develop a research agenda that has had a profound effect on occupational therapy practice (Parham & Mailloux, 2015). Ayres introduced a novel way of understanding children and their development. Over time, ASI came to include the theory of sensory integration, assessment methods, sensory & behavioral patterns, and the concepts to guide the intervention process. Currently occupational therapy that is based on a sensory approach to intervention is referred to as SI (sensory integration) or OT-SI (occupational therapy using a sensory integration basis).

Foundational Concepts

When we think of sensory development in terms of laying the foundation for overall development, we must acknowledge the contribution of the sensory systems as the building block in the foundation. Learning and behavior are built upon the base provided by our sensory systems as they are modulated via these systems. Solid sensory development – sound vestibular, proprioceptive and tactile systems – become the base for higher level skill development. Response to and subsequent integration of sensory information from the environment provides the opportunity for development of motor experiences, learning, cognitive and emotional skills (Parham & Mailloux, 2015; Schaaf & Mailloux, 2015).



Contributions of the Sensory Systems to Development

V. Types of Sensory Integration Dysfunction

Sensory Modulation Dysfunction

Our ability to modulate or regulate our sensory systems means that we are able to manage the sensory stimuli coming in from the environment and generate an appropriate response. Sensory modulation dysfunction occurs when a child is over or under responsive to the stimuli. A large number of children with a diagnosis of autism present with sensory modulation difficulties (Schaaf & Roley, 2006). When trying to determine the underlying sensory issue the therapist needs to consider the behaviors that occur in daily life that are consistent with different types of sensory modulation difficulties.

Under-responsive

The child who presents with sensory modulation difficulties that are characterized as under-responsive has a decreased attention to incoming sensory stimuli or poor sensory registration. The child does not attend to or register the stimuli and therefore is unable to generate the appropriate response. The clinical presentation of a child who is under-responsive may be a child who appears unaware of the environment. The under-responsiveness to stimuli may be subtle, such as not registering another person's facial expression and therefore responding with a socially inappropriate response: for example, laughing when someone is crying. In contrast, the under-responsiveness may also be to a greater degree, where large amounts of information are coming in and the child is unaware, such as a child walking into a heavy traffic area.

Many children with autism who are under-responsive move through life without noticing the details around them. This often presents as a child who is not connected to life experiences, is indifferent, or lacks enthusiasm.

Over-responsive

The child who presents with sensory modulation difficulties that are considered over-responsive has an increased awareness or attention to the incoming sensory stimuli, and the information coming in is too much for the child to regulate. This is often referred to as sensory defensiveness. These children respond with heightened reactions such as when a light touch is interpreted as an aggressive touch and the response is to hit the other person. Similarly, children may cover their ears and/or cry when they are in an activity (such as a school assembly) that has an increased noise level. A child may be over-responsive to many different types of sensory stimuli, or it may be associated with just one system.

Tactile Defensiveness

Tactile defensiveness can be described as the child's over-reaction to typical tactile stimuli from the environment. Children with tactile defensiveness often appear to be in distress or discomfort when they come into contact with certain sensations: for example, a child who refuses to wear jeans because they are stiff and have heavy seams and a snap, or a child who expresses a dislike for finger painting or pasting.

When working with a child with tactile defensiveness, the OT must determine the types of tactile input that is difficult for the child to regulate. Light touch is often the most difficult, such as that produced by sand and some clothing. Wet textures, such as soap and water, are often more difficult to process than dry textures. Many self-care activities require tactile processing of sensory stimuli and can therefore be an area of difficulty for families. Brushing hair, selecting clothing and shoes, washing hands and face can all pose a challenge and become a stressor. By identifying the details of the tactile processing the OT can then determine how to best address the underlying issue.

Gravitational Insecurity

Gravitational insecurity can be described as the child's over-reaction to vestibular stimuli. Children with gravitational insecurity have a fear of movement and falling. The exaggerated response is often elicited by movement of the head. These children may present as someone who is very cautious of movement. They may move slowly and wish to stay away from crowds. They will often prefer to keep their feet firmly planted on the ground and to sit on a stable surface. Their exaggerated response will often preset as fear or anxiety. This child may cling to an adult when encouraged to play on a swing set, or they may refuse to participate in the tumbling unit during physical education class.

When working with a child with gravitational insecurity it is important to develop a trusting relationship. The children need to feel secure as they engage in movement activities that are uncomfortable for them.

Other Sensory Systems

Just as the tactile and vestibular system can be over-responsive to sensory stimuli, so can our other senses. Children may have an adverse reaction to smells, sights, tastes, or sounds from the environment. Auditory defensiveness is a frequent concern for children with autism. When a child presents with auditory defensiveness they may have a negative response to sounds: for example, the excitement at a fair, with lots of people making noise and laughing, may cause distress or anxiety for the child. Because many social situations are tied to sounds, children with auditory defensiveness may find themselves unable to participate in typical social activities such as attending a birthday party.

MINI CASE STUDY

Marty is an 8 year 7-month old boy with a diagnosis of autism. When interacting with his peers he is slow to respond to requests and jokes, frequently doesn't respond to their facial expressions, and doesn't engage in physical exchanges such as "high fives." The kids think Marty is nice but a little "out of it" most of the time. The teacher reports that his attention during class is not great and she is concerned about his learning.

Read the case again and think about what clinical signs may provide information about Marty and his sensory modulation.

The fact that Marty does not pick up on the nuances of social language (slow to respond to requests and jokes) could indicate that Marty is not attending to auditory details during conversation.

The fact that Marty does not interpret facial and body cues embedded within a social context (frequently doesn't respond to their facial expressions and doesn't engage in physical exchanges such as "high fives") could indicate that he is not attending to the visual cues of body language and facial expression and/or connecting meaning to what he sees.

The fact that the teacher reports decreased attention during class and decreased educational outcomes could indicate that he needs more stimulation to maintain his attention during class activities, as typical movement during the school day is not supporting his attention.

All three of these concerns point to an under-responsive system. Marty is not attending to and using sensory information from his environment.

Sensory Discrimination and Perception Problems

Sensory discrimination is our ability to discriminate between the properties of objects in our environment or the sensory stimuli coming in. As sensory stimuli come in from the environment we are able to interpret the details of the stimuli and organize our response. For example, we are looking for our keys and see part of the key chain sticking out from under the newspaper. We are able to interpret the sensory stimuli as "seeing part of the key chain means that the rest of the key chain and our keys are hidden." Or we see an old friend and greet them with a hug: we are able to identify both of their arms in contact with our body, and differentiate them from our body.

Any of our sensory systems may present with discrimination difficulties.

Tactile Discrimination & Perception Problems

Tactile discrimination problems may present as having difficulty interpreting touch information or stimulus. A child may not be able to differentiate the difference between a quarter or a nickel by touch alone. It is not unusual for children with tactile discrimination issues to rely on their visual system to support function. When reaching in their pocket for a coin they may look at the coin to determine if it is correct.

Because we receive so much tactile information about the properties of objects through our hands, many children with tactile discrimination problems will also present with fine motor delays. As children are picking up toys and objects in the environment they may be receiving less information about the object and the possibilities for manipulation. This in turn decreases the opportunity to interact with the environment in a meaningful way.

Visual Perception Problems

Visual perception problems may present in many different ways as we use our eyes to take in visual stimuli and then use our perceptual system to interpret the information. We may use our visual perceptual system to determine the size of an object, the position of an object, or the location of an object. For example, when a child is looking for a toy in the toy box, they must be able to visually locate the target (toy) amongst many other toys. Or a child may have to recognize their shoe even though it has been turned upside down.

Proprioception Problems

Proprioceptive problems may present as difficulty interpreting where the body is in space. A child with proprioceptive problems may appear to be clumsy and awkward. Because the information registered by the proprioceptive systems comes in through our muscles and joints, these kids often need increased sensory input to be able to identify a stimulus: for example, to get a feel for the surface being walked on, the child may appear to be stomping, seeking the sensory input you and I get while walking. These are also the children who may press very hard during writing tasks, frequently breaking their pencils. When moving through a crowd the child with proprioceptive problems may be unaware of others, therefore bumping into them or stepping on their toes. Although the child with problems is unaware, the child on the receiving end is aware – and typically unhappy about the interaction, assuming the first child is rude or mean.

Other Perceptual Problems (i.e. auditory)

Auditory processing problems may present as difficulty with attending to auditory stimuli or discriminating details of sounds. Many children with auditory processing issues also have sensory processing issues in other systems. Auditory processing disorders are typically addressed by a speech language pathologist and/or an audiologist.

MINI CASE STUDY

Sally is a 12-year-old girl with a diagnosis of autism. Sally and her parents have come to an outpatient clinic for occupational therapy services to address her difficulties with coordination. Sally is transitioning to her local middle school next year, and although she will spend the majority of her time in the autism support classroom she will need to transition from her classroom to other select classes such as social studies, physical education, art, and music. Sally reports that she falls frequently and the occupational therapist noticed she has bruising on her legs. Sally reports that she has recently learned how to tie her shoes and upon observation it is noted that she looks at her hands when tying.

Read the case again and think about what clinical signs may provide information about Sally and her sensory discrimination.

> The fact that Sally is clumsy and falls frequently throughout the day could indicate that she has proprioceptive processing problems.
>
> The fact that Sally has more than usual bruising on her legs could be from her bumping into furniture and indicate proprioceptive processing problems.
>
> The fact that Sally is unable to tie her shoes without looking could indicate tactile discrimination problems and she is compensating by using her visual system.

All three of these concerns point to poor sensory discrimination. Sally is not detecting sensory information and therefore unable to make the postural and motor adjustments needed for function.

Vestibular-Bilateral Problems

Vestibular bilateral problems may present as difficulty with balance, equilibrium, or poor coordination between the two sides of the body (Parham & Mailloux, 2015). A child with vestibular bilateral problems may have difficulty participating in childhood activities such as riding a bike or playing cooperative hand games with a partner such as doing a clapping pattern associated with a rhyme. Children with vestibular bilateral issues may also present with postural challenges (laying their head on the desk) and difficulties with attention to task during instruction, and/or completion of schoolwork.

MINI CASE STUDY

Jonathon is a 4 year 4-month old boy with a diagnosis of autism. He and his family frequently go to the local playground. The mother noticed that Jonathon struggles to climb the ladder to the slide. Once on the slide he is unable to remain upright, and he will slide down in a supine position. The mother reports that she also has to push him on the swing – he is unable to initiate or maintain the pumping action to move the swing himself.

Read the case again and think about what clinical signs may provide information about Jonathon and his vestibular bilateral problems.

> The fact that Jonathon is unable to climb the ladder demonstrates poor coordination and use of both sides of his body.
>
> The fact that Jonathon is unable to maintain an upright posture while sliding could indicate postural challenges and issues with balance.
>
> The fact that Jonathon is unable to initiate or support maintenance of movement of the swing could indicate issues with use of both sides of his body. (It could also indicate issues with praxis, discussed below.)

All three of these concerns point to *poor vestibular bilateral processing*. Jonathon is unable to coordinate use of both sides of his body or stabilize his trunk to successfully interact with his environment.

