



# Playing And Learning: The Potential Of Elementary School Yards For Child Development

<sup>1</sup>Dian Nitta Efafras

<sup>1</sup>Magister of Landscape Architecture

<sup>1</sup>School of Architecture, Planning and Policy Development

<sup>1</sup>Bandung Institute of Technology, Bandung, Indonesia

**Abstract:** Sensory Processing Disorder (SPD) is a developmental disorder characterized by difficulties in processing sensory information. This condition is often diagnosed alongside Attention Deficit Hyperactivity Disorder (ADHD) and can disrupt various aspects of daily life. Although research on SPD has progressed, more studies are needed, particularly those focused on school-based interventions. This research aims to address this gap by identifying activities that can stimulate children's sensory systems using elements from the school landscape. The findings are expected to contribute to the development of effective intervention programs for children with SPD in school environments. Additionally, the research seeks to raise awareness among the community and educators about the importance of sensory stimulation for child development.

## I. INTRODUCTION

Sensory Processing Disorder (SPD) is a developmental disorder characterized by difficulties in processing sensory information. This condition is often diagnosed alongside Attention Deficit Hyperactivity Disorder (ADHD) and can disrupt various aspects of daily life. Although research on SPD has progressed, more studies are needed, particularly those focused on school-based interventions [1]. This research aims to address this gap by identifying activities that can stimulate children's sensory systems using elements from the school landscape. The findings are expected to contribute to the development of effective intervention programs for children with SPD in school environments. Additionally, the research seeks to raise awareness among the community and educators about the importance of sensory stimulation for child development. [2]

As technology advances, particularly through social media, it has become easier for people to educate themselves about various topics. Content related to developmental disorders has garnered significant responses from adults who experience symptoms but discover them too late to receive timely intervention. One such disorder affecting adults is Attention Deficit Hyperactivity Disorder (ADHD), which is commonly recognized as a condition involving difficulties in processing sensory information. This can lead to hypersensitivity (excessive responsiveness) or hyposensitivity (reduced responsiveness) to various stimuli, negatively impacting many aspects of daily life, such as being overly sensitive to sounds or completely unresponsive. This phenomenon is known as Sensory Processing Disorder (SPD). Although SPD is not clearly classified as a neurological disorder like other mental health conditions, the American Academy of Pediatrics states that SPD is a subtype of other neurological disorders that can cause impairments in children. The most common cause is infants who are not adequately stimulated through their sensory systems. In 2018, approximately 35.4% of toddlers in Indonesia suffered from developmental deviations, including issues with gross motor skills, fine motor skills, and emotional and mental disturbances. This has been linked to their limited ability to understand parental or family members' efforts in stimulating their senses [3].

Sensory stimulation has a profound impact on brain function and influences various aspects of cognitive, emotional, and motor development, including emotional regulation and awareness, which can reduce the occurrence of other developmental disorders. Sensory processing plays a crucial role in how we interact with our physical and social environments. It has been observed that 5% to 13% of children aged 4 to 6 years are affected by sensory processing disorders, suffering from debilitating social and emotional consequences [4].

Sensory Processing Disorder (SPD) involves difficulties in detecting, modulating, interpreting, and/or responding to sensory experiences, including auditory, visual, vestibular, tactile, multisensory, taste, and smell. Generally, sensory training can be applicable for all ages; however, to enhance quality of life in the future, this research focuses on early sensory training for children. According to [5], there is a classification of sensory training based on age into four groups: 3-4 years, 5-6 years, 7-8 years, and 9-10 years. Significant differences were found between Group 1 (3-4 years) and Group 2 (5-6 years) across seven categories of the Test of Sensory Integration Function (TSIF). The significant differences were attributed to variations between Group 1 and Group 4 (9-10 years) across five subscales: Postural Movement, Bilateral Integration Sequencing, Sensory Discrimination, Sensory Seeking, and Attention and Activity. Therefore, based on previous studies, this research targets children who have entered basic national education or elementary school. In relation to this issue, the aim of this study is to identify activities for training sensory skills in early childhood using open spaces in elementary schools. This is particularly relevant given the number of Indonesian children experiencing developmental delays and adults who discover their early disorders too late, impacting their daily lives due to a lack of early sensory stimulation.

