



# SENSORY PROCESSING DISORDER

When Feeling Doesn't "Feel Right"

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# WHO AM I?



- BA in English & Religion
- Chiropractic Physician
- Fellow of the American College of Functional Neurology
- Fellow of the American Board of Brain Injury Rehabilitation



# WHO AM I?

- Presently in private practice.
- I receive no funding from outside sources, including pharmaceuticals, medical equipment, nutraceuticals, or other potential conflicts of interest.



## What is SPD?

- First described by Anna Jean Ayres in 1972
- She defined Sensory Integration as “the neurological process that organizes sensation from one's own body and from the environment and makes it possible to use the body effectively within the environment.”
- Not a formal diagnosis (DSM-V), but probably a component of many other childhood diagnoses.





# What is SPD?

## ➤ Imaging shows differences in brain structure:

“To our knowledge, this is the first study to demonstrate reduced white matter microstructural integrity in children with SPD. We find that the disrupted white matter microstructure predominantly involves posterior cerebral tracts and correlates strongly with atypical unimodal and multisensory integration behavior. These findings suggest abnormal white matter as a biological basis for SPD and may also distinguish SPD from overlapping clinical conditions such as autism and attention deficit hyperactivity disorder.” (Owen 2013)





## What is SPD?

- Imaging shows unique structural differences between autism and SPD:

“Both the SPD and ASD cohorts demonstrate decreased connectivity relative to controls in parieto-occipital tracts involved in sensory perception and multisensory integration. However, the ASD group alone shows impaired connectivity, relative to controls, in temporal tracts thought to subserve social-emotional processing.” (Chang 2014)



# What is SPD?

- Imaging gives us a basis for SPD being a unique problem, but more study is needed to know how to assess it in a clinical setting

“We find strong correlations of FA with both parent report and direct measures of tactile and auditory processing across children, with the direct assessment measures of tactile and auditory processing showing a stronger and more continuous mapping to the underlying white matter integrity than the corresponding parent report measures. Based on these findings of microstructure as a neural correlate of sensory processing ability, diffusion MRI merits further investigation as a tool to find biomarkers for diagnosis, prognosis and treatment response in children with SPD.” (Chang 2015)



# What is SPD?

- Children with SPD show measurable differences in reflexive responses from the brain

“These results provide preliminary evidence that children who demonstrate severe SMD may have physiological activity that is different from children without SMD, and that these physiological and behavioral manifestations of SMD may affect a child’s ability to engage in everyday social, communication, and daily living skills.” (Schaff 2010)





# SPD and Autism



➤ The DSM V adds sensory issues as a contributing diagnostic feature, under the category of restricted & repetitive behaviors.

➤ *“Hyper- or hyporeactivity to sensory input or unusual interests in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement).”*



## What describes a child with SPD?

- Behaviors
  - Seekers
  - Avoiders
- Responses to the environment
  - Over-reactive
  - Under-reactive
- Other symptoms?
  - Attention, hyperactivity, anxiety, irritability, socialization . . .

# What senses can be involved?



➤ The 5 major senses



*Children...*

LITTLE PEOPLE WHO CAN'T HEAR  
THEIR NAME BEING CALLED - EVER  
YET CAN HEAR A PIECE OF  
CANDY BEING UNWRAPPED THROUGH  
THREE WALLS AND A THUNDERSTORM

[SIMPLEESTHINKING.COM](http://SIMPLEESTHINKING.COM)

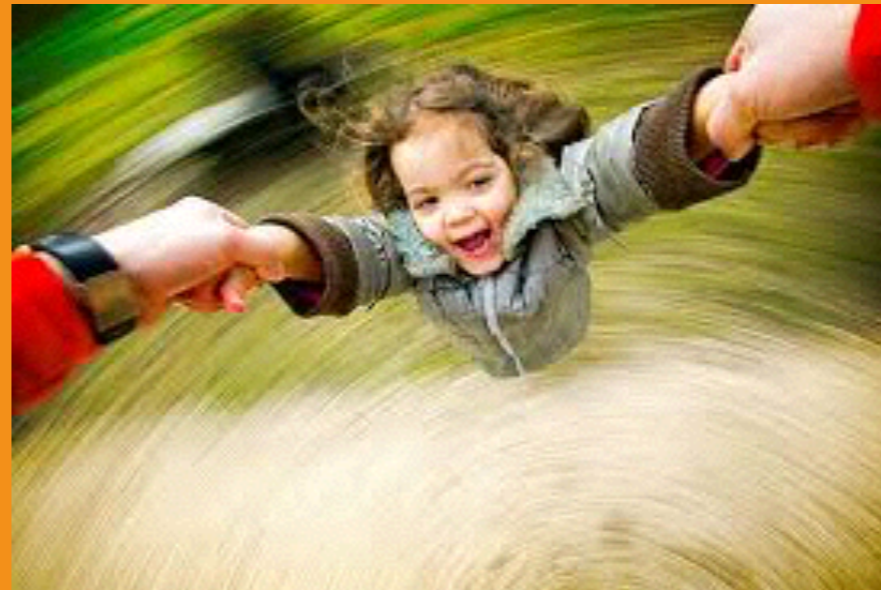






What senses can be involved?

