

Sensory Integration and Development in Children

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The goal of this article is to explain, from an Occupational Therapy and developmental perspective, the process of Sensory Integration in children. Included below are descriptions of the common senses we all know (sight, hearing, and touch), as well as two “hidden” senses that most people never even think about, the vestibular sense and the proprioceptive sense. Each section includes specific activities that parents, teachers, and caregivers can do in order to help develop that sense, for infants, toddlers, and school-aged kids.

All of these senses work together as a child develops, and a deficit in one or more areas can have a negative impact on a child’s acquisition of higher-level skills. The neurological process during which we interpret sensations from the body and our environment is called Sensory Integration, or Sensory Processing. Many children struggle with Sensory Processing, and Occupational Therapy can help improve these skills for better motor skills, improved self-regulation, and sustained attention during the school day.

Visual System

Definition: Our visual system allows us both to see and to interpret what we see. Developmentally, it is important for recognizing people, shapes, colors, and eventually letters and numbers. Socially, it helps us to read body language and facial expressions. For example, we must use our vision to guide our movement through the world safely and effectively.

Infants: Provide the baby with high-contrast black and white images, bright colors (especially red and yellow), simple geometric designs, mirrors, and slow-moving mobiles. One of the baby’s favorite things to look at is the human face (especially mom and dad). Books with pictures of faces are often interesting to babies and will stimulate their vision. As your baby grows, you can help their vision mature by presenting slowly moving items so that they have to track the item as it moves throughout their field of vision (first try horizontal movements, then vertical, then circular).

Preschool: Help your child learn shapes, and colors, and begin letter and number recognition through activities like puzzles, blocks, and books. Children gain valuable “practice” with their visual system

through activities such as rolling a ball, stacking blocks, pointing to pictures in a book, coloring and cutting with scissors.

School-Age: Higher-level visual skills are developing at this age, including figure-ground, visual discrimination, and visual memory. Hidden picture books (figure-ground), matching worksheets (discrimination), and games like Memory are all great for this age group. In addition to the school tasks of reading and writing, children can work on their eye-hand coordination at this age through mazes, connect-the-dots, and word searches.

For more information about the development of vision, visit the website of the American Optometric Association. It provides great information about what changes occur at each age and stage and development:

<http://www.aoa.org/x9419>

Auditory System

Definition: We use our auditory system (or sense of hearing) to identify both the quality and location of sounds in our environment. For example, our auditory sense alerts us so that we turn our heads when a car is approaching.

Infants: A baby is born with a very well-developed sense of hearing. Your baby can recognize (and prefers) the sound of parents' voices. Talking to your baby is one of the best ways to help your baby's auditory system develop. This can include your own singing, too! As young as one month, babies can remember sounds, such as a repeated lullaby. Parents should also talk to their babies as they go through their day, narrating what they are doing is a great way to introduce language. Babies respond to repetition, and to high-frequency sounds (which is why many prefer female voices). As your baby begins to make her own sounds, repeat them back to her as this lays the foundation for the turn-taking of spoken language. Music, of course, is another strong auditory input that babies enjoy. This can be anything from classical music to nursery rhymes and songs, to any music that mom and dad like! You can help your baby refine her sense of hearing by having her find (localize) a moving sound (slowly moving a rattle or noisy toy). As your baby grows, introduce the following auditory/language concepts during play: animal sounds, names of colors, and counting (fingers, toes, blocks, etc.)

Preschool: Continue to explore music through playing simple instruments, learning finger songs, and singing. Playing with puppets and using different voices (high, low, silly, etc.) is a fun activity, and it also engages the child in pretend play. Have your child point to pictures in a book as you read it. Listen for and identify sounds in the environment (“that’s a car horn”, “hear the birds chirping”, etc.). Work on giving one-step, then two-step directions. As always, continue to talk to your child during your daily routines and continue to read books.

School-age: At this age, you can help your child continually improve their auditory skills by giving him three- and four-step directions. Addressing the concept of voice volume may be an issue as children enter school, where they are asked to be quiet for long stretches of the day. Instead of expecting children to understand the term “inside voice”, a visual aid may be helpful. You can make a simple chart with the following information: 0 = silent, 1 = whisper, 2 = talking, 3 = yelling. Act out each volume with your child. Then, explain the rules of your home regarding when it’s OK to use each (i.e., yelling may be OK during play, or during an emergency; a whisper should be used at nighttime, etc.) One final piece of OT advice regarding School-Age children and auditory input relates to that dreaded word...homework. My advice is to know how your child responds to noises and be aware of how this impacts his/her focus during homework. Some children will require quiet workspace, away from distractions such as radio, TV, siblings, phone calls, or even a parent cooking dinner. However, other children thrive on “background noise” to help them. These kids may do well working at the kitchen table or wearing headphones with music playing as they work.