## II. RESEARCH METHODOLOGY

In conducting this research, a qualitative descriptive method was employed. The primary focus of the study is on data collection through literature review. The literature review refers to a written summary of articles from various sources such as journals, books, and other documents. This summary details the theories and information related to past contexts and current situations. During this process, the literature was organized based on specific topics, and relevant documents were collected to support the development of the research.

## III. THEORITICAL FRAMEWORK

Sensory integration is the process of recognizing, transforming, and differentiating sensations from the sensory system to produce a response. The Central Nervous System (CNS), which consists of the brain and spinal cord, serves as the main processing center for the body, controlling various functions including thoughts, movements, emotions, and other processes such as breathing and heart rate. Therefore, the CNS is crucial for overall well-being; damage or disease affecting this system can lead to functional impairments and significantly impact quality of life, making it critical for daily interactions. Dunn's Sensory Processing Model proposes four basic patterns of sensory processing that arise from the interaction between neurological thresholds and behavioral/self-regulation responses. Neurological thresholds refer to the amount of sensory input or stimulation required for an individual to notice and respond to sensory information. Individuals with low sensory thresholds are more likely to notice and respond to stimuli because their neurological systems are more easily activated by sensory events. Conversely, individuals with high sensory thresholds often miss stimuli that others can easily notice because their neurological systems require stronger stimuli to elicit a response. This framework provides a comprehensive understanding of how individuals process sensory information and highlights the importance of recognizing these differences in order to create supportive environments for those with varying sensory processing patterns [4] [6].

Neurological thresholds	Self-regulation strategies/behavioral responses	
	Passive	Active
High threshold	Low Registration	Sensation Seeking
Low threshold	Sensory Sensitivity	Sensation Avoiding

Figure 1. Sensory Processing from Dunn's Model

Based on these patterns, the results can be derived from the intersection of neurological thresholds and self-regulation:

1. **Sensory Seeking** (high threshold and active self-regulation strategies): Individuals with sensory seeking tendencies crave sensory experiences and are driven to continuously seek sensory input to meet their needs. They tend to look for intense, varied, or novel stimuli. Examples include very loud music, roller coasters, and other physical games.
2. **Sensory Avoidance** (low threshold and active self-regulation strategies): Individuals with this pattern tend to have a low threshold, requiring minimal sensory input. They will take steps to avoid specific sensory inputs (active response). For instance, they may wear headphones to block out noise or use strategies to avoid crowded places.
3. **Sensory Sensitivity** (low threshold and passive self-regulation strategies): Individuals with this pattern generally have a low threshold, needing little sensory input, and when sensory needs exceed their threshold, they may become upset. An example is feeling disturbed by labels on clothing.
4. **Low Registration** (high threshold and passive self-regulation strategies): Individuals with this pattern may not notice sensory stimuli that others perceive. A case in point is failing to recognize someone calling in a crowded room.

### **Importance of Sensory Integration**

The process of integrating information from various senses is crucial in daily life. Our ability to adapt, socialize, and learn is significantly influenced by how we process sensory information from our environment. Sensory training is an effective way to enhance these abilities. With proper training, individuals can:

- a. Increase awareness of the environment, so you can become more sensitive to various stimuli such as sound, light and touch, so you can respond better.
- b. Strengthening motor skills so that physical activity involving the five senses helps in developing body coordination and balance.
- c. Rich sensory experiences help the brain to make strong connections between what we see, hear and feel with what we learn, this can improve learning and thinking abilities.
- d. Reducing stress and anxiety, this activity takes the form of aroma therapy or gentle touch, so it can help you feel calmer and more relaxed.
- e. Improve social skills with joint activities that help to interact and collaborate between individuals.
- f. Sensory training is also a form of therapy that is very beneficial for those who have difficulty processing information from the senses, such as children with special needs.
- g. With a better ability to interact with the environment, we can enjoy life better.

## Review of Sensory Processing Disorder (SPD)

Sensory Processing Disorder (SPD) occurs when sensory signals are not organized into appropriate responses, disrupting a child's daily routines and activities. Unusual responses to sensory messages can be related to behavioral, emotional, or attentional issues, or may manifest as problems with motor skills or organization. A characteristic feature of children with SPD is their chronic sensory difficulties that interfere with their daily lives. Children with SPD often experience frustration due to their atypical responses to sensory input. According to A. Jean Ayres' theory, which introduced sensory integration for human development, this process involves visual, auditory, tactile, proprioceptive, and vestibular senses, forming the foundation for more complex skills such as counting, language, and emotional regulation. Based on developmental and behavioral disorders, SPD can be categorized into several types: Sensory Modulation