Praxis Problems

Praxis is our ability to come up with an idea, develop a plan, and then execute a novel motor task. A praxis problem may be referred to as dyspraxia. When a child first sees an object or opportunity in the environment (i.e. a bike) they develop an idea of what to do with the bike (i.e. I can ride that!). Next they develop a plan for how to ride the bike (i.e. I should get on and put my feet on the pedals). Finally, they initiate the movement required to carry out or execute the plan (i.e. they propel the bike forward). A child with dyspraxia may have difficulty with any stages of the process, appearing to be awkward and clumsy and have difficulty participating in a new game with peers. For example, they may see something in the environment (i.e. the bike, a swing, a toy) and may not know how to interact with it (problems with ideation) or they may see the bike and know they want to ride it but may not know how to plan for making that happen (planning) or they may know they want to ride it, know they must get on it to make it move but they may not know how to initiate the movement to propel the bike (execution). You may have noticed that at each phase the description includes the statement "They may not *know*…." That is because praxis is a cognitive process that ends when the movement is initiated by the person. Because we are unable to see the process occurring in the brain the occupational therapist uses the clinical observation of motor behavior and interaction with the environment as the measure of a child's practic abilities.

MINI CASE STUDY

Alex is a 3-year-old boy with a diagnosis of autism. He just received a play farm set for his birthday. The toy includes a barn that opens up to show various animals in different stalls or areas of the barn. The barn unhooks to open and the compartments inside have gates that open out or lift up for access to the animals. Alex gets excited when her sees the barn and he immediately wants to play with it. He shakes the barn to try to open it. His mother shows him the hook and he pulls at the hook still unable to open it. She opens the barn. Alex is again excited but is unable to open the various stalls for access to the animals. With help to open the gates he is able to play with the toy.

Read the case again and think about what clinical signs may provide information about Alex and his praxis problems.

> The fact that Alex is excited when he sees the barn indicates that he has *ideation*: the ability to develop the idea of what he wants to do with the toy.
>
> The fact that Alex tries to open the toy and the gates inside the barn indicates that he has a *motor plan*: he wants to open the different parts of the toy.
>
> The fact that Alex is unable to actually open the parts of the toy indicates that he has difficulty with *execution* of his plan. He is unable to execute the motor task of interacting with something new in his environment.

Sensory Seeking Behaviors

A child who presents with sensory seeking behaviors seeks increased sensory stimulation from the environment. Sensory seeking behavior can occur within any of the sensory systems. For example, a child who is seeking tactile input may excessively touch things in their environment. If a person is nearby, they may touch their hair inappropriately. If a child is seeking vestibular stimulation when playing on the swing set, they may continually wind and unwind the chains to spin the swing.

Although the reasons for sensory seeking remain unclear, some theories suggest that sensory seeking may occur because the child is not getting the amount of information they need to interpret the incoming stimuli and therefore they seek to increase the stimuli coming in so they can attend and respond to it. For example, if their tactile system isn't giving them the information they need to interpret an object they may touch it repeatedly to try and gather the information. Another theory is that the child may be using the

sensory stimulation to regulate arousal levels, or maybe they find pleasure in the outcome of the stimulation.

VI. Sensory Processing and Participation

The Occupational Therapy Practice Framework (OTPF-3) identifies the areas of occupation as Activities of Daily Living (ADL's), Instrumental Activities of Daily Living (IADL's), Play, Leisure, Work, Education, Social Participation and Rest/Sleep (AOTA, 2014). Difficulties processing sensory information can lead to challenges participating in all areas of occupation. Let's consider some examples of how sensory processing dysfunction can impact engagement in occupations:

Children with an over-responsive tactile system (the behavioral manifestation is extreme sensitivity to textures)

- May be unable to participate in dance class because they are unable to wear the leotard or the tights. (Social Participation; Leisure; ADL's)
- May refuse to wear a Halloween costume. (Social Participation)
- May not keep their socks and shoes on, limiting community outings. (Play; Leisure; Education; Social Participation)

Children with an under-responsive tactile system

- May be unable to complete fasteners such as shoe tying or buttoning. (ADL's)
- May be unable to retrieve an item from their book bag without looking. (IADL's)

Children with a diminished proprioceptive system

- May be very heavy-handed when writing, pressing so hard on their pencil they rip the paper. (Education; IADL's)
- May be like a "bull in a china shop," stepping on or bumping into other children in the play area/playground without acknowledging the contact. The other kids don't like it and think these children are bullies. (Social Participation, Leisure, Play)

Children with an over-responsive vestibular system

- May refuse to participate in the "gymnastics unit" during physical education class. (Education; Social Participation; Leisure)
- May not enjoy the rides and games at the summer festival. (Social Participation; Leisure; Play)

Children with an under-responsive vestibular system

- May demonstrate out-of-seat behaviors during class, falling behind in schoolwork. (Education; IADL's)
- May not easily settle down at the end of the day: they can't fall asleep and/or they wake up very early. (Rest/Sleep; ADL's)

As discussed earlier, the sensory systems are the building blocks to overall development. If the functions of our sensory systems are impaired, we often see a decrease in typical childhood interactions. In turn, the child may experience limitations in skill development. For example, a child who presents with tactile defensiveness (over-responsive tactile system) has decreased interaction with the environment via touch. This decreased interaction with the environment leads to delayed development of fine motor skills. Likewise, the child who presents with gravitational insecurity (over-responsive vestibular system), and is afraid to move, doesn't develop the gross motor skills typically acquired during movement. These limitations in turn create a cycle of delay.

In addition, sensory processing difficulties can raise the stress level of the family unit. A child with light sensitivities (visual processing) may be unable to go to a grocery store that has high ceilings and fluorescent lights without having a meltdown, but the family can't afford a babysitter every time they grocery shop. Another child may have a negative behavioral response to background noises such as a fan motor or lights humming (auditory processing), and be unable to comfortably attend church or go to a dance recital with the family. Limitations in participation affect the entire family unit, not just the impacted child.

VII. Assessment of Sensory Integration Function in Children with Autism

During the assessment process the occupational therapist is looking for a clustering of behaviors within a category to provide insight into the child's occupational performance. The clinical indicators should come from a variety of sources such as parent report, observation in a natural setting, clinical observation, and structured assessment measures such as a questionnaire. Once an area of sensory processing emerges from the data, the therapist must determine if the child's sensory challenges interfere with performance and participation. (Many individuals have "quirky" behaviors that may be noticeable to others, but those behaviors only become a problem when occupational performance and participation are limited due to the sensory challenges.)

Identifying the root of a sensory processing disorder is often like trying to complete a puzzle or solve a mystery. The occupational therapist must sort through the clues (behavior patterns, work samples, parent and/or teacher report) and organize them into clusters and then clinically reason through the possibilities.

Typically, the first set of data comes to the OT via a referral: a teacher requests a screening because a child is having difficulty completing schoolwork, or a parent reports that the morning routine is difficult as the child struggles with getting dressed and completing grooming in the morning before school. Following a referral, the occupational therapist will often gather additional information from the team (parents, teachers, child) via one or more methods. The occupational therapist works to create an occupational profile of the child that includes information about what they want and need to do, how they do it, where they do it, and with what supports.

Because the children we are discussing have a diagnosis of autism, use of traditional standardized testing tools may be a challenge. Many children with ASD perform poorly on traditional standardized tests that are criterion or norm referenced due to the characteristics of autism, such as poor sensory processing, poor attention, or poor language skills. Because standardized tools require specific procedures during administration and the child may not be able to comply, the results are often skewed and not reflective of the child's actual ability. Therefore, the occupational therapist must rely more heavily on clinical observations as discussed below.

There are also other, non-standardized, options to gather data. One such tool, a sensory history, is a non-standardized questionnaire that asks the parent or teacher to identify behaviors such as "is bothered by tags in their shirt" or "only eats crunchy food." The OT will review the sensory history to determine if there is a pattern to the behaviors.

Other, standardized, assessments include the Sensory Profile and the Sensory Processing Measure (SPM).

The Sensory Profile, developed by Winnie Dunn (1999), is a questionnaire that has been norm referenced. The questionnaire consists of a series of statements, and the parent/caregiver rates each statement. It comes in four versions: the Infant/Toddler Sensory Profile, The Sensory Profile, the Adolescent/Adult Sensory Profile and the Sensory Profile-School Companion. The results of each will organize the reported behaviors into categories related to sensory processing.

The Sensory Processing Measure (SPM) is also norm referenced. It offers forms for the Home, the Main Classroom, and the School Environments, as well as a preschool edition (Glennon, Miller-Kuhaneck, Henry, Parham, & Ecker, 2007). Online resources for the SPM are available here: Western Psychological Services, http://bit.ly/1RG7dz3

The Comprehensive Observations of Proprioception (COP) developed by Blanche, Bodison, Chang, & Reinso (2014) is a scale that measures proprioceptive processing via therapist observation. Online resources for the COP can be found here: http://sensorymetrics.net/COPForm

For a more detailed examination of standardized assessment options, please see the handout "Common Sensory Assessments," pages 28-29.

Ideally used in combination with data collection, informal observation of the child allows the occupational therapist to gather data about the child's participation in daily life. If possible, the child should be observed in the day care setting, the classroom, home, and/or the community. During the observation, the OT will interpret the child's observed behaviors such as laying his head on the desk during classwork (vestibular-bilateral problems) or walking around the perimeter of the playground during recess (gravitational insecurity). These informal observations support the outcomes of the more formal testing. For example, when the results of the Sensory Profile indicate an issue with touch processing, it is important to also observe how these difficulties impact typical day to day interaction. If an assessment indicates a problem area, but the problem area does not interfere with participation, then it does not become a priority for intervention.

In addition to observation of the child within their environment, the occupational therapist will also gather data via the use of clinical observations, developed by Ayres, which can reveal information about the function of the neurological system of the child. These clinical observations are not standardized, and due to the nature of the procedures are often administered differently with different children, so normative information may not be available; that said, they allow the OT a means of supplementing the information already gathered via traditional assessment measures.

Depending on the severity of the autism diagnosis, clinical observations may be particularly helpful in understanding the nature of the problem: if children are unable to understand the specific directions to participate in the data gathering, the occupational therapist may instead choose to observe the behavior (or modified behavior) occurring naturally in the environment. For example, if a child is unable to understand the requirements of "prone extension," the occupational therapist may choose to observe and document their response to being prone on a swing. Although not the clinical observation of "prone extension," this data can offer insight into the child's systems and needs. Is the child able to maintain extension of the upper trunk, neck, and upper extremities without movement? With movement? If so, for how long? When recording the information, the occupational therapist must clearly note the circumstances of the data collection.

Examples of commonly-used clinical observations (Bundy, 2002; Blanche, 2010) are:

Prone Extension: The ability to simultaneously lift the head, flexed arms, upper trunk, and extended legs up against gravity from the prone-lying position. Poor prone extension often is associated with inadequate processing of vestibular-proprioceptive inputs. The presence of tight hip flexors should be ruled out before interpreting the results of this observation.

Supine Flexion: Simultaneous flexion against gravity of the knees, hips, trunk, and neck from a supine-lying position; the top of the head should approximate the knees. The ability to assume this position has been related to somatosensory function and praxis.

Crossing Midline: The ability to cross the body midline with one or both hands to manipulate objects in contralateral space. Deficits in this area may be associated with inadequate bilateral integration or poor trunk rotation and may also be indicative of deficits in the development of hand preference.

Equilibrium Reactions/Righting Reactions: Equilibrium reactions are compensatory movements of body parts that serve to MAINTAIN the center of gravity over the base of support when either the center of gravity or support surface is displaced. Righting reactions are used to ATTAIN or REGAIN such postures. These reactions are related primarily to visual and vestibular-proprioceptive function. Deficits in vestibular-proprioceptive functioning are most apparent when balance deficits occur or increase under conditions where vision is occluded.

