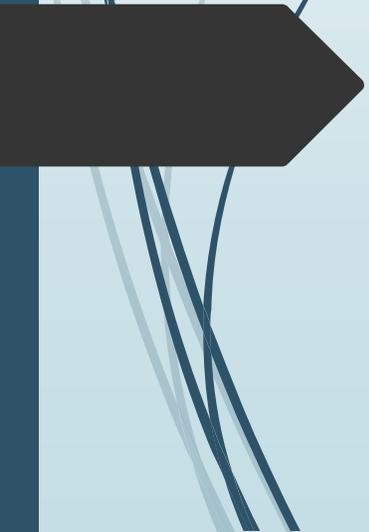


# Sensory Processing Disorder (SPD): Controversial Aspects of Diagnosis and Treatment



Jacqueline Dobres MS OT R/L, BCBA

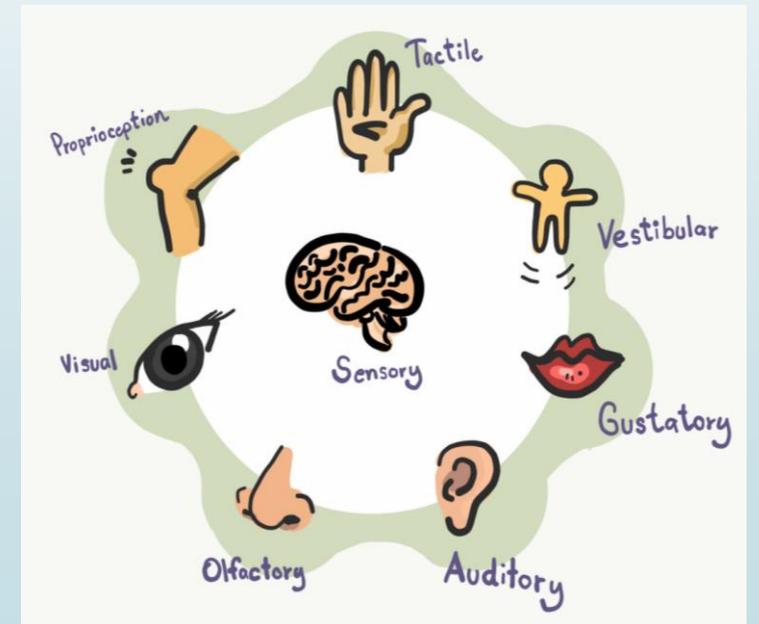
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# Active Learning Objectives

- ▶ 1. Learners will describe aspects of sensory processing disorder in terms of a theoretical but not formally recognized diagnosis.
- ▶ 2. Learners will evaluate SPD research according to the levels of the evidence and practically apply their knowledge to discuss the strength of that research
- ▶ 3. Learners will establish a framework for conducting trials and then analyzing data related to sensory integration activities that also compares it to other dimensions (i.e. attention, escape from work).

# Sensory Processing Disorder

- ▶ Not in the DSM 5- should not be used as a diagnosis
- ▶ There is no universally accepted definition
- ▶ Difficulty organizing or interpreting sensory information from the environment or one's body
- ▶ Hyper or hypo sensitivities
- ▶ Touch, Smell, Taste, Auditory, Visual





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# Sensory Processing Disorder

- SI/SP-T is thought to impact attentional, emotional, motoric, communication, and/or social difficulties
- Hypothesized to result in challenges related to initiating or sustaining peer interactions, developing engaged relationships, participating in activities of daily living, and regulating arousal behaviors
- Specific developmental domains, such as language development (e.g., Ayres and Mailloux, 1981; Mauer, 1999), are also hypothesized to be impacted and to thus incidentally benefit from SI/SP-T

# Manifestations



- ▶ Responses to stimulation more quickly, more intensely, and for a longer duration than do typically developing individuals
- ▶ Extreme responses to stimuli such as noise in a classroom, odors in a restaurant, the touch of clothing, the clipping of finger and toenails, the movement of playground equipment, and/or the sight of cluttered environments
- ▶ Behavioral responses are proposed to include a range of “fight, flight or freeze” reactions such as aggression, withdrawal, or preoccupation with the expectation of sensory input