Figure 2 Bouy Sensory Analogy

Source: [7]

Many health professionals use the term SPD to generally refer to three primary diagnostic types or groups. This categorization results from research conducted by Lucy J. Miller, Ph.D., and colleagues ([7])

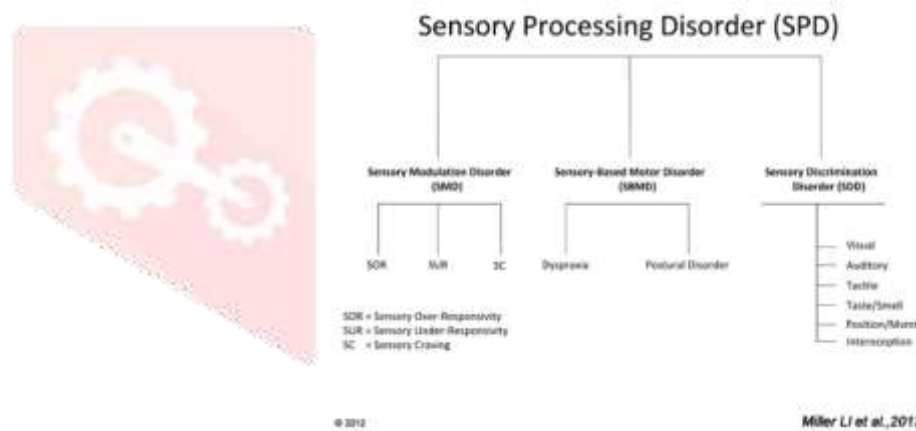


Figure 3 Sensory Processing Disorder

Source: [8]

Type I SPD is called Sensory Modulation Disorder (SMD). SMD involves over/under response to sensory stimuli, or over/under seeking of sensory stimuli. Under these conditions, stimulus attributes, such as frequency, intensity, duration, novelty, and complexity are processed differently. Symptoms of SMD include fear-anxiety patterns, stubborn, negative, or self-serving behavior. SMD involves over/under response to sensory stimuli, or over/under seeking of sensory stimuli. In this condition, stimulus attributes, such as frequency, intensity, duration, novelty, and complexity are processed differently. Symptoms of SMD include fear-anxiety patterns, stubborn, negative, or self-serving behavior. In SMD, children generally have difficulty responding to sensory input so they give inappropriate responses. Sensory modulation disorder is divided into

several types, namely *sensory overresponsive* (BEER), *sensory underresponsive* (ON), dan *sensory seeking/craving* (SS).

<i>Sensory Overresponsive</i> (BEER)	<i>Sensory Underresponsive</i> (ON)	<i>Sensory Seeking/Craving</i> (SS)
Responds quickly, intensely and longer to sensations than is normal	Lack of response or not paying attention to sensory stimuli from the environment so that they act apathetically and do not have the urge to be responsive and explorative	Children are often dissatisfied and continue to seek sensory stimulation from existing activities, causing more sensations.

SPD Type II is known as Sensory Based Motor Disorder *Sensory-Based Motor Disorder (SBMD)*, SBMD includes symptoms that indicate disorganization in motor responses such as dyspraxia and difficulty controlling body posture. Sensory Based Motor Disorders (SBMD). As the name suggests, SBMD includes symptoms indicating disorganization in motor responses such as dyspraxia and difficulty controlling body posture. Children with SBMD have poor postural movement. In this dysfunction, children experience errors in interpreting *input* Sensory originating from the proprioceptive and vestibular systems. *Sensory-based motor disorder* have two subtypes, namely dyspraxia and postural disorders.

Dyspraxia	Postural
Children experience problems in accepting and carrying out new behavior. Children with dyspraxia have poor coordination in the oromotor, gross motor and fine motor domains.	Children have difficulty stabilizing their bodies when moving or when resting. Children with postural disorders usually appear weak, tire easily, and tend not to use their dominant hand consistently.