Protective Extension: A protective reaction that results from loss of balance that involves extension of the non-weight bearing "downhill" limbs, or those on the side toward which the fall would occur. A support reaction is characterized by extension of weight bearing downhill limbs. Immature or poor responses may contribute to the identification of decreased vestibular-proprioceptive function. However, protective extension and support reactions develop early in life and may not be impaired in clients with sensory integrative dysfunction.

Projected Action Sequences: The ability to plan and produce anticipatory action sequences. Anticipatory or projected action sequences are those in which the goal must be formulated and the plan of action developed before movement is initiated. This ability, especially when it involves bilateral movement patterns, is related to vestibular-proprioceptive processing and sequencing praxis. Examples of tasks that assess this function include jumping in a series of squares or circles on the floor, catching a ball whose trajectory cannot be anticipated, kicking a rolling ball, and running, jumping, or stepping over a rolling object. Projected action sequences can also be observed during a variety of treatment activities. Demands are greatest when both the client and the object are moving; demands are minimal when both the client and the object are still. A critical component of the quality of performance is that the client performs the demanded action without need to hesitate, stop, or correct the planned action once it is initiated.

Sequential Finger Touching: The ability to sequentially oppose the thumb to each of the other fingers, index to little finger and back. Considered a test of cerebellar function, also used to assess somatosensory processing.

Weight Bearing and Proximal Joint Stability: The ability to stabilize proximal joints. Can be observed by having the client assume a quadruped position, making sure that they understand the desired position. Observe for inability to maintain position without locking elbows, winging of the scapula, or lordosis of the trunk. Poor postural stability may be associated with poor vestibular-proprioceptive processing and poor extensor muscle tone. In the past, the ability to stabilize joints has erroneously been equated with cocontraction or simultaneous contraction of antagonistic muscles around a joint. While the ability to cocontract muscles may be an element of postural stability, cocontraction often does not occur under normal conditions of joint stabilization.

Reciprocal Stride Jumps and Jumping Jacks: Reciprocal stride jumps and jumping jacks involve bilateral reciprocal, alternating, or symmetrical limb movements. The client is asked to perform the actions in imitation of the examiner. The inability to perform these tasks after demonstration by the examiner and a practice trial has been associated with deficits in bilateral integration and sequencing praxis.

The overall assessment process should culminate in an occupational profile that includes past medical and developmental history; a narrative of the child including social history, play history, activity of daily living skills and daily routines and community engagement; identification of strengths, needs and barriers; priorities of the child/family/team; and a recommendation for services.

While developing the narrative of the child, keep the autism diagnosis and the child's sensory processing challenges in mind, considering the following:

- Does the child have a preference/avoidance for a certain type of sensory input?
- What kind of sensory input results in organized/disorganized behaviors?

- What behaviors does this child demonstrate when disorganized?
- Is the child over- or under-responsive to sensory stimuli? If so, which ones?
- How do these issues impact participation?

The identification of the needs and barriers will include evaluation of performance skills and patterns. For children with autism, as performance skills are evaluated, the therapist should continue to gather information regarding the role of sensory processing, considering the following:

- How does the child register sensory information?
- What is the child's arousal level?
- How does the child regulate/modulate sensory information?
- Is the child able to discriminate or interpret sensory information?
- Is the child able to demonstrate ideation, planning and execution of the movements?
- How does the child organize his/her behavior during participation?

(Schaaf & Roley, 2006).

The occupational profile is then used to develop the intervention plan to address the needs of the child and family. When developing goals with the family it is important to remember that the goals should be occupation based. Although the occupational therapist uses many of the clinical observations discussed above, the goals should not be a reflection of the clinical observations. For example, the clinical observation of sequential finger touching provides insight into the child's ability to dissociate fingers and the child's understanding of where their body is in space (how the fingers relate to one another). An example of an occupation that may be related to poor performance with sequential finger touching is difficulty with fasteners such as buttons, difficulty opening small containers such as the toothpaste cap, or difficulty using a writing utensil such as a crayon or pencil. The clinical observations are used to better understand the child's needs and can be used to track developmental change over time.

VIII. Sensory Integration (SI) Intervention Strategies for Children with Autism

Intervention will require the occupational therapist to assume multiple roles: direct intervention provided to the child, education and support of the family, consultation to the team (family, teachers, aides, other professionals), and home programs to support performance. Ideas for the development of direct intervention approaches will be addressed below. In addition, suggestions/examples of education, consultation, and/or development of considerations for home will be provided.

The foundation of OT-SI, or occupational therapy using a sensory integration basis, is that "neural system functions" can be changed via the engagement in a sensory rich environment. Thus, a sensory based intervention relies on the occupational therapist to support exploration of the environment by offering activities for engagement to promote development – bearing in mind that sensory based intervention is more effective when more than one sensory system is engaged (Parham and Mailloux, 2015).

The use of sensory input during intervention requires the active engagement of the child. As the sensory input is available the child must then process the information and organize it to support participation. The goal is to elicit an adaptive response, or organization of "a successful, goal-directed action on the environment" (Parham & Mailloux, 2015, p. 259). In simpler terms, an adaptive response is when the child successfully responds to an environmental challenge. A basic adaptive response may occur, for example, when a child gets on a swing but doesn't hold on, the occupational therapist moves the swing, and the child grabs the ropes of the swing to stabilize (the adaptive response). As the movement of the swing gets bigger, the child is required to increase their stabilization by making postural adjustments and holding tighter (a higher level adaptive response).

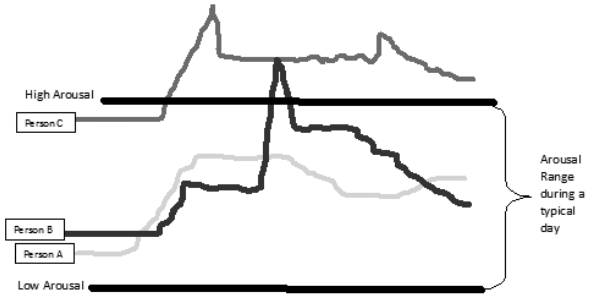
Evaluation is the guide to intervention, answering such questions as "Which sensory systems are impacting occupational performance?" and "What are the priorities for the child/family?" The occupational therapist uses evaluation findings and data to develop a plan for intervention, based on the sensory needs of the child coupled with the interests of the child. The occupational therapist creates an environment that is inviting to the child, and provides opportunities for the child to actively explore the environment within the boundaries of what is needed to promote development.

For a child with autism, intervention can pose an additional challenge. Many children with autism present with a decreased interest in participation, and therefore decreased motivation to engage. So, in addition to creating sensory opportunities to promote development, the occupational therapist must also find ways to motivate the child to engage, such as discovering the child's interests and passions and incorporating them into the intervention plan. Armed with the assessment data and child specific preferences, the occupational therapist designs each individual session to meet the child's needs.

Finally, the occupational therapist should have a keen awareness of the significant impact sensory stimulation can have on the state of the nervous system: autonomic nervous system responses that can

result from misuse of sensory stimulation are nausea, sweating, drowsiness, etc. The occupational therapist has a responsibility to monitor and make observations about the child's response to any sensory input, in relationship to their arousal level and their autonomic nervous system response, during the entire session, and adjustments should be made based on these observations.

At the start of each session, the occupational therapist must also determine the child's arousal level, or the level of alertness of the child's CNS. Typically, a person's arousal fluctuates within a range: for example, in the morning a child's arousal state may be low; by the end of the school day, however, their arousal level is high. Humans are at their best when arousal level is within the expected range. At that time, we are able to attend to environmental stimuli, process it, and respond to it. But in a circumstance where a person's system is very stressed, their arousal level may increase or decrease to a level outside of the typical range.



Arousal Levels

For example, Person A above wakes up at a low arousal level; after a shower and caffeine, the person's arousal level increases, and continues to increase throughout the day as Person A faces stimuli from the environment (traffic, work demands, etc.). The arousal level begins to decline as the day comes to an end and Person A listens to the radio during the drive home. Although it presents with some ups and downs throughout the day, Person A's arousal level remained with the range of normal.

Person B wakes up with a little more energy than Person A, and starts the day in much the same way. Then, on the way to work, Person B is in stop and go traffic and gets in a minor fender bender: this incident immediately increases Person B's arousal level, sending it outside of the normal range. While there were no injuries and all parties continued on their way, Person B is still shaken up; the arousal level, although gradually decreasing, remains high for a period of time.

Person C is a child with autism who has difficulty processing sensory information, who begins the day with an arousal level within the range of normal, but already high. Any disturbance, such as a change in routine, a loud noise, or unexpected touch, may increase the arousal level to outside the normal range. Due to difficulty regulating responses to sensory input, Person C will stay at a high level of arousal throughout the day. Therefore, Person C will not process incoming sensory information effectively, and behavior and performance will be impacted.

As we can see, arousal level is influenced by sensory input from the environment. For example, attending a child's birthday party may include lots of young children laughing and playing. The noise level is probably high. There are decorations all around. The auditory (laughing, squealing, music playing), visual (balloons, decorations, lots of people), vestibular (chasing kids, jumping in a bounce house), proprioceptive (bumping into to others, hugging, clapping), and tactile (eating sticky ice cream and cake, handling toys) input, plus the smells and tastes, comprise an increased amount of sensory input that is not typical. Based on this additional sensory input, a child's arousal level will likely begin to increase, and may reach a high level outside of the typical range. The result for a typically developing child may be a "melt down," which is the child's way of coping with the sensory overload.

Arousal levels for some children with autism may routinely run high or low. Other children may have a fluctuating arousal level, high at times, low at times, or somewhere in between. To maximize therapy sessions, the occupational therapist should determine the child's arousal level at the start of the session, then sensory input can be used to regulate the arousal level and bring it into the mid-range. For example, if a child comes to occupational therapy and appears sluggish, the therapist may determine that the child is currently in a state of low arousal: therefore, their ability to attend to relevant stimuli will be decreased. The occupational therapist would then use sensory input to increase the child's arousal level prior to engaging them in occupation, which could be accomplished by using vestibular input such as a scooter or swing to "wake up" the system and prepare it to work. In contrast, if a child comes to occupational therapy and they are at a state of very high arousal, they will be unable to attend to relevant stimuli in a meaningful way. The occupational therapist would then use sensory input to decrease the child's level of arousal: this could be accomplished by turning down the lights, playing soft music, and using slow, predictable movement on a swing. The goal of both of these interactions is to bring the arousal level into the typical range, where registration of sensory stimuli is accurate and response to the stimuli is functional. Once the child's system is ready to accurately take in sensory input and process it for use, the occupational therapist can then engage the child in an interaction that requires them to interact with the environmental challenges.

To reiterate: each session should be planned for each individual child to address the specific needs of the child and to monitor the response of the child.