➤ A sense of head movement (Vestibular)





What senses can be involved?

➤ A sense of body movement (Proprioception)





## What senses can be involved?

- A sense of internal physiology (interoception)

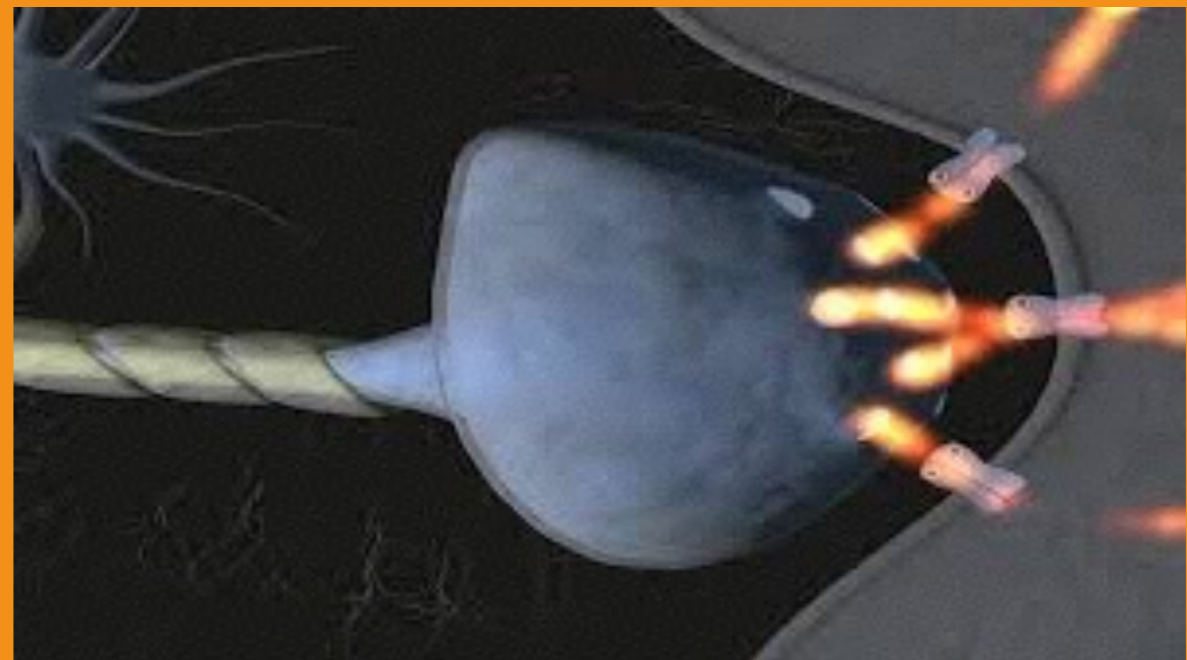






How does the brain perceive these senses?

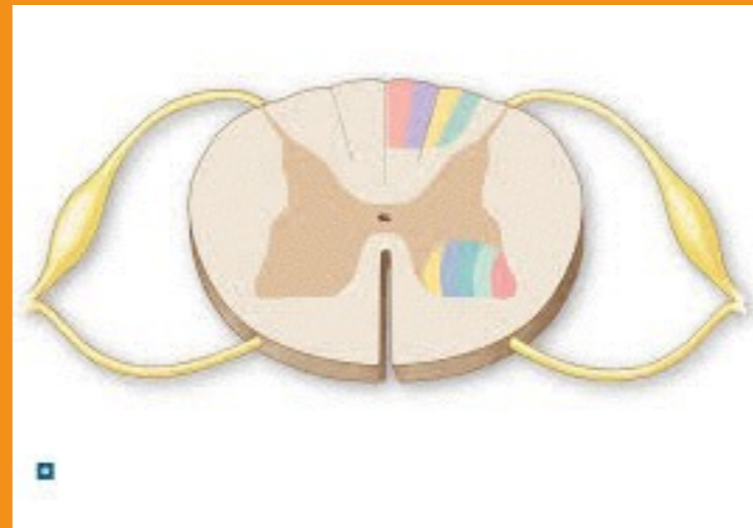
- In a word . . . MAPS, MAPS, MAPS. But first:
- Receptors trigger signals that travel along nerves





How does the brain perceive these senses?