To learn more about how your child’s hearing develops from in utero throughout childhood; visit the home of the American Speech-Language and Hearing Association: <http://www.asha.org/public/>

Tactile System

Definition: This is our sense of touch, which plays an important role in a child’s motor and social development. The tactile system provides information about the shape, size, and texture of objects. This information helps us to understand our surroundings, manipulate objects, and use tools proficiently. For example, you are using your tactile system when you reach into your pocket and find a quarter among several coins.

Infants: Touch helps promote parent-child attachment by giving your baby a sense of safety, security, and love. Developing awareness of the nature and quality of a variety of tactile inputs also gives infants

valuable information about the world around them, thus aiding their cognitive and fine/gross motor skills. Offer infants a variety of safe textures to explore (plastic or wooden toys, stuffed animals, soft blankets, “crinkly” toys, feely books, tactile mats, and tactile balls). Give her an infant massage (with or without lotion). Lightly rub her feet and clap her hands together. Expose her to different textures and sensations, such as a vibrating toy, a soft cloth, a feather, a scratchy piece of sandpaper or a bumpy ball. Be sure to tell her what the textures are as you show them to her. Allow for some “naked time” every day, so that your child can feel textures on her arms, legs, back, and belly. (If you are daring, you can go without a diaper for a while!) Also, be sure to have some supervised “tummy time” every day, so that your baby does not become too sensitive on her stomach (This position is necessary in order to prepare for crawling and develop upper body stability and strength).

Preschool: One activity preschoolers often enjoy is a sensory table (or at home, you can make a “sensory bin”). Fill a large plastic bin with a mixture of dried rice and beans, then you can hide small toys or “treasures”, puzzle pieces, or simply cups and spoons for empty-fill. Other fun suggestions include modeling clay, Play-Doh, and finger paints. Don’t be afraid to let them get messy! They are working on developing their tactile awareness, as well as the small hand muscles needed for later activities such as handwriting. Finally, taking a nature walk to pick up and explore various outdoor items (leaves, rocks, petals, dirt, etc.) is a great way to enjoy a nice day, while promoting this important sense.

School-Age: The sense of touch is highly developed in this age. A few ways to challenge your older child to use and perfect this sense are: draw letters on his back with your finger and have him guess, fill a cloth bag with common objects and have him identify things (one at a time) without looking in the bag. Activities such as arts and crafts, stringing beads, and lacing cards can help children continually improve their tactile skills.

Vestibular System

Definition: This is a system located in the inner ear. It gives us our sense of spatial awareness, controls balance, and assists with movement. By providing information about the position and movement of the head in relation to gravity, the vestibular system lets us know the speed and direction of our movements. For example, if your body is falling to the side, the vestibular system registers the movement of the head and sends signals to activate the muscle groups we need to maintain balance.

Infants: You probably already know and have discovered the positive effects of the typical movements that babies enjoy: gentle, rhythmic rocking and swinging. This can be very organizing for a fussy baby. In addition to baby swings that can be used inside the home, infants often enjoy being pushed in a stroller, riding in a car (in a car seat), or being gently swung in a blanket with mom and dad holding the ends. Once head control is firmly established, gentle bouncing on your lap, lifting the baby overhead, and slow, safe inversion (tilting baby upside down over your lap), can all help this sense mature. If your baby dislikes being laid down for diaper changes, try putting her down on her belly first (so that she feels more grounded) then turn her over to her back for the diaper or clothing change. Some babies may feel like they are “falling” and startle and cry with diaper changes if they are laid down too quickly.

Preschool: Kids in this age group are all about challenging their own vestibular systems! Provide lots of opportunities for your preschooler to explore playground equipment (swings, slides, merry-go-rounds), spinning toys (Sit and Spin, scooter boards), and rocking (rocking toys, glider chair). You’ve probably noticed that many children will also seek out this input themselves, through just plain rolling around or twirling in circles. To an adult whose vestibular system becomes less efficient with age, it can be hard to watch all that spinning...but know that it is good for their developing understanding of their body and how it moves. (*Note: excessive self-stimulating such as spinning can indicate a sensory disorder*).