Tactile Defensiveness

Let's consider a child with tactile defensiveness. The child has an interest in trains. The occupational therapist may want to consider a few of the following concepts when planning the intervention:

- Tactile defensiveness means the child's tactile system is ____?____ reactive to incoming tactile stimuli. (hyper)
- The goal is to engage the child in sensory opportunities to facilitate development of the neural systems. To have direct access to the tactile system in which the receptors are located _____?_____ (on the surface of the skin, with most receptors in the hands and feet) the occupational therapist would ask the child to remove their shoes and socks.
- Then knowing that stimulation of multiple sensory systems has a more positive effect on development AND to develop a relationship based on trust and fun, the occupational therapist may use the child's love of trains and choose a "bolster swing" (see Using Sensory Equipment, below) to begin the session. The child and the occupational therapist can both go for a ride on the "bolster swing/train."
- As the child participates in play on the "train" the occupational therapist can change the speed and/or direction of the swing to elicit an adaptive response. The child may have initially been straddling the bolster swing with his hands placed in front of him on the smooth swing. As the therapist-guided speed and direction change (as the train races down the track and around the bends) the child will need to make postural adjustments (adaptive response). When the movement of the swing increases still more, or changes directions more often, the postural adjustments may not be enough and the child must reach for the ropes (adaptive response). The ropes are a different texture than the smooth surface of the swing, increasing the active sensory input into the hands.
    - Because of the child's interest in trains, the child is more likely to be an active participant in the play process, and be less focused on the tactile input.
- After racing down the tracks, the child can pull the train into the station for a tune up. The occupational therapist has carefully selected "tools" available for tuning up the train. The tools can be different weights, sizes, and textures. The occupational therapist and the child proceed in the imaginative play process, facilitating engagement with a variety of textures in the environment.
- To increase the opportunity for tactile engagement, the occupational therapist can expand the interaction to include cleaning/scrubbing the train with a variety of different brushes or cloth textures of the child's choice, or painting the train a variety of different colors using different dry paint brushes.
    - As participation with the imaginative play task increases the tools or brushes can be located in texture bins of rice, macaroni. The child must retrieve the desired object (tool or brush) from the bin to complete the "job."
- The occupational therapist will continue to offer opportunity for active exploration of a variety of textures using the child's interests to support participation.

Gravitational Insecurity

Let's consider a child with gravitational insecurity. This child enjoys arts and crafts.

- Gravitational insecurity means that the child's vestibular system is ___?___ reactive to a change in position of the head or center of gravity (hyper). This indicates an issue with vestibular-proprioceptive processing.
- The goal is to engage the child in sensory opportunities to facilitate development of the neural systems. To have direct access to the vestibular system in which the receptors are located _____?_____ (inner ear) the occupational therapist could ask the child to sit at a table on a small ball (one that allows their feet to be firmly on the ground).
- Then knowing that stimulation of multiple sensory systems has a more positive effect on development AND to develop a relationship based on trust and fun the occupational therapist may use the child's love of arts and crafts and choose to make jewelry at the table. Trust between the child and the occupational therapist is key to this intervention. The child must be confidant that they are safe and that the occupational therapist respects their movement limitations boundaries.
- Because of the child's interest in arts and crafts they are likely to be an active participant in the play process, and be less focused on the vestibular input.
- By having the child sit on a ball the opportunity for movement is built in to the session. The movements are small and controlled by the child. The therapist can then set up the work space to facilitate larger movements on the ball.

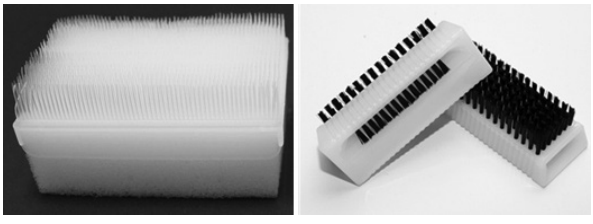
Tactile Discrimination

Let's consider a child with tactile discrimination problems. This child has an interest in animals. The occupational therapist may want to consider a few of the following concepts when planning intervention:

- Tactile discrimination problems means the child's

tactile system is ___?____ reactive to incoming stimuli. (hypo)

- The goal is to engage the child in sensory opportunities to facilitate development of the neural systems. To have direct access to the tactile system in which the receptors are located _____?_____ (on the surface of the skin, with most receptors in the hands and feet) the occupational therapist would ask the child to remove their shoes and socks.
- To directly stimulate the skin surface, the occupational therapist can use a brush to "scrub" the child's hands. The therapist can utilize any brush that adequately impacts the child's system in a positive way (i.e. no pain).
  - A common brush utilized by many occupational therapists is a surgical scrub brush (see below). The soft, yet stiff, bristles stimulate the receptors (skin) and increase the child's awareness of their hand.



Surgical Scrub Brush & Nail Brush

  - The therapist can brush the palmar surface of the hand and then brush each finger as an isolated unit. Finally, the therapist can brush the tips of the fingers.
- Now that the tactile system is "awake" and ready, the occupational therapist can hide small zoo animals in a bin of rice or macaroni. The hard texture of the dried food will provide more tactile input than a soft texture. The hidden animals should have distinct differences that can be identified by touch. For example, an elephant with a long trunk, a lion with a mane, a crocodile with a long nose and teeth, a monkey with a curly tail, a bear with a big body.
  - The occupational therapist can ask the child to locate a specific animal via touch: for example, "find the monkey." The child reaches into the bin to feel around and locate the monkey.
  - The occupational therapist continues to ask the child to locate all of the animals, making sure the child is not relying on the visual system.
  - This activity should be expanded to include typical objects the child uses throughout the day, such as a key, a paperclip, a pencil, an eraser, coins, etc.

Proprioception

Let's consider a child with proprioceptive problems. This child has an interest in sports. The occupational therapist may want to consider a few of the following concepts when planning intervention:

- Proprioceptive discrimination problems means the child's proprioceptive system is ___?____ reactive to incoming stimuli. (hypo)
- The goal is to engage the child in sensory opportunities to facilitate development of the neural systems. To have direct access to the proprioceptive system in which the receptors are located _____?_____ (in the muscles and joints) the occupational therapist should consider activities that include joint compression, pressure and vibration.
- To directly stimulate the proprioceptive system, the occupational therapist can place the child prone on a therapy ball. The key point of control, or where the therapist provides physical support on the child's body, can be proximal (i.e. pelvis) or distal (i.e. ankles). The therapist can ask the child to "walk" on extended arms.
  - The child can be encouraged to bend their extended arms and push themselves back. The therapist can then shift them towards the floor again and the child "catches" themselves on extended arms.
- Remaining on the therapy ball, the child can be asked to retrieve the small soft balls a little bigger than their hand by weight shifting onto one upper extremity and reaching for the ball with the other upper extremity.

Therapy Ball: Prone Weight Bearing & Weight Shifting

- The child can then "slam dunk" the ball into a trash can basketball hoop. This should be repeated multiple times with both arms with the therapist maintaining control of the child's lower extremities and therefore changing the upper extremity requirements and positions. The joint compression into the shoulder and the "heavy work" of weight bearing and weight shifting will increase proprioceptive awareness in the arms.

Visual Perceptual

Let's consider a child with visual perceptual problems. This child has an interest in fish. The occupational therapist may want to consider a few of the following concepts when planning intervention:

- Visual perceptual issues may present themselves as problems with visual attention, visual memory, or visual discrimination. The visual system is __?___ reactive to the visual stimulus. (under)
- The goal is to engage the child in sensory opportunities to facilitate development of the neural systems. To have direct access to the visual system receptors (the eyes), the occupational therapist should consider activities that are visually appealing and of interest to the child.
- Stimulating multiple sensory systems is more effective and provides the opportunity for overflow between systems: the relationship between the vestibular system and the visual system make them a good match for this intervention. The child can be sitting a large air pillow (see below) that is now a fishing boat.

Air Pillow

The child will have a "fishing rod" weighted with a magnet on the end of the rope. The occupational therapist has placed various (paper) fish (with a paper clip attached) on the floor.

  - The child will have to stay on the boat while fishing. The therapist/waves will move the boat up/down and side/side in the water as the child fishes, stimulating the vestibular system.
  - The therapist will ask the child to retrieve a fish (visual attention: find a fish!"), or to retrieve a specific fish (visual discrimination: "find all of the red fish", "find all of the fish with a black tail") or specific fish in a specific order (visual memory: "find the red, blue, and then the green fish in that order").

Praxis

Let's consider a child with praxis problems. This child has an interest in dinosaurs. The occupational therapist may want to consider a few of the following concepts when planning intervention:

- Praxis is difficulty figuring out how to do a novel task. So intervention should be focused on activities that are ___?___ to the child. (novel)
- The occupational therapist should use sensory activities to create a context where the child is motivated to problem solve and come up with ideas and plans.
- To directly encourage the child to use his sensory systems to participate in a novel task, the occupational therapist can build an obstacle course. The course can be a dinosaur dig. The child will be required to climb up a ramp, trapeze swing over the "lava pit" (foam pieces in a large sack), crawl through a tunnel and climb over a barrel, all in search of dinosaurs, which are small plastic toys hidden in a theraputty at the end of the gross motor portion of the obstacle course.
  - As the child goes through the obstacle course the occupational therapist will encourage the child to "figure out" the various challenges without giving the answer. For example, as the child unsuccessfully attempts to cross the "lava pit" on the trapeze swing the occupational therapist can offer cues to support performance but not solve the problem. Cues may be related to the performance that is interfering with success, such as "Your feet are touching the lava." This cue provides the child with some information, but also requires the child to problem solve. After hearing the verbal cue the child may go through a series of thoughts leading him to a solution: "Why are my feet touching the lava? Oh, because my arms and legs are hanging straight. So I need to bend my knees and maybe my elbows while I am swinging."
- Once the child has made it through the gross motor portion of the obstacle course the child can be asked to help "hatch" the dinosaur eggs by manipulating the putty to reveal the dinosaur inside.
- After all of the dinosaurs have been "hatched" the child can be encouraged to sort the dinosaurs into categories. The complexity of the categories can be dependent on the child's cognitive level. For example, a child with high interest and understanding of dinosaurs may use categories such as carnivores, herbivores and omnivores. A child with lower cognitive functioning or a younger child may sort the dinosaurs by colors, such as yellow, blue and red.

Using Sensory Equipment

Vestibular equipment is any equipment that allows the opportunity for movement, such as swings, scooters, riding toys, etc.

SWINGS: Some swings can be hung from one suspension point, allowing for rotational, linear, orbital, or vertical stimulation (vertical stimulation can be achieved by using a vertical stimulation device to suspend the swing, which allows for an up/down or vertical movement of the swing). Other swings can be hung from two suspension points, which limits them to primarily linear movements.

Bolster Swing: One & Two Suspension Points

Most therapists typically use a prone or sitting position on a swing, but other positions, such as kneeling and standing, also have benefit. Moving the child into a higher position with a smaller base of support against gravity will increase the challenge and require a more mature adaptive response.

When using a swing with a base (platform, net, bolster, frog, etc.) the therapist can ask the child to reach for/pick up toys while in prone, sitting or kneeling; catch/throw a ball or bean bags to the therapist or a target; propel the swing using upper extremities while in prone, considering the height of the swing and the amount of weight bearing desired; pump the swing while in sitting; move the swing by pulling on a rope/inner tube/hoop. The therapist can also consider tilting the surface of the swing: for example, when a child is sitting on a platform swing, tilting the base requires an adaptive response that includes both postural and upper extremity engagement and adjustments.

Platform Swing: In Sitting & In Prone

SCOOTERS: When using a scooter, consider the type and size of the scooter and the needs of the child.

If the occupational therapist is working on prone extension, the scooter should be smaller: this provides a smaller weight bearing surface and therefore requires a higher level of prone extension. Children can use a scooter in prone on a level surface, propelling themselves with alternating upper extremity movements or simultaneous upper extremity movements, or they can pull themselves along a rope that has been attached to a door.

If the occupational therapist is working on supine flexion, the child can assume a prone position on the scooter with the rope overhead. The child can be asked to propel the scooter using reciprocating upper extremity movements to pull along the rope while they keep their lower extremities lifted off the floor. Another option for addressing supine flexion is to position the child in sitting and ask them to propel the scooter using simultaneous movements of the lower extremities to move forward. This will require the child to "pull" themselves forward with their legs.

