Sensory Processing Disorder: A Design Research Report

Ashley Booth
abooth@siu.edu

Follow this and additional works at: http://opensiuc.lib.siu.edu/uhp_theses

Recommended Citation
http://opensiuc.lib.siu.edu/uhp_theses/443

This Dissertation/Thesis is brought to you for free and open access by the University Honors Program at OpenSIUC. It has been accepted for inclusion in Honors Theses by an authorized administrator of OpenSIUC. For more information, please contact opensiuc@lib.siu.edu.
SPD
SENSORY
PROCESSING
DISORDER: A DESIGN
RESEARCH REPORT

A. BOOTH’S HONORS THESIS
Many children, teens, and adults have sensory processing disorder or experience the same symptoms. Symptoms include over-sensitivity or under-sensitivity to the environment, poor balance, meltdowns, and more.

Although many people do not realize that they have SPD, research suggests that this affects 15 million people in the U.S.

More specifically, 5 to 15% of all school-aged children have some type of sensory processing disorder. 40 to 85% of children with other disabilities like Autism, also experience SPD.

This wide demographic shows the need for further exploration into SPD. After further exploration, I will identify a specific area that holds opportunities for my industrial design thesis.
Sensory Processing Disorder (SPD) is a neurological disorder that causes a person’s nervous system to misinterpret the environment via the senses.

In order to understand the relationships between behaviors and neurological thresholds patterns, occupational therapist Dr. Dunn created the Sensory Processing Framework. When people with SPD behave a certain way, his matrix can help understand their behaviors.

With SPD, however, comes controversy. Not all doctors, schools, and caretakers recognize SPD as a proper diagnosis. It is often mistaken for ADHD and other behavioral problems.

What’s happening
According to neuroscientist Dr. Hylin, sensory processing disorders occur because the patients’ brain and central nervous system are not wired the same as the majority of the population.

A deeper look
As demonstrated below, people with SPD do not have effective sensory “gates” and their environment is not filtered. This can lead to sensory craving, over-sensitivity, and other SPD subtypes.

Causes
Although we know the neurological causes of SPD, we do not know why some brains are like this. From genetics to environmental factors neuroscientists and doctors have not found a direct cause for sensory processing disorders.

https://nspt4kids.com/health-topics-and-concerns/sensory-processing-disorder/


In-put and Out-put of the Senses

There are many types and behaviors associated with SPD that can often resemble other behavioral disorders. However, even though behaviors often look similar from the outside, they are neurologically different.

The study, as shown here, investigated the areas of the brain affected in children with SPD, Autism, and both. It discovered that the area affected in SPD children is the corpus callosum. Although it appears to be slightly on those on the Autism Spectrum, the disconnectivity of the corpus callosum is mostly isolated with SPD. The corpus callosum is responsible for coordinating motor skills, processing sensory information from the nervous system, and other cognitive tasks.

Not only does this explain why processing sensory information is different for people with SPD, but it concretely shows that SPD brains are wired differently instead of being a symptom of different issues like many skeptics believe.

Characteristics of sensory processing disorder have been organized under three umbrella terms. Within those terms, the behaviors and physiology problems have been furthered defined and categorized.
People with sensory modulation struggle with the organization of the senses. Their brains are unable to efficiently sort the information received and distribute the information as needed.

**Over Stimulation**
Those with over-stimulation are more sensitive to their environment. This can cause anxiety and panic attacks. In response to these feelings, they may try to avoid contact with triggers.

**Under Stimulation**
Unable to detect sensory stimuli properly, those with under stimulation may struggle with body movements. In children, this can look aggressive as they may accidentally run into others.

**Sensory Craving**
These people feel the need to consistently seek out sensory stimuli. This could involve anything from trying to touch everything to spinning in circles for long durations.

**Dyspraxia Disorder**
Controlling motor skills and processing sensory information into organizational methods is an issue for people with dyspraxia. This often includes like making and following a plan.

**Postural Disorder**
Postural disorder makes it difficult for the body to understand its orientation. This makes controlling one’s body, especially when standing or sitting, difficult.
With sensory discrimination, the brain is unable to process information from the senses accurately. This often means associating stimuli with the wrong connotation. More specific examples include:

**Visual:** unable to see the difference between the letters “O” and “Q”.

**Auditory:** unable to differentiate similar sounding words like “pen” and “pin”.

**Tactile:** unable to feel the difference between acorns or walnuts.

**Taste/Smell:** struggles to taste the difference between oranges and grapefruits.

**Movement:** unable to feel if tripping backward or falling forward.

**Introspection:** not able to understand if food craving is out of need or because of want.

People who may have Autism, ADHD, ADD, Aspergers, and more often have some form of SPD.

Those with SPD often experience more than one subgroup. For example, a child may have issues with visual discrimination, craves tactile senses, but is overstimulated by sounds.