# Sensory Integration or Sensory Processing

- ▶ Old definition: “organize sensory information for use” and along with motor performance *Ayres (1972, p. 4)*
- ▶ New definition: “difficulty detecting, modulating, interpreting and/or responding to sensory experiences, which is severe enough to disrupt participation in daily life activities and routines and learning” *(Miller et al., 2007a)*.
- ▶ *Both are widely used terms (often times interchangeably)*

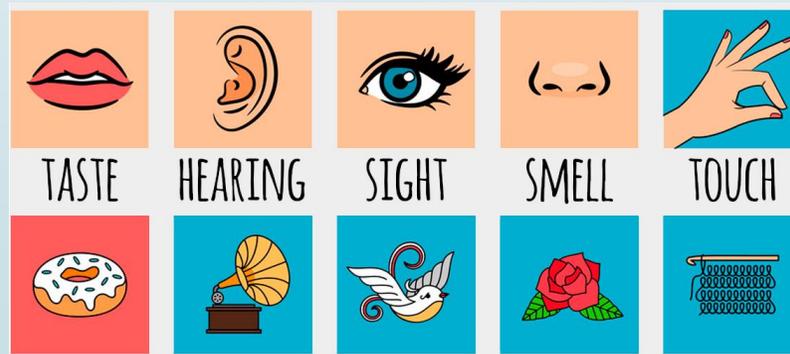


# Ayres Sensory Integration

- Was developed in the 1970's and beyond by Jean Ayers
- In 1972 she published a book outlining her theory, how children can be assessed as well as treated for sensory challenges
- In 1979 she publishes Sensory Integration and the Child which was a parent component to her theory
- Throughout the 80-90's some researchers discredit her work and controversy around sensory integration emerges
- 2000's there is a push for high quality research on SI
- Sensory Integration was trademarked in 2007

# Ayres Sensory Integration

- ▶ A theory
- ▶ A frame of reference
- ▶ “a process related to multimodal processing that supports the formation and retrieval of multisensory perceptions in the central nervous system”



(Smith Roley, S., Mailloux, Z., Miller-Kuhaneck, H., Glennon, T. 2007)



# Sensory Integration as Theory

- Used to explain behavior
- Plan intervention
- Predict how behavior will change through intervention
  
- Three main components of sensory integration theory:
  - Describing typical sensory integration development
  - Defining sensory integrative dysfunction
  - Guiding intervention programs

(Smith Roley, S., Mailloux, Z., Miller-Kuhaneck, H., Glennon, T. 2007)  
(Bundy, Lane, and Murray 2002)



# Ayers approach to typical sensory integration functioning

- ▶ Purposeful activity
- ▶ “1) learning takes place as a function of reward or reinforcement
- ▶ 2) one learns what he does
- ▶ and 3) learning takes place because there is a purpose for its taking place”
  
- ▶ The person must perceive the goal and process of the intervention in order to benefit from it...in other words, it's not passive

(Smith Roley, S., Mailloux, Z., Miller-Kuhaneck, H., Glennon, T. 2007)  
(Ayers, 1960, p. 38)