Ramps work well with scooters: the child can assume a prone position to fly down the ramp and crash into a crash pad or a wall of cardboard bricks or soft foam pieces. Next. the child can rebuild the wall, propel back to the ramp, and pull themselves up the ramp using bilateral upper extremities. They can then turn around and repeat the activity.

To add additional resistance, the therapist can sit on the scooter or on a wheeled therapy stool and the child can be asked to push the therapist along a path. The therapist can adjust the amount of resistance by dragging their foot.

Typical equipment to support proprioceptive input may provide resistance or pressure, such as a trampoline, "steamroller," therabands/tubing, weighted vests and blankets, medicine balls, body socks, massagers/vibrators, etc.

The therapist should create a context that requires the child to participate in resistive activities, such as crawling through tunnels/barrels/tubes and crawling under foam blocks/bolsters/weighted blankets. The therapist can also use ramps/ladders/steps for climbing up/down. Ropes/theraband/inner tubes can be used to support the climbing and add extra resistance or used to play tug-o-war.

Children may enjoy playing "Simon Says" or dancing while in a body sock. Jumping on a trampoline, catching a medicine ball, and then diving into a crash pad is a great proprioceptive and fun activity. "Squishing" or providing deep pressure is a great activity for lowering arousal levels: the child can lay on the mat in prone and the therapist can roll a therapy ball or air pillow over the child;

alternately, make a "sandwich" with the child on the bottom or in the middle, sandwiched between mats, foam pads, blankets, etc. Massagers and vibrators are also a great tool for addressing the proprioceptive system: large electric massagers can be used all over the body, or small, toy like massagers can be used in the hands.

Body Sock

Tactile input is offered by anything in our environment that we touch.

To provide options of items with interesting textures, occupational therapists will often create "texture bins" holding reusable items such as macaroni, sand, rice, beans, etc. A variety of brushes, such as paint brushes, hair brushes, nail brushes, etc. can be used. There are many toys on the market such as bumpy balls and animals, soft and squishy toys filled with liquid or sand, and stretchy toys that can be squeezed and pulled. Theraputty, finger paint, clay, and dough are great resistive and tactile toys: small items (coins, buttons, etc.) can be hidden in them, and the child can locate the items using their tactile system. The therapist can use "wet" textures such as shave cream, finger paint, pudding, slime, etc., and also consider combining wet and dry textures to create something novel and unpredictable such as sand/water, paint/rice, pudding/crushed cereal.

As stated earlier, using a multisensory approach is recommended to create change to the CNS. Most of the items identified above offer the opportunity to provide stimulation to a primary sensory system, and a secondary sensory system as well. For example, many swings are carpeted, so they offer both vestibular and tactile input; if you add the vertical stimulation device, you also add proprioception to the mix. The occupational therapist is seldom able to isolate a sensory input.

When designing an intervention, the occupational therapist should also consider the visual, olfactory, and auditory stimulation occurring naturally from the environment. Does intervention occur in a room with bright lights? Lots of decorations? High ceilings? Poor acoustics? An air conditioning vent? If so, consider how this context will impact the child's behavior, and what can be changed. Lights can be dimmed, music can be played and bulletin boards can be emptied. Similarly, some things will need to be managed: the air vent system and the "hum" that accompanies it cannot be changed, but sound dampening headphones may help to reduce the impact of the noise. Finally, what should be added to the existing context? For example, the therapist can facilitate visual skills by using visual targets during play: flashlights, bean bags, looking for items placed around the room, and aiming at a target during the movement activities will support ocular motor and visual development.

As we've discussed, regulating arousal level can be a very important part of preparing the child for intervention and participation. When children present with a low arousal level, the occupational therapist will need to increase it. This can be accomplished by incorporating quick, unpredictable movements (such as on a swing, trampoline, therapy ball, or air pillow), using bright lighting in the room, or playing fast, loud music. Many therapists also consider using food, such as sour candy or spicy chips, to increase arousal level (the therapist should always check with the family first about allergies, cultural guidelines, preferences/aversions, etc.). To decrease arousal levels, providing a closed in space (laying under a pile of pillows, in a tent, under a weighted blanket, etc.), sandwiching or squishing the child, rolling a therapy ball over them, decreasing the lighting in the room, playing soft music, or just keeping the room very quiet all work well, as does using controlled, regular movements on a trampoline or swing, Oral motor activities also can be very calming: sucking or blowing can help a child focus, such as sucking through a straw or blowing the whistle of a musical toy.

IX. Case Studies

CASE STUDY #1:

Samuel is a 5 year 7 month old boy with a diagnosis of autism.

He is the oldest of three boys. He lives with both parents: his dad is a pilot and is away from home for days at a time; his mother, a former teacher, is now a stay at home mom due to Samuel's diagnosis.

Samuel is verbal and ambulatory. He likes trains and the color blue. He is able to follow 2-3 step directions.

Samuel is currently enrolled in full day kindergarten at his local public school. Samuel rides the bus to and from school daily. He is in a classroom with 16 other children. There are two other children in the class receiving special education services. There is one teacher and one aide.

Samuel is currently working at grade level, although he requires verbal prompts to stay on task. He is easily distracted and frequently plays with his clothing. He completes any unfinished classroom work with the special education teacher.

Samuel started the school year off fine, but as the structure of school becomes more defined Samuel appears to be having some behavioral challenges. Samuel has some behavioral outbursts and occasional hitting during transition times, most notably, when they leave the classroom to attend a special class such as physical education or art. He has hit a few of peers reporting that they hit him first. He is also having difficulty during large school assemblies and music class, covering his ears and at times crying. He was initially making friends, but the other children in the classroom are including him less. The teacher is concerned about his social progress and also the impact of his new behaviors on his classroom performance.

The teacher has requested an OT screening and the parents have agreed. Although Samuel as never received OT services before, they are friendly with a few other parents of children with autism so they have heard OT.

You're the OT on the educational team!

- Where do you start?
- What assessment tool will you use?
- What observations do you note from the case?
- In what sensory systems do you see a clustering of behaviors? How will identification of the system(s) inform your next step?
- What type of service delivery model will you use with Samuel? Why?
- What intervention strategies will you use with Samuel? Why?
- How might the multisensory approach impact direct intervention during occupational therapy sessions?
- How will you determine if your strategies are working?
- What will you share with the educational team?
- What will you share with the family?

Take some time to consider each question and jot down your thoughts before reading on. Space is provided at the end of the course.

Where do you start?

Complete an observation in the classroom, request work samples, interview the teacher and the aide, interview the parent(s), spend time with Samuel. (The time spent with Samuel should be therapist directed, for the purpose of gathering data.)

During the classroom observation the therapist should look at Samuel's posture and position at his desk, as well as his attention to task during academic tasks and less structured activities.

Does he sit upright? Lay his head on the desk? Wrap his feet around the legs of the chair? Tug at his clothing? Wiggle in his seat?

Is he able to complete his work within the allotted time? If not, why? Is his pace slow? Does he lose attention? How long does he attend? How does his attention differ during preferred and non-preferred tasks, manipulative and paper/pencil tasks? What are the environmental distractors (for example, noises or movement outside of the classroom) that impact his attention? When Samuel loses attention, is he able to come back to the task or does he require redirection?

What is his arousal level? How does the environment impact his arousal level? What strategies, if any, does Samuel use to regulate his arousal? For example, does he get out of his seat frequently? Does he chew on his pencil? If Samuel has a behavioral issue, what preceded it?

What classroom skills does Samuel demonstrate? Document his fine motor skills, visual motor and visual perceptual skills, bilateral skills, postural skills, gross motor skills such as finger use, grasp, and pinch. Handwriting? Keyboarding? Cutting with scissors? Turning pages of a book? Movement transitions from the floor to standing to floor, standing to sitting in a chair, etc.? Is he able to gather/manage/organize the classwork materials such as notebooks, textbooks, papers, pencils, etc.?

The therapist should also observe the teacher's style of interaction with Samuel and the class. Does the teacher use primarily verbal instruction? Project based instruction? How does Samuel respond to his teacher and his peers?

What assessment tool will you use?

The Sensory Processing Measure (SPM) – the Home, the Main Classroom, and the School Environments. The SPM is appropriate for a child Samuel's age and provides the therapist specific, school related information from a sensory perspective.

What observations do you note from the case?

Verbal, ambulatory, the oldest of three, mom is stay at home and often acts as a single parent due to dad's travel schedule; likes trains and the color blue

In what sensory systems do you see a clustering of behaviors? How will identification of the system(s) inform your next step?

- Tugs at clothing (tactile)
- Hitting other kids while in line (tactile)
- Easily distracted, maybe by clothing (tactile, attention)
- Overwhelmed by loud noises (auditory)

Samuel appears to have a clustering of behaviors that are rooted in the tactile system.

The OT should take a closer look at his classroom context and social context (playground). The results from the sensory profile should be used to corroborate the observation results. The OT should also have a more detailed conversation with the mother asking probing questions to gather data about Samuel's sensory history.

What type of service delivery model will you use with Samuel? Why?

The overall goal is to support Samuel's school participation. Therefore, the OT should provide direct services to Samuel within the context of the classroom.

By providing services in the natural environment, the OT can better understand the sensory inputs from that environment and how they impact Samuel. Strategies can then be developed to support his participation in the classroom, cafeteria, at recess, etc.

Often, to address a specific sensory need, the therapist must provide a 1:1 intervention in addition to the services in the natural environment.

In addition, the occupational therapist must work with the team to help them understand Samuel's needs in the classroom.

What intervention strategies will you use with Samuel? Why?

Goals should be developed with the teacher and the parents. The OT intervention will then focus on the goal areas.

GOAL: Participation in classroom tasks

The OT should explore Samuel's response to various textures in the environment to develop an understanding of preferences and sensitivities. The OT can explore various textures with Samuel, beginning with preferences and working into non-preferred textures.

The OT can provide a "sensory bin" in the classroom with a variety of brushes and textured small toys, and encourage Samuel to "get his hands ready" before non-preferred activities. For example, Samuel may scrub his hands with the brush of choice prior to school work that requires contact with a non-preferred texture such as paste or clay.

GOAL: Attention to task during work time

The OT has observed that during work time, Samuel gets distracted and will begin tugging at his clothing.

The OT should call the parents and explore Samuel's preferences and non-preferences for various textures. When selecting his clothing for the day, they should consider his preferences and make suggestions to support respecting his preferences; other modifications may include tagless shirts, fleece sweatpants with an elastic waist, and socks without seams or turned inside out so the seams are on the outside.

The OT can also suggest to the parents a home program that includes "scrubbing" with a rough wash cloth prior to getting dressed in the morning or during daily hygiene tasks.

GOAL: Successful transitions with his class

Unanticipated contact during transitions may be causing Samuel's response of aggression towards the peers that "hit" him.

The OT should recommend to the teacher that Samuel be at the back of the line when transitioning to activities outside of the classroom, so that the typical bumping and jostling among the kids is more under his control.

How might the multisensory approach impact direct intervention during occupational therapy sessions?

Prior to the intervention, the occupational therapist should consider the primary goal: attention to and participation during classwork. What are the barriers that are preventing Samuel from accomplishing this goal?

To answer this question, the therapist must consider the task itself. What is required to participate in class? Being a student is a complicated role and involves many cognitive, motor, and sensory systems to support the outcome.

A quick task analysis offers some insight: For Samuel to participate in class he will need to attend to the task, he will need the postural tone to support his posture and movement, he will need to make postural adjustments, he will need to have grasp to use typical classroom tools such as a pencil and scissors, he will need to be able to follow directions, and he will need to engage with his teacher and peers in reciprocal interactions.