School-Age: Many children at his age continue to crave intense vestibular input, and enjoy input such as amusement park rides, roller coasters, bike riding, skiing/snowboarding, and skateboarding. If your child wants to be “on the go” when it’s time to sit quietly (for example, during mealtime, homework, or a long car trip), it can be helpful to provide some strong vestibular input prior to the upcoming stationary time. Swinging, bike riding, playing hopscotch, or using a slide can all provide the desired input if you can get outside. In the home, you could provide a small trampoline (or allow jumping on the bed with an adult present), do jumping jacks, use a hippity hop, or have them use an exercise ball for bouncing. Some children have increased attention for seated work if they can get periodic movement during the task. Sitting on an exercise ball or using a movement cushion can help during this time. Here are examples of products that may be helpful:

Cushions: <http://www.therapro.com/Air-Cushions-C4218.aspx>

Ball chair: <http://www.sensory-processing-disorder.com/exercise-ball-chair.html>

Proprioceptive System

Definition: This sense can be simplified as “body awareness”. Receptors in our muscles, joints, and tendons send the brain information about the location of the limbs and overall body position. It also tells us how much force to use for a particular task. For example, even if your eyes were closed, you would know if I raised your hand over your head. You also know too much force to use to lift a full can of soda (but imagine what it feels like when the can you thought was full is actually empty!)

Infants: One of the main ways we give a baby early information about their bodies is through the ancient practice of swaddling. Yes, it is calming to a fussy baby and helps them sleep. Yes, it recreates the “womb space” and makes them feel safe. But, it is also providing their growing nervous system with valuable information and feedback about this little body that they are just getting used to. The tightness of swaddling is a type of deep pressure input to the body and limbs, that helps the brain learn about this new body of theirs, in a very calming, organizing way. Another way to provide this input (and also calm a baby) is a gently vibrating seat. Many are commercially available and include noise and lights to entertain as well. As your child ages, he/she might enjoy getting extra input from you in the form of massage or gentle “tapping” over the arms, legs, hands and feet. Try singing a song like “Head, Shoulders, Knees and Toes”, or rhyme like “This little piggy”...but expand both to include other body parts.

Preschool: Playground equipment where she can climb on, crawl under, or hang on will give great “heavy work” input to her body that helps develop this system. In the house, you can do wheelbarrow walking or play “tug-o-war” with a towel or blanket. Taking the cushions off the couch and setting up obstacle courses around the house where she needs to crawl over or through, then get up and jump over or balance on, then roll under and out, etc. Adjusting her body and her movement as she goes through the obstacle course will help her gain better control over her muscles and the amount of force she needs to use. And it’s fun!

School-Age: Try games like Twister, or “Simon Says”, focusing on the concept of left and right, and having her cross the midline of the body (i.e., “Simon says put your right hand on your left ear”). Have your child do household chores, such as sweeping, carrying groceries, and washing the table or floor. Cooking is another great activity, since the mixing, stirring, rolling, and kneading are all “heavy work” for the hands.

SENSORY PROCESSING CHECKLIST FOR PARENTS AND CAREGIVERS

If you answer “yes” to one or more of these questions, your child may be experiencing difficulties with sensory integration:

- Was your child unusually fussy, difficult to console, or easily startled as an infant?
- Is your child over-sensitive to stimulation? Does he/she overreact to touch, taste, sounds, or odors?
- Does your child strongly dislike baths, haircuts, or nail cutting (screaming, crying, “melting down”)?
- Does your child use too much force when handling objects, coloring, writing, or interacting with siblings or pets?
- Does your child seem to have weak muscles? Does she tire easily? Does she prefer to lean on people or slump in a chair?
- Was your baby slow to roll over, creep, sit, stand, walk, or achieve other motor milestones?
- Is your child clumsy? (Does she fall frequently, bump into furniture or people, and have trouble judging the position of her body in relation to the surrounding space).
- Does your child have difficulty following instructions or sequencing the steps for an activity?
- Does your child avoid playground activities, physical education classes, and/or sports?
- Does he/she not enjoy age-appropriate motor activities such as jumping, swinging, climbing, drawing, cutting, assembling puzzles, or writing?

For further information on Sensory Integration and for children diagnosed (or suspected) of a Sensory Processing Disorder:

<http://www.sensory-processing-disorder.com/index.html>

<http://www.spdfoundation.net/index.html>

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

Check out Kids Health website for further information on the development of senses, as well as other great information:

<http://kidshealth.org/parent/growth/index.html#cat166>

If your child is experiencing difficulty with any of these areas of development, please contact your pediatrician and/or an Occupational Therapist to assess if there is an underlying problem. Children develop at their own pace, with a wide range of normal skill acquisition. If he/she has difficulty in several areas of sensory development, it may indicate a Sensory Integration Dysfunction.