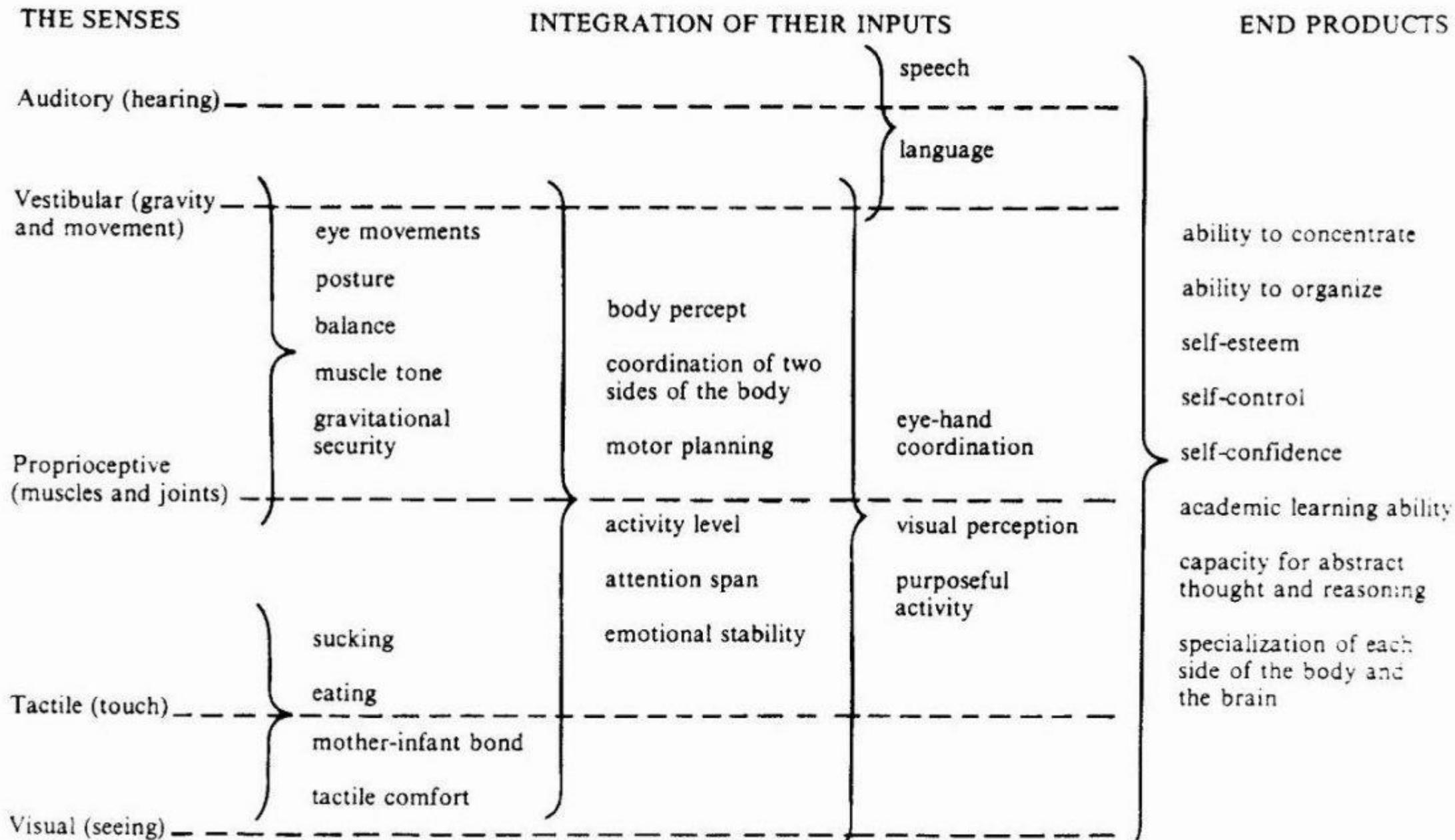


Image: Western Psychological Services SI and the Child 1979

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# Ayers Sensory Integration Therapy

- ▶ Must be a trained clinician (above being an occupational therapist)
- ▶ Done in a specialized clinic space
- ▶ Must be child-led
- ▶ Therapist creates a “just-right” challenge
- ▶ Therapists should be using the ASIFM (fidelity measure) which will help ensure that treatment follows the basic tenants of the theory



# Ayers Sensory Integration Fidelity Measure (ASIFM)

- “fidelity refers to the extent to which the intervention delivered in a study is true to the underlying therapeutic principles on which it is based”
- A fidelity measurement guides the analysis of the intervention
- Allows the researcher to verify the therapeutic intervention as accurate to the defined intervention
- Allows for the study to be replicable



# What does not qualify?

- ▶ Wilbarger Approach
- ▶ Vestibular-Oculomotor Protocol
- ▶ Alert Program for Self-Regulation

# Sensory Processing

- ▶ used to describe the way in which sensation is detected, transduced, and transmitted through the nervous system



(Smith Roley, S., Mailloux, Z., Miller-Kuhaneck, H., Glennon, T. 2007)