The occupational therapist should identify the barriers that are unique to Samuel: of the requirements to classroom participation identified above, what can and can't he do? The occupational therapist then needs to design a session to address Samuel's barriers. Samuel's barriers to performance can be identified as attention, tactile processing, postural control and adjustments, pencil grasp and control, following directions, and social participation.

The first step to determining Samuel's needs is to evaluate his level of arousal at the beginning of the session. Samuel presents with a slightly elevated arousal level, so the occupational therapist needs to lower his arousal level for optimal engagement – for example, having Samuel lay down on a mat while the therapist rolls a therapy ball over him to provide pressure/proprioceptive input. The occupational therapist should observe Samuel's response to the input. As it is determined that he has "relaxed" or lowered his arousal level, the session can move towards goal attainment.

The direct intervention should begin with Samuel taking off his shoes and socks. This will offer the opportunity for increased tactile input throughout the session.

Since Samuel is a student in a public school, the

occupational therapist probably won't have access to the suspended equipment, but there are options for stimulating the vestibular system that don't require a swing. A nice, portable piece of equipment that provides a movement experience is a "vestibular disc," which can be used to provide rotary vestibular input. Samuel can be asked to assume a prone position on the vestibular disc which is positioned on a carpeted floor. The prone position will require Samuel to assume and maintain this position against gravity; the movement of the vestibular disc will increase his muscle tone and support his engagement in this task; the carpet will provide tactile input into his hands and feet.

The occupational therapist has gathered a list of words associated with trains, and written each word on an index card. These can be placed in a circle around Samuel, and he can be asked to locate specific words: "Find ____." Samuel will then move the disc in a circle, visually scanning the words and trying to locate the correct one. When Samuel finds the correct word, he is offered praise and asked to place the card on an "x" to make a pile of the words. If this task is easy for Samuel, it can be graded up by asking him to "Find ____ and _____ and ____." He will now have to retain three items in his short term memory and locate them on the floor around him. As he locates the correct words he adds them to the pile.

Once all of the words have been found, Samuel can transition to heel sitting on the floor. The vestibular input will increase Samuel's attention so he is better able to participate in a school task. The occupational therapist has prepared several pieces of paper that have one short sentence on each: "The first car is called the_____," or "Trains drive on a _____." The occupational therapist will read the sentence to Samuel and ask him to find the word that fills in the blank. He can then be encouraged to occasionally weight bear on one hand while he manipulates the cards to find the correct word to complete the sentence. Once the word is located, Samuel will place it on the paper and go to the next sentence. The intermittent weight bearing on the carpeting will provide an opportunity for tactile input into his hands and proprioceptive input into his upper extremities.

After all of the sentence are complete Samuel can be encouraged to stand in front of large pieces of paper taped to the wall, each with a picture of one of the objects from his sight words – for example, the first paper will have a picture of an "engine car" Samuel will be asked to stand at the wall and paint the "engine," either by finger painting or painting with a brush. After he has filled in the object with paint, he will be asked to paint the word under the picture. Standing at the wall will require Samuel to maintain his upper extremity against gravity and use the proximal stability he was working on while weight bearing and weight shifting into his upper extremities earlier. The paint is yet another opportunity for tactile input, although now a wet texture is introduced. The carpeting as he stands barefoot at the picture is also an additional opportunity to tactile input.

After Samuel has painted the pictures and the words, the occupational therapist can transition Samuel to the sink so he can wash up. The sink may be down the hall, requiring Samuel to walk on a smooth, cool surface in his bare feet. Samuel will be encouraged to use soap and water to clean his hands and/or the brushes. He will be encouraged to dry his hand using a cloth towel instead of a paper towel. The occupational therapist and Samuel will return to the area they were working and put on his socks and shoes. Incorporating "clean up" into the session provides another opportunity for wet tactile input, the soap and water. The use of paint put the wet texture in context for Samuel and also provides a reason to wash his hands. The opportunity to don/doff his shoes offers multiple benefits from increased sensory input to practicing his ADL's.

As Samuel progresses academically, the therapist can exchange the train words for his sight word vocabulary or spelling words.

How will you determine if your strategies are working?

A data collection system should be developed to gather outcome data to inform the clinical reasoning process. Has attention to task and work completion improved? Has the number of physical incidents with his peers decreased?

Factors specific to the intervention strategies used during occupational therapy include:

- *How long was Samuel able to maintain a position of prone extension against gravity during the session?*
- *How long was Samuel able to attend to the academic task?*
- *Was Samuel able to visually scan the environment and locate the words?*
- *How long was Samuel able to maintain his upper extremities against gravity at the wall to paint?*
- *What was Samuel's reaction to the tactile input? What were his responses to the textures? Was there a difference in his response to the wet vs. dry textures?*
- *Was Samuel able to complete the ADL tasks of hand washing/drying and donning/doffing his socks and shoes?*

What will you share with the educational team?

The educational team should be given information regarding sensory processing and how sensory processing impacts participation. Examples should be provided that included over/under stimulation and the potential behavioral responses.

Team members should be encouraged to inform the occupational therapist about concerning behaviors that occur during the school day. The occupational therapist can further investigate the behavior to determine the underlying cause and if appropriate, suggest strategies to support performance. The strategies may include developing a "sensory diet" or use of sensory input to regulate arousal in support of positive behaviors. (A sensory diet provides sensory opportunities offered throughout the child's day to proactively support regulation. For example, if the occupational therapist knows that the child responds positively to somatosensory input, the use of "squishing" paired with the opportunity to use a "fidget toy" such as a bead necklace prior to art class may support the child's participation in a class that is typically a challenge.)

The therapist will share Samuel's response to the intervention and outcomes. For example:

- *Did his attention to task increase post vestibular input? If so, share with the teacher the outcome and suggest the opportunity to build movement into his day as his attention decreases during class time.*
- *Share with the teacher Samuel's ability to visually scan his environment and participate in an academic task. If he was overwhelmed by the visual input, the occupational therapist can suggest simplifying some of his worksheets by reducing the amount of visual stimuli per page.*
- *Share Samuel's response to the wet and dry tactile input. If Samuel was challenged by the wet texture, suggest options during classroom tasks that involved wet textures such as painting or pasting.*

What will you share with the family?

The family should be an integral part of the team. As options are being explored and developed, parental input is essential. If the family is unable to be present during team meetings and informal exchanges of information, the parents should be part of the communication mode used to share information.

CASE STUDY #2:

Mary is a 10 year 5-month old girl with a diagnosis of autism.

She is the second of four children. Her dad is an auto mechanic and her mom is a nurse.

Mary is ambulatory and non-verbal. She has a simple augmentative communication system/picture board using picture symbols to indicate her basic needs: yes/no, hungry/thirsty, potty, hurt, tired, happy/sad.

Although Mary attends her local public school she is currently working in the life skills curriculum at school in a self-contained classroom. Her Individualized Educational Program (IEP) goals are focused on participation in basic ADL's such as toileting, hygiene, self-feeding after set up, donning/doffing her coat.

Mary continues to make slow but steady progress with her IEP goals. But the parents report increased stress in during the morning routine, primarily related to dressing on school days. Mom is often on the night hospital shift and dad is responsible for getting all four kids ready for school. Mary is reluctant to participate in her self-care activities and often demonstrates behaviors such as hitting and crying during the morning routine, making it difficult to manage. Specific behaviors include:

- Refuses to wear certain clothing
- Has difficulty getting her arms and legs into the openings
- Hitting and crying during dressing
- Overwhelmed by loud noises
- Rocking forward and backward with one foot slightly in front of the other when she is staying in one place
- Will clap her hands and squeal when excited

The parents need Mary to increase her independence with dressing so that morning routine is less stressful for the entire family.

The parents are seeking outpatient occupational therapy services to support Mary's activities of daily living (ADL's).

You're the outpatient OT!

- Where do you start?
- What assessment tool will you use?
- What observations do you note from the case?
- In what sensory systems do you see of clustering of behaviors? How will identification of the system(s) inform your next step?
- What type of service delivery model will you use with Mary? Why?
- What intervention strategies will you use with Mary? Why?
- How might the multisensory approach impact direct intervention during occupational therapy sessions?
- How will you determine is your strategies are working?

Take some time to consider each question and jot down your thoughts before reading on. Space is provided at the end of the course.

Where do you start?

Interview the parent(s), spend time with Mary. (The time spent with Mary should be therapist directed, for the purpose of gathering data.)

To gather information about her sensory systems, Mary should be encouraged to interact with the sensory equipment such as swings, barrels, trampolines, climbing equipment, scooter, etc. The occupational therapist should use clinical observations and document Mary's response to the environment. For example:

What swing does she prefer? (solid surface vs. soft surface, one suspension point vs. two suspension points, etc.) What position on the swing does she prefer? (sitting, prone, supine, etc.) What type of movement does she prefer? (rotation, linear, orbital, etc.) Is her movement self-directed (she is able to move the swing or able to communicate that she wants the therapist to move the swing) or therapist directed?

What is her arousal level? How does her arousal level change in response to the environment?

How does she use her fine and gross motor skills to interact with the environment?

How does she use cognition (such as attention, memory, problem solving, sequencing, etc.) to support her performance?

What assessment tool will you use?

The Sensory Profile. The SP is a good choice to use with Mary because it is a caregiver questionnaire that provides information related to all of the sensory systems. The results will help to identify how Mary processes sensory information. It will also facilitate a dialogue with the parents.

What observations do you note from the case?

Non-verbal, ambulatory, the second of four kids, mom works shifts so dad is often solely responsible for the kids care.

Mary is generally compliant but when she is upset she cries loudly and hits. She is frequently upset when in a hectic context.

In what sensory systems do you see of clustering of behaviors? How will identification of the system(s) inform your next step?

Refuses to wear certain clothing (tactile)

Has difficulty getting her arms and legs into the openings (proprioceptive)

Hitting and crying during dressing (tactile, proprioceptive)

Overwhelmed by loud noises (auditory)

Rocking forward and backward with one foot slightly in front of the other when she is staying in one place (vestibular/sensory seeking)

Will clap her hands and squeal when excited (proprioceptive/sensory seeking)

Mary appears to have a clustering of behaviors that are rooted in the sensory defensiveness and sensory seeking behaviors.

The OT should gather additional data about the home context. The results from the sensory profile should be used to corroborate the observation results. The OT should have a more detailed conversation with the parents asking probing questions to gather data about Mary's sensory history.

What type of service delivery model will you use with Mary? Why?

The overall goal is to support Mary and the family during the morning routine. Therefore, the OT should provide direct services to Mary within the clinical context.

In addition, the OT should use Parent Coaching – defined as a verbal interaction where "therapists engage parents in collaborative, goal specific conversations to identify what works to further enable child, parent and family performance within the home, and community" (Graham, Rodger, & Ziviani, 2010, p.5) – strategies to support the parent's interaction with Mary during dressing. Strategies can then be developed to support her participation in the home.

What intervention strategies will you use with Mary? Why?