However, a side effect that all of these neurological disorders include is negative emotions for the person with the disorder, caretakers, and surrounding people who lack the understanding.

http://www.thesensoryspectrum.com/what-is-interoception/

A helping hand: Therapy

Therapy Types

Depending on the type of SPD and the personality characteristics of the person, the approach and the type of therapy varies.

Despite the differences in SPD types, there are some standard therapy genres that are applied in order to help with SPD. This includes sensory integration therapy, occupational therapy, physical therapy, cognitive behavioral therapy, and play therapy.

Together, these therapy methods can be tailored to be more individualized. This will be a more effective treatment.

Sensory Integration Therapy

Many therapists use sensory integration as a way to help a person cope with sensory issues. By changing a person's experience and stimuli association, this method aims to make SPD easier to manage.

Although sensory integration therapy can be used on its own, it is more effective when paired with occupational therapy and other types of therapy.

Occupational Therapy

OT's evaluate the child and work to find a method that helps them focus and changes behaviors via mindset. Common methods include brushing, a sensory gym, and sensory diet.

Occupational therapy is widely used for all subtypes of SPD but can be more effective when paired with another therapy type to address the SPD issues in a more personalized manner.

Physical Therapy

Often used with occupational therapy, physical therapy focuses on developing motor skills, spatial awareness, coordination, motor planning abilities, and flexibility.

Although this focuses on the physical health of the patient, physical therapy can help boost self-esteem, social skills, and self-regulation.

Cognitive Behavioral Therapy

Unlike physical or occupational therapy, cognitive behavioral therapy focuses on behavior and mindfulness. Doing this addresses anxiety, depression, eating disorders, and obsessions without dependence on medication.

This type of therapy focuses on working with the therapist to create treatment plans, understand self-help, and keeping track of progress.

Play Therapy

Play therapy gives the patient, normally a child, a chance to relax at their own pace. This encourages communication, explores thought processes, and insights on behaviors.

Play is essential for healthy childhood development. It can help develop social, and emotional skills.

Tools for play include dancing, storytelling, dolls, and other toys.


https://www.goodtherapy.org/learn-about-therapy/types/play-therapy

https://www.additudemag.com/sensory-processing-disorder-treatment/

**modulation**
- **General SPD**

**motor**
- **General SPD**

**discrimination**
- **General SPD**

**general SPD**
- **General SPD**
By following blogs and joining online support groups for SPD, I was able to participate in conversations, find resources, see rants, and ask questions. Topics that appeared repeatedly in these communities include:

- finding the right type of therapy
- everyday coping methods
- sensory-friendly products
- anxiety and panic attacks
- advice for talking about SPD
- tips for handling overwhelming environments like work or school

Reaching Out: Survey

In order to understand the issues and the demographics SPD, I reached out to the Facebook group Sensory Processing Disorder Advocacy.

Within 24 hours, multiple members reached out expressing their interest, offering support, and general appreciation for investigating and discussing SPD.

Within 48 hours, 190 people had responded to the survey. This led to invaluable stats and insights into the daily life of a person with SPD.
The average age of a child with SPD is 6-12 years.

At 40%, over-stimulation is the most common subtype of SPD.

Most people experience issues and behaviors that involve multiple senses.

Over 50% of people use both toys and therapy to cope with their SPD.

Of all the products used, masking and calming products are the most widely used.

Both parents and children 6-12 yrs. should be considered when designing.

Sensory over-stimulation needs to be further explored.

Multiple senses should be addressed in the solution.

Toys and therapy work well together and need to be included in designing the solution.

Further investigation needs to be completed with masking and calming products in order to understand their uses, their effectiveness, and their opportunity areas.
LIVING WITH SPD: ADULTS

Child vs. Adult SPD

Adults living with SPD have the same issues that many children do. However, many adults may not have been diagnosed correctly or at all, do not know that they have SPD, or were diagnosed post-childhood.

Addressing this issue is similar to therapy for children. However, unlike children, adults have less neuroplasticity than children. This can require more intensive therapy. Some things that need to be consciously learned can include relearning behaviors and motor skills, developing adapting and coping methods, sensory diet programs, and communicating issues to others.

A Hidden Issue

Additionally, because behaviors had time to simmer and develop, it is difficult to distinguish SPD related behavior from other disorders like depression, anxiety, and anti-social. A more behavioral example is refusing to eat because of tactile sensitivity can look like anorexia.

LIVING WITH SPD: KIDS

Factors

Besides therapy physical or occupational therapy, children's behaviors are influenced by internal and external factors. This includes allergies, amount of sleep, nutrition habits, environmental atmosphere, and characteristics of brain function.