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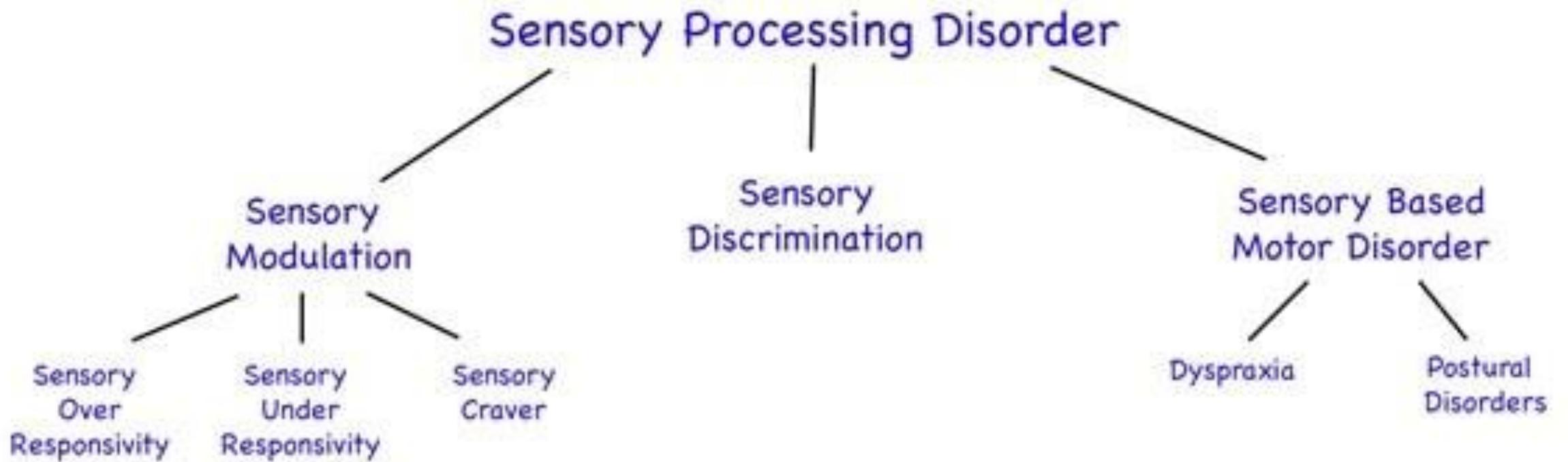
# Sensory Processing Disorder

- ▶ Lucy Jane Miller formally publishes the term Sensory Processing Disorder in her books in 2006
- ▶ She then published her treatment approach in 2012, *A SECRET*
- ▶ Uses elements of Ayers Sensory Integration but also includes additional therapies such as listening therapy
- ▶ Strategies can be delivered in a variety of settings including home and school
- ▶ In 2009, Miller et al. (2009) suggested a change in nomenclature from “sensory integration” to “sensory processing” disorder while maintaining the foundational sensory elements



# Three Main Types of Sensory Processing Disorder

- Sensory Modulation Disorder (SMD)
- Sensory-Based Motor Disorder (SBMD)
- Sensory Discrimination Disorder
  
- Can occur separately or in combinations



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# Sensory Modulation Disorder (SMD)