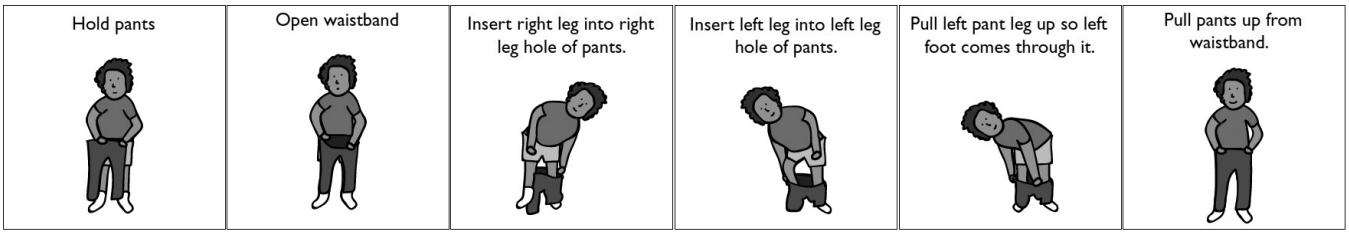
Goals should be developed with the parents. The OT intervention will then focus on the goal areas.

GOAL: Complete evening hygiene routine

> *The OT should explore Mary's response to various textures in the environment to develop an understanding of preferences and sensitivities. The outcomes should be discussed with the family.*
>
> *The OT can explore various textures with Mary, beginning with preferences and working into non-preferred textures as Mary tolerates them.*
>
> *The OT can suggest using a bath mitt with a preferred texture during bathing, and having a variety of different textured towels for drying off, introducing the different textures as Mary tolerates them.*
>
> *In addition, the parents should try to vary the amount of pressure provided during the drying. This can be a great opportunity to offer tactile input.*
>
> *After bathing, the OT can suggest the use of a body lotion, asking the parents to take into account the scent of the lotion: since it is bedtime, the scent should be one that Mary finds calming. Rubbing down the skin surface with lotion is an additional opportunity to provide tactile input.*

GOAL: Complete Upper Body and Lower Body Dressing

> *The therapist can complete a task analysis of upper body and then lower body dressing. This should be followed by an observation of Mary during these tasks.*



The therapist can then break the task into steps and introduce each step using a picture schedule, like the one above, depicting each step and provide verbal and/or physical cues as needed. The parents can be taught how to provide cues and supports.

The OT can suggest that the parents work on dressing following the newly established evening hygiene routine, to allow for more time and reduce the possibility of stress due to time constraints (other children needing assistance, the bus coming, etc.).

As Mary increases her skills, her parents can begin to transfer the skills into the morning routine.

How might the multisensory approach impact direct intervention during occupational therapy sessions?

In addition to the support provided to the parents for carry over in the home, the direct intervention session may include using a multi sensory approach. Since intervention is taking place in an outpatient clinic, the resources to support sensory based intervention will be more readily available.

Prior to the intervention, the occupational therapist should consider the goal: getting dressed in the morning. What are the barriers that are preventing Mary from accomplishing this goal?

To answer this question, the therapist must consider the task itself. What is required to get dressed? Getting dressed is a complicated task and involves many cognitive, motor, and sensory systems to support the outcome.

A quick task analysis offers some insight: If Mary gets dressed in sitting she will need to attend to the task, be able to have postural tone to support her posture and movement, she will need to make postural adjustments, she will need to know where her body is in space, she will need to have grasp and sustained grasp of the clothing, she will need to understand the sequence of putting on her clothes.

The occupational therapist should identify the barriers that are unique to Mary: of the requirements to dressing identified above, what can and can't she do? The occupational therapist then needs to design a session to address Mary's barriers. Mary's barriers to performance can be identified as attention, postural control/adjustments, awareness of position of her limbs, eye hand coordination, sustained grasp, and cognitive sequencing.

The first step to determining Mary's needs is to evaluate her level of arousal at the beginning of the session. Mary presents with a highly elevated arousal level, so the occupational therapist needs to lower her arousal level for optimal engagement. For example, the occupational therapist may choose to begin by altering the visual and auditory input from the environment by providing therapy in a private room, turning down the lights, and playing soft music. The therapist may then want to use a swing to provide vestibular input to Mary: this can be accomplished by placing a tube on a small platform swing that is suspended from one suspension point and having Mary lay down inside, then covering her with a blanket and moving the swing in a slow, predictable, orbital movement, limiting verbalizations to what is necessary. The occupational therapist should observe Mary's response to the input. As it is determined that she has "relaxed" or lowered her arousal level the session can move towards goal attainment.

Once Mary is able to attend and participate, the occupational therapist will transition Mary from the swing to the trampoline, which will have a "crash pad," or a bag

filled with foam pieces, placed beside it. The occupational therapist will ask Mary to step onto the trampoline and – standing in front of Mary and holding both of her hands – will ask Mary to jump 10 times, then jump off the trampoline and crash land on the crash pad. The therapist will encourage the jumping by providing physical cues while holding Mary's hands, and will count the jumping up/down. The structured jumping on the trampoline will

provide vertical vestibular input and strong proprioceptive input. The vestibular input will be motivating to Mary as she is a sensory seeker, and it will also support her attention. Mary is also a proprioceptive seeker and has decreased proprioceptive awareness; the heavy jumping on the trampoline will increase her proprioceptive awareness and provide her with information about where her body is in space, and the final crash into the crash pad is an additional reinforcer about her body in space. After Mary crashes into the pad, she will be asked to repeat the jumping on the trampoline and the crash pad. The occupational therapist will observe Mary's response to the sensory input, paying close attention to her arousal level, attention to task, and her adaptive responses.

After Mary is ready to move on from the trampoline, she will climb a "mountain" – a large foam wedge that has a rope down the middle. Mary will be asked to hold the rope in both hands and use it to pull herself up the mountain. At the top, the occupational therapist has placed some oversized clothing and a small laundry bin. Once Mary arrives at the top, she is asked to gather the clothes and place them in the basket. The heavy, proprioceptive work of pulling her body up the incline will increase her proprioceptive awareness of her upper and lower body and require her to sustain her grasp. In addition, the tactile and proprioceptive input into her hands will help prepare them for task engagement. Picking up and placing the clothing in the laundry basket will require eye hand coordination. The occupational therapist then directs Mary to slide down a ramp and land in a foam pit.

After Mary figures out how to get up and out of the pit, she is directed onto a large bolster swing hung from two suspension points. The occupational therapist will use clinical observations to determine Mary's current arousal level If needed, the swing can be used to decrease Mary's arousal level in the same way it was accomplished at the start of the session: slow, predictable movements with a decrease in sensory input from the environment. If Mary's response to the heavy, proprioceptive work has been to maintain her arousal level in an optimal state, then the swing can be used to continue to work towards goal attainment.

Mary can be directed to sit on the swing holding on to the ropes on both sides. The occupational therapist can propel the swing forward towards the wall. Mary can be asked to lift her legs and push off of the wall to propel the swing backwards. As Mary is swinging back and forth the therapist can hold up pieces of oversized clothing and ask Mary to release her grasp on one rope, reach for the clothing and to toss it in a laundry bin. This will be repeated multiple times and on both sides. The number of repetitions should not be predetermined, but based instead on Mary's response to the input. The linear swinging will increase Mary's postural tone, and the movement of the swing will require postural adjustments. The vestibular input from the swing will also support Mary's attention. Mary will be required to lift her lower extremities up against gravity and to maintain them in that position while swinging. This position will further engage her core musculature. The pushing off of the wall with her lower extremities will provide proprioceptive input into her lower body. The ropes will provide tactile input into her hands and the opportunity for maintaining a sustained grasp.

Mary will then be directed to transition from the swing to a small bench where she can sit with her feet on the floor. Mary will be told she is going to practice getting dressed. She will be offered a choice of oversized clothing (for example, "Do you want the blue shirt or the red shirt?"). After Mary indicates her choice she will be instructed to put on the shirt using backward chaining, an approach used to scaffold learning to support cognitive processing and promote success (Shepard, 2015). The parents will be invited to join the session so that they can observe the structure and cues provided to support her performance. The parents will be offered tips on how to cue Mary, how to encourage her, and how to reward her performance.

How will you determine if your strategies are working?

A data collection system should be developed to gather outcome data to inform the clinical reasoning process. Has her self-dressing improved? What is she able to do? What is the efficiency of her abilities? Do the parents report a decrease in behaviors related to the self-care routine? Do the parents report a decrease in family stress as a result in the changes in performance?

X. Conclusion

On a final note: although occupational therapists have a basic understanding of sensory based intervention, advanced training is highly recommended to develop the clinical skills to support the use of OT-SI with a variety of diagnoses. There are multiple advanced training opportunities available.

Caution is always required when using sensory based intervention techniques. Sensory input has a very powerful impact on our CNS, and should be used with caution and a keen clinical eye, based on client need as determined by evaluation. The occupational therapist should always closely monitor the child's ANS reaction to the input and the child's emotional response to the input, using both to determine the next steps of the process.

The occupational therapist plays a central role on the team, filling in the gap for understanding the sensory systems and how they impact function. To maximize the influence of occupational therapy services for a child and family dealing with autism, the therapist must be aware of the multifaceted needs of the child and the family. Providing direct services to influence the state and development of the sensory systems is vital. Direct services can target specific developmental needs and facilitate maturity of the CNS. But it is important to remember that providing intervention 1-2 times per week, although important, is going to promote a limited change in development. The role of the child's occupational therapist is to create a supportive environment that will maximize the child potential. Therefore, in addition to direct intervention, the occupational therapist must also assume the role of an educator and an advocate.

When used correctly, rooted in a theoretical understanding of how the brain works, sensory based intervention can be a powerful tool to engagement and participation of those with autism who present with an abnormal response to sensory stimuli.

Notes

Common Sensory Assessments

Assessment	Ages	Format	Time to Administer/ Scoring	Subscales
Infant Toddler Sensory Profile Dunn (2002)	Birth-3	·Criterion-referenced; judgment-based questionnaire measuring infant/toddlers' reactions to sensory experiences completed by primary caregiver. ·Yields scores on frequency of observed behaviors rated on a Likert scale of 1-5 from "Almost Never" to "Almost Always." Scores summed into 4 quadrants (Low Registration, Sensation Seeking, Sensory Sensitivity, and Sensation Avoiding) and/or sensory systems. ·Scores given in relation to distance above and below the mean (Typical Performance)	15 min.	*Birth to 6 mos.:* General Processing Auditory Processing Visual Processing Tactile Processing Vestibular Processing *7 to 36 mos.:* General Processing Auditory Processing Visual Processing Tactile Processing Vestibular Processing Oral Sensory Processing
Sensory Profile Dunn (1999)	Ages 3-10 years	·Criterion-referenced, judgment-based questionnaire of 125 items completed by a primary caregiver ·Standardized on children with Autism ·Scores fall in range of Typical Performance, Probable Difference (1 sd <mean), or Definite Difference (2 sd < mean). SP Supplement provides an updated scoring system with expanded cut scores for easier interpretation ·Scoring software and Spanish versions available ·Yields scores on frequency of observed behaviors rated on a Likert scale of 1-5 from "Almost Never" to "Almost Always"	20-30 minutes	Sensory Processing Modulation Behavior and Emotional Responses
Adolescent/ Adult Sensory Profile Dunn (2002)	Ages 11+	·Criterion-referenced, judgment based self-report questionnaire of 60 items ·Yields scores on frequency of exhibited behaviors based on a Likert scale of 1-5, from "Almost Never" to "Almost Always." Scores are summed according to four sensory quadrants (Low Registration, Sensation Seeking, Sensory Sensitivity, and Sensation Avoiding). Scores given in relation to distance above and below the mean	15-20 minutes	Taste/ Smell Sensitivity Movement Processing Visual Processing Touch Processing Activity Level Auditory Processing