- Nerves connect with the central nervous system at various sites





How does the brain perceive these senses?

➤ ALL of these sites are organized into MAPS

➤ Maps are either of OURSELVES or of our SURROUNDINGS







How does the brain perceive these senses?



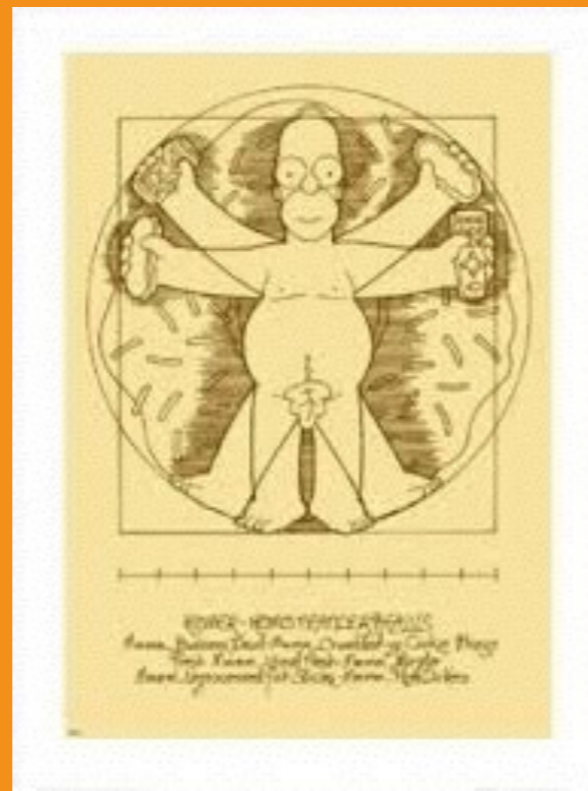
➤ The primary purpose of the environmental maps is to understand what's happening in space around us.

- Am I safe in this environment?
- Am I threatened in this environment?
- How sure am I about the nature of this environment?





How does the brain perceive these senses?



- The primary purposes of our body maps are to know where we are in our surroundings, and to help us move effectively within them.
  - How do I fit into this environment?
  - How can I interact with this environment?



## What if these maps are skewed?

- What behaviors might be produced?
- Would you feel safe?
- Might you seek a way to learn more about your environment?
- Might you avoid circumstances that you find impossible to understand?
- Would your movements be precise and controlled?
- Does it change your risk for injury?





# Let's review

OK - This makes sense.  
Now let's interact!



40x per second!!



Sight	Sound	Touch
Smell	Taste	Head &
Body		Movement

Hey - what's going on around here???



# What can be done?

## ASSESSMENT

- Parent report
  - Sensory Profile
  - Sensory Processing Measure
- Physical exam
  - “Does this child produce expected normal responses to environmental stimuli?”
    - Vestibular
    - Visual
    - Proprioceptive / muscular
    - Tactile



## What can be done?

- Animal studies involving an “enriched environment” provide preliminary evidence that SIT could be effective for treating a variety of neurobehavioral symptoms

“Based on this review, the essential features in the enriched environment paradigm which should be included in sensory integration treatment are multiple sensory experiences, novelty in the environment, and active engagement in challenging cognitive, sensory, and motor tasks. Use of sensory integration treatment may be most applicable for children with anxiety, hypersensitivity, repetitive behaviors or heightened levels of stress. Additionally, individuals with deficits in social behavior, social participation, or impairments in learning and memory may show gains with this type of treatment.” (Reynolds 2010)





# What can be done?

## TREATMENT

- Specific to the individual's deficits
- Multimodal
  - i.e. uses multiple sensory pathways simultaneously
- Re-testing of aberrant responses



# What can be done?

## TREATMENT

- The best avenue for treatment is going to focus on building accurate maps of space and self.
- Maps are constantly being made and re-made through primarily:



Dynamic vision



Vestibular activation



# What can be done?

## DYNAMIC VISION

- There are 7 functional classes of eye movements:
  - Gaze holding
  - Vestibular-Ocular Reflex
  - Vergence (this is actually 2 eye movements)
  - Smooth pursuit
  - Saccade
  - Optokinetic nystagmus
- Each can be assessed, corrected, or used with therapeutic value





## What can be done?

### VESTIBULAR THERAPY

- This system perceives 2 types of movement
  - Rotational
    - yaw, pitch and roll
  - Linear
    - bob, heave and surge
- Ocular and postural responses to each can be assessed, corrected or used therapeutically



# What can be done?

## OTHER THERAPEUTIC OPTIONS

- Vibration
- Brushing
- Tactile perceptions
  - Graphesthesia (recognizing letters on skin)
  - Barognosis (perception of weight)
  - Stereognosis (recognizing shapes by feeling)
- Auditory
- Smell & taste



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