Type III SPD is called Sensory Discrimination Disorder (SDD). SDD refers to a condition in which there is abnormal processing of auditory or visual sensory information. This can manifest as inattention, difficulty concentrating, and disorganized or negative behavior. *Sensory Discrimination Disorder (SDD)* Sensory Discrimination Disorder (SDD). SDD refers to a condition in which there is abnormal processing of auditory or visual sensory information. This can manifest as inattention, difficulty concentrating, and disorganized or negative behavior. Children with SDD have difficulty interpreting the quality of stimuli, so that children cannot differentiate between similar sensations. Sensory discrimination makes it possible to know what the hand is holding without looking, to find certain objects by simply holding them, to distinguish certain textures or smells, or to hear something even if there are other sounds around it. *Sensory discrimination disorder* in the visual and auditory systems can cause learning or language disorders, while SDD in the tactile, proprioceptive and vestibular systems causes impaired motor abilities. [9]

#### IV. RESULT AND DISCUSSION

Sensory integration therapy emphasizes stimulation of the three main senses, namely tactile, vestibular and proprioceptive. These three sensory systems are less familiar than the senses of sight and hearing, but these sensory systems are very important because they help the child's interpretation and response to the environment. Based on data compiled by a doctor named Megan Anna Neff in [10]. There are five classic symptoms, namely physical and tactile sensations that appear from the outside, namely the tactile system (touch), the auditory system (hearing), the visual system (sight), the taste system (tasting), and the olfactory system (smell). These five senses are very important for absorbing information about our external environment. However, there are other sensory systems such as proprioception (body awareness), and vestibular (balance and spatial orientation). These additional senses play an important role in motor skills and overall sensory integration. The following is an explanation of body sensory:

Tactile System	The tactile system is the largest sensory system formed by receptors in the skin, which send information to the brain regarding stimuli of light, touch, pain, temperature and pressure. The tactile system consists of two components, namely protective and discriminatory.
	<ul style="list-style-type: none"> <li>a. Children with hypersensitivity to tactile stimulation or also known as <i>tactile defensiveness</i>, can cause misperceptions of touch. In general, there is a response of withdrawing when touched, avoiding groups of people, refusing to eat certain foods or wearing certain clothes, and using the tips of the fingers to hold certain objects.</li> <li>b. Children with hyposensitivity can have a less sensitive reaction to stimuli such as pain, temperature, or touch of an object. Children will seek more stimulation by bumping into toys, people, furniture, or by chewing objects. Lack of reaction to pain can put the child in danger.</li> </ul>
Visual system	<p>Visual stimuli are captured by visual receptors in the eyes and provide information about color contrast, shape, appearance and movement. The visual processing system helps us determine what to pay attention to and directs actions and movements in the world.</p> <ul style="list-style-type: none"> <li>a. Children with hypersensitivity to visual stimulation generally have a response. People who respond visually are too sensitive to visual input and often experience physical pain (headaches/nausea) because of it.</li> <li>b. Hyposensitive children may react less sensitively to Those who are less visually perceptive may have difficulty spotting subtle differences in visual elements</li> <li>c. Children who are less responsive or sensory seekers have difficulty naming colors, shapes and sizes</li> </ul>
Auditor System	<p>Hearing receptors located in the inner ear identify loud, soft, high, near, and far sounds. This experience helps us process the volume, pitch, pitch, and rhythm of sound.</p> <ul style="list-style-type: none"> <li>a. Children with hypersensitivity to excessive auditory stimulation are sensitive to auditory input and may be "super listeners" and can often detect sounds in their environment that others cannot detect. They often have negative reactions to too much noise or to certain sound frequencies.</li> <li>b. Children who are hyposensitive to hearing may receive less input from their auditory system and seek additional auditory stimulation and the response is generally to fail to pay attention to sounds, struggle with auditory cues and may not hear subtle sounds.</li> </ul>
Gustatoris system	The Gustatory System or taste receptors will capture the sense of taste on our tongue and connect it with our sense of smell (smell). Experiences related to our taste system include our ability to perceive sweet, sour, bitter, salty, and spicy tastes.
	<ul style="list-style-type: none"> <li>a. Children with hypersensitivity to excessive auditory stimulation are sensitive to taste and have a high sensitivity to taste. They tend to avoid new flavors and have a limited diet.</li> <li>b. Children with hyposensitivity may react less sensitively to tastes and want more stimulation by seeking out strong tastes.</li> </ul>
Olfactory System	<p>Smells are processed through 'Olfactory' receptors located in the nose. The sense of smell can distinguish various kinds of odors. Strong memory can also be associated with smells</p> <ul style="list-style-type: none"> <li>a. Children with hypersensitivity to excessive auditory stimulation of smell or "super kissers" have a heightened sensitivity to smell and can detect subtle changes in their environment. Certain odors can trigger strong physical reactions and pain.</li> <li>b. Children with hyposensitivity can react less sensitively to smells. People who are less responsive have a low awareness of smells. Lack of awareness can harm them because they are less likely to detect toxins in their drinks, food and environment. Improving olfactory processing may help improve their safety.</li> </ul>
Vestibular system	The vestibular system is located in the inner ear (semicircular canals) and detects movement and changes in head position. The vestibular system is the basis of muscle tone, balance, and bilateral coordination.