Sensory Profile-School Companion Dunn (2006)	Ages 3-12	·Criterion-referenced, judgment-based questionnaire completed by the child's primary teacher ·Yields scores on frequency of observed behaviors rated on a Likert scale of 1-5 from "Almost Never" to "Almost Always." Three types of scores are derived: (a) Sensory Quadrant Scores, (b) School Factor Scores, and (c) Section Scores. Scores given in relation to distance above and be-low the mean	15 minutes to administer 15 minutes to score	Environmental Sensations: ·Auditory ·Visual Body Sensations: ·Movement ·Touch Classroom Behaviors: ·Behaviors
Sensory Processing Measure (SPM) Glennon, Miller-Kuhaneck, Henry, Parham, & Ecker (2007)	Ages 5-11 years	·Norm-referenced, judgment-based questionnaires completed by primary caregiver, main teacher, and school personnel familiar with child. ·Three forms: Home Form, Main Classroom Form, and School Environments Form (art class, music class, physical education class, recess/playground, cafeteria, and school bus) ·Four-point Likert scale. Home and Main Classroom Forms yield standard scores (social participation, vision, hearing, touch, body awareness, balance and motion, planning and ideas, total sensory systems). Environmental difference score shows the difference in sensory processing across environments	20 minutes for the Home and Main Classroom Forms, 5 minutes for each additional School Environments form	Higher-level integrative functions: Praxis Social participation Sensory systems: Visual Auditory Tactile Proprioceptive Vestibular
SPM-P Glennon, Miller-Kuhaneck, Henry, Parham, & Ecker (2010)	Ages 2-5 years	·Norm-referenced, judgment-based questionnaires completed by primary caregiver, daycare provider, or preschool teacher	15-20 minutes for the Home and Main Classroom Forms, 5 minutes for each additional School Environments form	Higher-level integrative functions: Praxis Social participation Sensory systems: Visual Auditory Tactile Proprioceptive Vestibular

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Additional Resources:

Sensory Integration Topics by Zoe Mailloux
http://www.zoemailloux.com/sensory-integration-topics.html

Sensory Integration Network
https://www.facebook.com/SensoryIntegrationNetwork

Autism Speaks
https://www.autismspeaks.org/

Autism Spectrum Disorder Fact Sheet
http://www.ninds.nih.gov/disorders/autism/detail_autism.htm

AOTA
http://www.aota.org/Practice/Children-Youth/Autism.aspx

CDC
http://www.cdc.gov/ncbddd/autism/index.html

Research Autism
http://researchautism.net/

Sensory Integration and Autism Spectrum Disorder
(3 CE Hours)

FINAL EXAM

1. **To receive a diagnosis of Autism Spectrum Disorder (ASD) a child must meet four criteria with specific distinctions related to each criterion. Which is NOT a criterion for an ASD diagnosis?**
   a. An intellectual developmental disability
   b. Deficits in social communication and interaction (SCI) - three distinctions
   c. Restrictive, repetitive behaviors (RRP) - two out of four distinctions
   d. Symptoms cause impairment in "social, occupational or other important areas" of function

2. **The role of the peripheral nervous system (PNS) is to _____.**
   a. Control basic functions such as heart rate, breathing, and consciousness
   b. Process information as a stimulus is introduced
   c. Receive information from the brain stem, spinal cord and various parts of the brain
   d. Transmit information to the central nervous system (CNS) to support movement and reactions.

3. **The receptors for the vestibular system are located _____.**
   a. In our muscles and joints
   b. In our skin, with the majority in the palms of our hands and the soles of our feet
   c. In the inner ear
   d. In the nose and tongue

4. **The _____ system has two functions: protection and discrimination.**
   a. Auditory
   b. Proprioceptive
   c. Tactile
   d. Vestibular

5. **According to Ayres Sensory Integration (ASI), when we think of sensory development in terms of laying the foundation for overall development, we must acknowledge the contribution of the sensory systems as _____.**
   a. A crack in the foundation
   b. Contrary to higher level skill development
   c. Detrimental to learning and behavior
   d. The building block in the foundation

6. **_____ may present as having difficulty interpreting touch information or stimulus: a child may not be able to differentiate the difference between a quarter or a nickel by touch alone.**
   a. Proprioceptive problems
   b. Tactile defensiveness
   c. Tactile discrimination problems
   d. Vestibular bilateral problems

7. **Proprioceptive problems may present as difficulty interpreting where the body is in space. A child with proprioceptive problems _____.**
   a. May appear to be stomping, seeking the sensory input you and I get while walking
   b. May appear unaware of the environment
   c. May not be able to recognize their shoe if it has been turned upside down.
   d. May refuse to wear jeans because they are stiff and have heavy seams and a snap

8. **A child with a praxis problem (dyspraxia) who sees an object or opportunity in the environment such as a bike, and knows he wants to ride it but doesn't know what to do, has difficulty with _____.**
   a. Any stage of the process
   b. Execution: Making the bike move
   c. Ideation: I can ride the bike
   d. Planning: How to ride the bike

9. **Which of the following is NOT characteristic of vestibular bilateral problems?**
   a. Difficulty participating in childhood activities such as riding a bike or playing cooperative hand games with a partner
   b. Difficulty with balance, equilibrium, or poor coordination between the two sides of the body
   c. Negative response to sounds, tastes, and smells
   d. Postural challenges and difficulties with attention to task

10. **The _____ is norm referenced. It offers forms for the Home, the Main Classroom, and the School Environments, as well as a preschool edition.**
    a. Comprehensive Observations of Proprioception (COP)
    b. Sensory History
    c. Sensory Processing Measure (SPM)
    d. Sensory Profile

11. **Clinical observations, developed by Jean Ayres, can reveal information about the function of the neurological system of the child. For example, when looking at _____, immature or poor responses may contribute to the identification of decreased vestibular-proprioceptive function.**
    a. Crossing Midline (The ability to cross the body midline with one or both hands to manipulate objects in contralateral space)
    b. Protective Extension (A protective reaction that results from loss of balance that involves extension of the non-weight bearing "downhill" limbs, or those on the side toward which the fall would occur)
    c. Sequential Finger Touching (The ability to sequentially oppose the thumb to each of the other fingers, index to little finger and back)
    d. Supine Flexion (Simultaneous flexion against gravity of the knees, hips, trunk, and neck from a supine-lying position)

12. **The overall assessment process should culminate in an occupational profile that includes _____.**
    a. A narrative of the child
    b. Past medical and developmental history
    c. Priorities of the child/family/team
    d. All of the above

13. **A sensory based intervention relies on the occupational therapist to support exploration of the environment by offering activities for engagement to promote development – bearing in mind that sensory based intervention is more effective _____.**
    a. When environmental challenges have been eliminated
    b. When only one sensory system is engaged
    c. When more than one sensory system is engaged
    d. When the child is not actively engaged

14. **Many children with autism present with a decreased interest in participation, and therefore decreased motivation to engage. In addition to creating sensory opportunities to promote development, the occupational therapist must also find ways to motivate the child to engage, such as _____.**
    a. Asking the child's parents to sit in on sessions and enforce engagement
    b. Incorporating the child's interests and passions into the intervention plan
    c. Using a system of penalties for failure to engage
    d. All of the above

15. **At the start of each intervention session, the occupational therapist must determine the child's _____, or the level of alertness of the child's CNS.**
    a. Arousal level
    b. Emotional mood
    c. Physical anticipation
    d. Sensory workload

16. **During an intervention for a child with tactile defensiveness, the occupational therapist may _____.**
    a. Ask the child to find and retrieve a desired object from a texture bin containing rice or macaroni
    b. Ask the child to sit at a table on a small ball
    c. Build an obstacle course
    d. Place the child prone on a therapy ball and ask the child to "walk" on extended arms

17. **During an intervention for a child with praxis problems, the occupational therapist should _____.**
    a. Consider activities that are visually appealing
    b. Consider activities that include joint compression, pressure and vibration
    c. Use a brush to "scrub" the child's hands
    d. Use sensory activities to create a context where the child is motivated to problem solve and come up with ideas and plans

18. **Which of the following typical equipment would provide the MOST proprioceptive input?**
    a. Enjoyable textures: soft and squishy toys filled with liquid or sand
    b. Novel textures: texture bins holding reusable items such as macaroni, sand, rice, beans, etc.
    c. Resistance or pressure: therabands/tubing, weighted vests and blankets, medicine balls, etc.
    d. The opportunity for movement: swings, scooters, riding toys, etc.

19. **Which of the following typical equipment would provide the MOST vestibular input?**
    a. Enjoyable textures: soft and squishy toys filled with liquid or sand
    b. Novel textures: texture bins holding reusable items such as macaroni, sand, rice, beans, etc.
    c. Resistance or pressure: therabands/tubing, weighted vests and blankets, medicine balls, etc.
    d. The opportunity for movement: swings, scooters, riding toys, etc.

20. **When children present with a low arousal level, the occupational therapist will need to increase it prior** to beginning the intervention. One way this can be accomplished is by _____.
    a. Decreasing the lighting in the room
    b. Incorporating controlled, regular movements on a swing
    c. Incorporating quick, unpredictable movements on a swing
    d. Keeping the room very quiet

ANSWER SHEET

First Name: _____ Last Name: _____ Date: _____

Address: _____ City: _____

State: _____ ZIP: _____ Country _____

Phone: _____ Email: _____

NCBOT #: _____

Other: License/certification # and issuing state/organization _____

Clinical Fellow: Supervisor name and NCBOT account # _____

Graduate Student: University name and expected graduation date _____

** See instructions on the cover page to submit your exams and pay for your course.

By submitting this final exam for grading, I hereby certify that I have spent the required time to study this course material and that I have personally completed each module/session of instruction.

Sensory Integration and Autism Spectrum Disorder Final Exam

1. Ⓐ Ⓑ Ⓒ Ⓓ	5. Ⓐ Ⓑ Ⓒ Ⓓ	9. Ⓐ Ⓑ Ⓒ Ⓓ	13. Ⓐ Ⓑ Ⓒ Ⓓ	17. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ	6. Ⓐ Ⓑ Ⓒ Ⓓ	10. Ⓐ Ⓑ Ⓒ Ⓓ	14. Ⓐ Ⓑ Ⓒ Ⓓ	18. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ	7. Ⓐ Ⓑ Ⓒ Ⓓ	11. Ⓐ Ⓑ Ⓒ Ⓓ	15. Ⓐ Ⓑ Ⓒ Ⓓ	19. Ⓐ Ⓑ Ⓒ Ⓓ
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SENSORY INTEGRATION AND AUTISM SPECTRUM DISORDER

(3 CE HOURS)

COURSE EVALUATION

Learner Name: _____ Completion Date: _____

❑ PT ❑ PTA ❑ OT ❑ OTA ❑ SLP ❑ SLPA Other: _____

	Disagree				Agree	
Orientation was thorough and clear	1	2	3	4	5	
Instructional personnel disclosures were readily available and clearly stated	1	2	3	4	5	
Learning objectives were clearly stated	1	2	3	4	5	
Completion requirements were clearly stated	1	2	3	4	5	
Content was well-organized	1	2	3	4	5	
Content was informative	1	2	3	4	5	
Content reflected stated learning objectives	1	2	3	4	5	
Exam assessed stated learning objectives	1	2	3	4	5	
Exam was graded promptly	1	2	3	4	5	
Satisfied with learning experience	1	2	3	4	5	
Satisfied with customer service (if applicable)	1	2	3	4	5	n/a

What suggestions do you have to improve this program, if any?

_____

_____

What educational needs do you currently have?

_____

_____

What other courses or topics are of interest to you?

_____

_____