Tools

Children often use toys to cope and to learn. Although useful, these tools are often distracting if used in school. Some schools offer sensory rooms to help with therapy. In early education, teachers often use mats, puzzle, and weight blankets to help students regulate sensory issues.

Behavior

Behaviors are influenced by one's internal fight or flight response that is triggered by stimuli. Those with SPD, however, often react to this response intensely. An example of this could be spinning for hours, refusing to talk, or rejecting to wear certain clothes because of the material's texture.

Diagnosis

With children, it can be difficult to understand if a child's behavior is caused by SPD, a behavioral disorder like ADHD, or if a child is just having a rough day.

The tell-tale difference between SPD and other disorders, however, is that SPD shows different neurological wiring. This, as discussed previously, can be seen via CAT scans. However, most diagnoses are given by occupational therapists.

Being able to get a diagnosis involves teachers, parents, counselors, and other caretakers. To help, some schools offer programs like Individualized Education Program (IEP) or reach out to therapists.

https://www.growinghandsonkids.com/behavior-or-sensory-integration-issues.html
LIVING WITH SPD: CARETAKERS

What’s happening
When it comes to diagnosis, therapy, and coping methods, it is primarily the caretakers’ responsibility. This is especially true when it comes to children. Caretakers must reassure the SPD person while reinforcing positive behaviors and mindfulness.

When doing this, caretakers are often searching for therapists and answers to specific behaviors. Caretakers often find these answers and other information online, in social media, from therapists, and while talking to others.

Creating an environment
Caretakers must also consider creating a sensory friendly environment in the home. This can include adjusting the environment by dimming lights, adding tactile-friendly areas, and minimizing noise-making areas. To understand if this is working, caretakers can track process in order to gain insights about changing behaviors.

All of these responsibilities, consistent problem solving, and attentiveness, can wear a caretaker down after a period of time.

THE OUTSIDE PERSPECTIVE

At School
Teachers are a major part of noticing behaviors and diagnosing disorders. However, because classrooms are overwhelmed with students, it is difficult to be able to spend time understanding each child. Additionally, educating educators about SPD takes time and resources that schools may not have.

Other students may give the SPD student unwanted attention. If the SPD student is still learning coping methods, then other students may also feel negative emotions.

At Work
Like school, adults with SPD may have difficulty being apart of the office community. SPD may make it difficult to be complete tasks efficiently, socialize, and concentrate during the work day. If coworkers do not understand and work around the issues, then it could lead to anxiety and job-switching.

In public
Sometimes strangers do not understand why people with SPD are behaving the way they are. This can lead to assuming bad attitude or parenting skills and harsh judgment can be made. This spreads and endorses negative emotions.

Occasionally, entertainment and educational businesses will factor in SPD into their environment. This often includes dimming lights, minimizing sounds, and creating sensory friendly areas for calming.

Kelly Richter  
St. Louis City Museum  
Sensory Day Organizer

"I was trying to imagine something we could do to accommodate those with special needs [...] and Sensory Days was born."

**When:** started last year and worked with Autism Speaks for an understanding of how to be more sensory friendly.

**Why:** looked at other museums that were becoming more accommodating to those with special needs and wanted to widen their breadth of accessibility.

**How:** Exhibits are adjusted to be less obnoxious with sound and lights are dimmed. Also created a quiet area to provide a sensory break. It is held on a Sunday since fewer people tend to come on that day.

**Response:** Overwhelmingly positive and supportive response. However, the museum does not limit admission and that was the only complaint.

To understand the user experience, I wore earplugs while pet sitting vocal animals.

1: Carry around ear plugs  
2: Squeeze to wear  
3: Adjust throughout time  
4: Throw away

- can see how many are left
- awkward packaging for transporting ear plugs
- foam has an uncomfortable expanding moment
- painful process to shove them in my ears
- muffles sound to a bearable level
- ear plugs not friendly to small ears

Ensures cleanness is not sustainable
Every person with SPD has a unique neurological wiring and behavioral issue. Caretakers need support and often go online to search for help. Users need access to coping methods no matter when or where. This calls attention to the need for constant availability. Therapy, even when done properly, needs years of practice and reinforcement from caregivers. SPD involves multiple senses. The most effective coping methods and therapy also incorporate multiple senses. Along with behavioral issue and pain, negative emotions and connotation are often found in SPD and similar disorders. From family members to teachers and doctors, this is a need for understanding and acknowledgment of SPD.
The Solution

Caretakers
provides support
information

Multi-Senses
sound
taste
smell
balance
touch
organization
easy of use

SPD User
in the moment
long-term

Transport

CONSIDERATIONS

Using these key elements as guidelines, there are requirements that must be included in the design process and solution. This includes:

- Centering the solution around children and teens
- Looking at over responsiveness as a more specific user group
- Encouraging mindfulness
- Being readily available and transportable
- Assisting the caretaker

DESIGN DIRECTION