	<ol style="list-style-type: none"> <li>a. Children who are hypersensitive to vestibular stimulation have a response <i>fight</i> or <i>flight</i> so the child is afraid or runs away from other people. The child may react fearfully to simple movements, playing equipment on the ground, or being in a car and the child may refuse to be carried or lifted from the ground, ride an elevator or escalator, and often appear anxious.</li> <li>b. Hyposensitive children tend to seek excessive and deliberate bodily activity, such as rolling, spinning, hanging upside down, swinging for long periods, or moving constantly.</li> </ol>
Proprioceptive system	<ol style="list-style-type: none"> <li>a. The proprioceptive system is found in muscle fibers, tendons and ligaments, which allows children to subconsciously know the position and movement of the body. Fine motor tasks, such as writing, using a spoon, or buttoning buttons.</li> <li>b. Hypersensitivity to proprioceptive stimulation causes children to be unable to interpret feedback from movements and have low body awareness. Signs of dysfunction of the proprioceptive system are <i>clumsiness</i>, a tendency to fall, odd body postures, messy eating, and difficulty manipulating small objects, such as buttons.</li> </ol>

### Good handling

Children with SPD who are diagnosed and treated early have a greater chance of overcoming their sensory problems and living a normal life. However, several factors influence their success [11]. Influencing factors include:

Timing of diagnosis and therapy	The sooner a child is diagnosed and gets therapy, the better his or her chances of making a full recovery or reducing long-term impacts. If diagnosis is delayed, secondary problems such as depression or anxiety can emerge and complicate the condition.
Type and severity of SPD	Motor disorders are usually easier to overcome than sensory processing disorders. In addition, mild symptoms are easier to overcome than severe symptoms.
Child personality	Children who are tough and flexible tend to overcome challenges more easily than children who are rigid or give up easily.
Family and school support	Support from parents and teachers is very important in helping children overcome SPD.

Although SPD can pose limitations, with the right help, children with SPD can learn to overcome their difficulties and live independently. Parents play an important role in teaching their children strategies for overcoming challenges and finding an environment that suits their needs. However, children without SDP still need sensory training to minimize disturbances to children, therefore an environment is needed that helps train sensors in an environment that is frequently visited or has many users aged >12 years, so the target location is the school yard. . The following is the connection between landscape elements and the school yard, including:

Tabel 1. Children's Landscape and Sensory Elements

	School Corridor	School field	Plant area	Play area	Hardscape elements		
					Bench	Water Pool	Stones, gravel and sand
<b>Tactile</b>	Textured corridor walls		Plant selection is not a thorny and dangerous type of plant	There are play facilities that help manage touch		Children can touch water for tactile sensory training	With the texture of stones, pebbles and sandstone in certain spots, it can also help children to train their senses
			Planting shade trees as a form of shade to practice observation				
<b>Visual</b>	Colored and patterned corridor walls and floors	The colorful surroundings can be a visual	Select plants that have colored flowers, leaves or fruit	Colorful toys can help train children's vision	A colored bench can help children to train visual		
<b>Auditory</b>		School bell					
		Sound media that					

		sounds because of the wind					
<b>Gustatory</b>			Can make edible plants so children can eat fruit, leaves or flowers				
<b>Vestibular</b>	Patterned and colored floors can help children have the mindset of following the shape of the floor pattern so they can play			Play equipment that helps children practice balance, such as hanging or etc			
<b>Prosprioceptif</b>				Play equipment can also help children to train their joints and movements			

Source: Personal Analysis, 2024

When designing an outdoor space that consists of various sensors based on the senses, it is necessary to pay attention to these aspects when designing a sensory garden (Erwina, n.d.):

