

Sensory Processing

We learn about our environment, our body, and how our body interacts with our environment, through eight sensory systems. We have five *external* sensory systems, which give us information about the world we live in (our external environment):

- **Visual** (sight)
- **Auditory** (sound)
- **Olfactory** (smell)
- **Gustatory** (taste)
- **Tactile** (touch)

We have three *internal* sensory systems, which give us information about our body (our internal environment):

- **Vestibular** (balance & movement, position of head in space)
- **Proprioceptive** (posture, weight, & body position in space)
- **Interoception** (thirst, hunger, temperature, heart rate etc.)

We receive **proprioceptive** information through receptors in our muscles, joint capsules, tendons, and the stretch of our skin; these receptors are activated by picking things up, pushing, pulling, crashing into things, squeezing, stretching, etc. This information helps the brain make sense of where the body is in space. The **vestibular** receptors are tiny hairs located in our ears; fluid in our ears moves whenever our head moves, which activates the receptors. This system primarily provides the brain with information on body movement. **Interoception**, is a recently discovered hidden sense, that enables our body to understand signals from our body, in order to live a healthy life. Signals are sent to our brain regarding body temperature, pain, itch, nausea, fullness, hunger, thirst, need for the bathroom, physical exertion and sexual arousal. **Interoception** is directly linked with self-awareness and self-regulation.

Sensory Integration

Sensory integration is the “organization of sensation for use... (so that) the brain can use those sensations to form perceptions, behaviors, and learning” (Ayres, 1979, p.5). Sensory processing includes:

1. **Recognizing** sensory information from any of the seven sensory systems
2. **Interpreting** the sensory information
3. Creating a **motor response** to the sensory information

Once sensory input is recognized, the nervous system determines whether or not the information is important, and will either *ignore* information it deems non-essential, or *facilitate* the transmission of information perceived as important. This is essentially a filtering process, because if our nervous system responded to every piece of sensory information it received at all hours of the day, we would be completely overloaded!

If the sensory information is considered important, the nervous system then determines whether or not the information is a threat. If a threat is perceived, the *sympathetic nervous system* is activated and creates a *fight-fright-or-flight motor response*. If a threat is not perceived, the nervous system continues to interpret the information and will form a non-fight-fright-or-flight response.

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When the nervous system is able to recognize, interpret, and respond to sensations, “the brain can use those sensations to form perceptions, behaviors, and learning” (Ayres, 1979, p.5). In other words, the integration of sensory information from the eight sensory systems facilitates the acquisition of higher level skills, and makes up the foundation of learning:

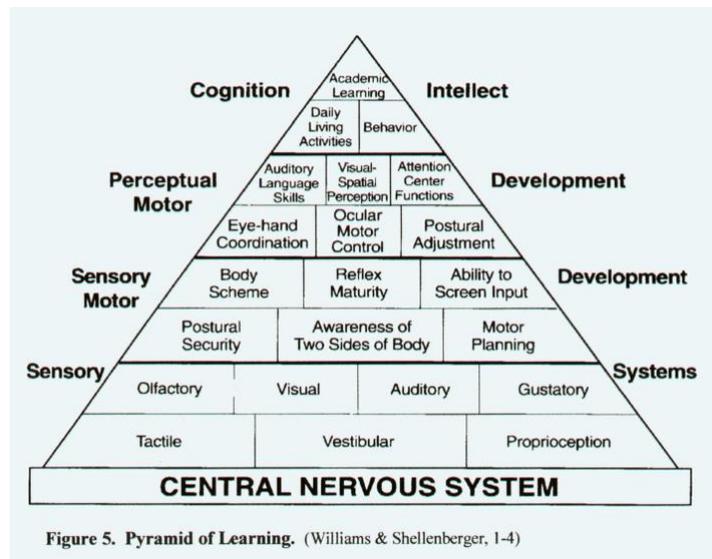
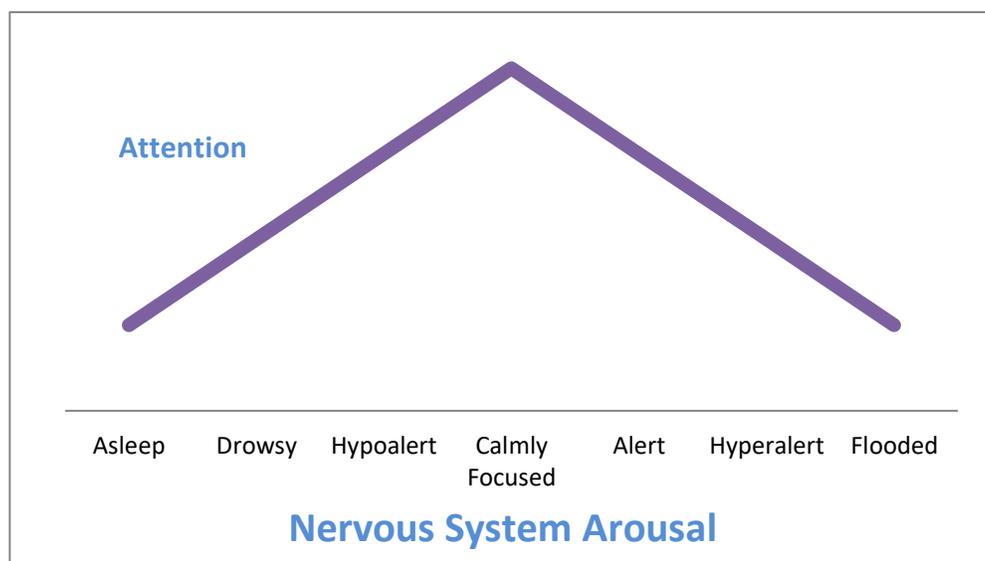


Figure 5. Pyramid of Learning. (Williams & Shellenberger, 1-4)

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In order to attend to a task, focus and learn, our nervous systems need to be at an optimal level of arousal or alertness. We use sensory experiences throughout the day to keep our nervous system in an optimal state of arousal through self-regulation. If our nervous system is below the optimal state of arousal for the activity, a sensory experience that excites or alerts us (i.e. cold shower) would bring us up. If our nervous system is above the optimal state of arousal, a sensory experience that relaxes us (i.e. rocking in a rocking chair) would calm us down.



Children with Complex Needs

Children who have complex needs often have difficulty integrating sensory information. First of all, they may have difficulty receiving/recognizing sensory input. For example, a child who has a visual impairment, is deaf or hard of hearing, or a child with abnormal tone will experience sensory input from their environment in a different way than children with typically developing nervous systems.

Second, interpreting sensory information can be difficult for children with complex needs. Some children have difficulty with the filtering process; their nervous system may not be able to filter out sensory information that is not important to the task at hand, making it hard to focus on the information that is important. These children are often impulsive and very easily distracted. On the other hand, the nervous system may filter out relevant information needed in order to make sense of a situation. These children often miss cues, appear to ignore others, and may seem “lost in their own world”. Some nervous systems are *hyper-sensitive*, and perceive non-threatening sensory input as dangerous, sending the child into a fight-fright-or-flight response. Often, children with a hypersensitive nervous system become overloaded easily, and they respond by either *fight*: melt down (tantrum, pushing, pulling, biting); *fright*: shut down (ignore); or *flight*: attempt to escape (leave, bolt, drop to the floor, hide, etc.).

Finally, children with complex needs may have difficulty planning and coordinating a motor response to the sensory input. Children with movement disorders, abnormal tone, visual impairment, etc. may have difficulty planning and controlling a voluntary motor response.

When working with children with complex needs, consider the importance of sensory integration in the acquisition of new skills, and consult with an occupational therapist on designing a program that supports the child’s individual sensory needs.

References

Ayres, A.J. (1979). *Sensory integration and the child*. Los Angeles, CA: Western Psychological Services.

Mahler, Kelley. (2015). *Interoception: The Eighth Sensory System*.

Williams, M.S. & Shellenberger, S. (1996). “*How does your engine run?*” © *A leader’s guide to the alert program for self-regulation*. Albuquerque, NM: TherapyWorks, Inc.