- a. Hardscape Elements; Hard elements are landscape components that include paths, seating, playgrounds, gazebos, pergolas, walls, fences, signage, and others.
- b. Softscape Elements; pay attention to vegetation according to hyposensitive, and hypersensitive. Some examples of types of plants that can be used are:
  - I. Strong-smelling plants such as mint and lemon balm can be used to provide a stronger sensory stimulus through strong aromas.
  - II. Plants that have striking colors such as sunflowers, marigolds or zinnias, can be used to provide stronger sensory stimulation through striking colors.
  - III. Plants that have a rough texture or unique shape such as cacti (along with other succulents), agave, yucca, and bonsai can be used to provide stronger sensory stimulation through a rough texture.
- c. In the visual aspect, gardens can use a variety of colors, textures and shapes to stimulate children's visual stimulation. This can be achieved through the use of different types of plants, flowers, or water features. Warm colors such as red, orange and yellow tend to increase children's activity. Meanwhile, cool colors, such as blue or purple, tend to be calming.
- d. On the auditory aspect, elements in the school yard can come from fish ponds such as the splashing of water, or the rustle of wind from tree leaves so that these sounds can provide a feeling of calm and peace for children.
- e. The tactile or tactile aspect of the school yard allows children to explore texture with supporting landscape elements such as smooth stones, rough bark, or grass.
- f. In the smell or olfactory aspect, the yard can have various aromas from vegetation such as fragrant flowers, herbs from the family medicine garden so that this aroma can support children to train their olfactory sensors.
- g. The sensory aspect of taste or gustatory can be supported by landscape elements in the form of an edible garden consisting of leaves, flowers and fruit that are safe for children to taste.

## V. RESULT AND DISCUSSION

The literature reviewed shows that sensory perception at an early age is very important for the lives of teenagers and adults, of course influencing daily activities. Therefore, this research has reviewed several literature reviews regarding the importance of sensory training, and this research shows that landscape elements, both hardscape and softscape attributes, can help improve sensory training through the senses of visual, hearing, smell, taste, balance and train muscles and joints. child. The effectiveness of good sensory reception is under 12 years of age, so elementary school children have the potential to be targeted in this research. Therefore, landscape planning in the school yard is very good and can help improve children's learning through outdoor space for playing as well as learning.

## REFERENCES

- [1] A. Ben-Sasoon and A. Carter, "The relationship between ADHD and sensory processing disorder in children: A review of the literature," in *Journal of Attention Disorders*, pp. 113–121.
- [2] N. Passarello *et al.*, "Sensory Processing Disorders in Children and Adolescents: Taking Stock of Assessment and Novel Therapeutic Tools," *Brain Sci*, vol. 12, no. 11, p. 1478, Oct. 2022, doi: 10.3390/brainsci12111478.
- [3] G. Baird and E. Simonoff, "Prevalence of disorders of the neurodevelopmental spectrum. Archives of Disease in Childhood," 2915.
- [4] P. Passarello, "The impact of sensory processing disorder on social-emotional development in young children: A systematic review," *Journal of Child Psychology*, 2022.
- [5] C. Lin, H. Chen, and Y. -C, "Age-related differences in sensory integration function among children: A cross-sectional study," *Journal of Occupational Therapy*.
- [6] W. Dunn, "Supporting Children to Participate Successfully in Everyday Life by Using Sensory Processing Knowledge," *Infants & Young Children*, vol. 20, no. 2, pp. 84–101, Apr. 2007, doi: 10.1097/01.IYC.0000264477.05076.5d.
- [7] L. J. Miller, D. A. Fuller, and J. Roetenberg, *Sensational kids: hope and help for children with sensory processing disorder (SPD)*, Perigree trade paperback, Revised edition. New York, New York: Penguin Group, 2014.

- [8] “Subtypes of SPD.” Accessed: Jun. 09, 2024. [Online]. Available: <https://sensoryhealth.org/basic/subtypes-of-spd>
- [9] A. P. Association, “Diagnostic and statistical manual of mental disorders (5th ed.),” *American Psychiatric Publishing.*, 2013.
- [10] “8 Senses: Hidden Sensory Systems,” Insights of a Neurodivergent Clinician. Accessed: Sep. 22, 2024. [Online]. Available: <https://neurodivergentinsights.com/blog/8-senses>
- [11] “Sensory Processing Disorder in Adults: Symptoms, Treatment, More,” Healthline. Accessed: Oct. 31, 2024. [Online]. Available: <https://www.healthline.com/health/mental-health/sensory-processing-disorder-in-adults>