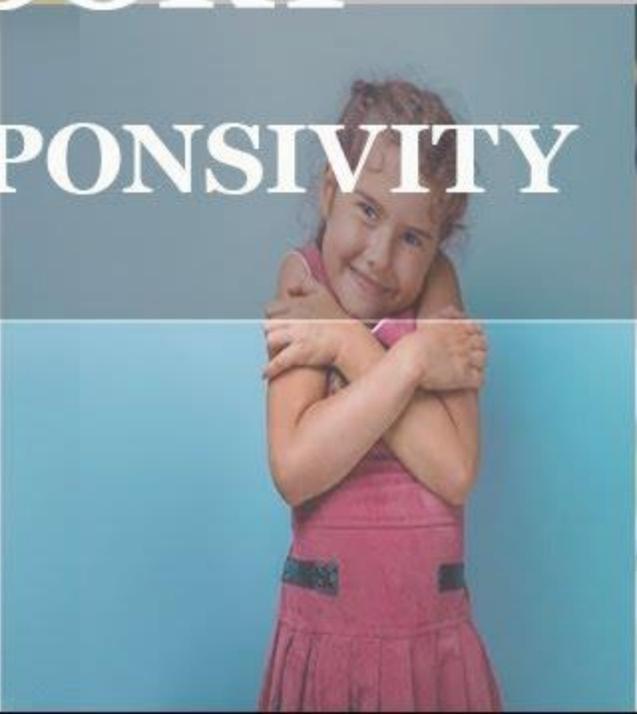
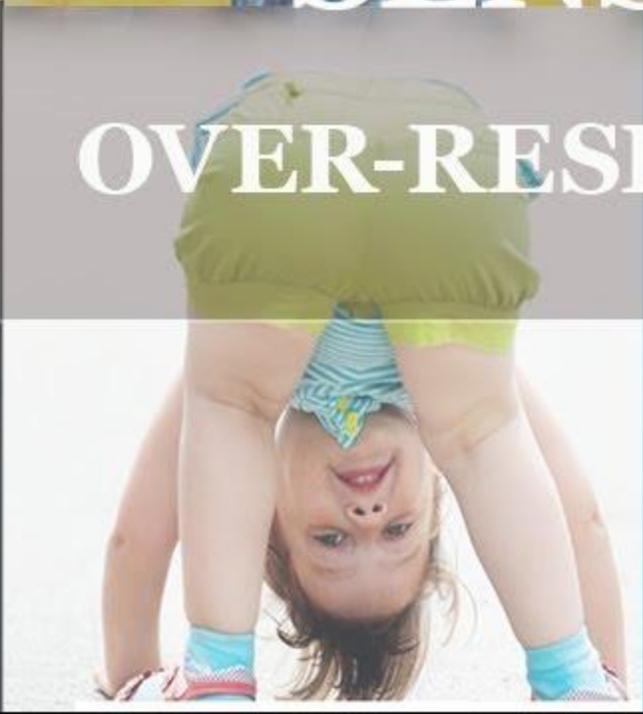
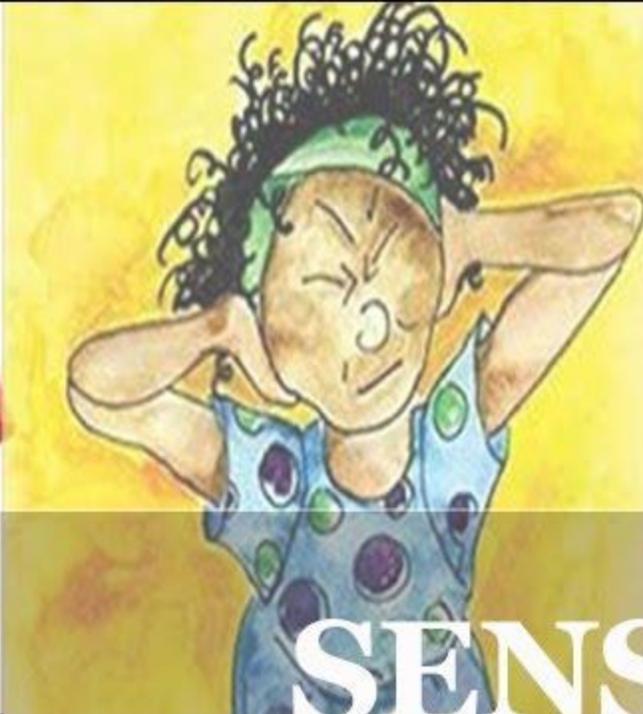
- Sensory over responsiveness
- Sensory under responsiveness
- Sensory craver

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# SMD: Sensory Over Responsivity

- Have an exaggerated response to stimuli that neurotypical people would find tolerable
- Fight or flight
- May present as tactile defensive
- May present as fearful of movement (gravitational insecurity)
- May present as reacting negatively to certain food groups (gagging or vomiting)
- Avoidance behavior interferes with social interaction or learning

(Hough, M. 2014)



**SENSORY**

**OVER-RESPONSIVITY**

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# SMD: Sensory Under Responsivity

- ▶ Lack of awareness to sensory stimuli
- ▶ May appear unaware of sensory stimuli
- ▶ Low arousal
- ▶ Appear to be daydreaming
- ▶ Appear uninterested
- ▶ Often times have low endurance
- ▶ May mouth objects



SENSORY  
UNDER RESPONSIVITY



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## SMD: Sensory Craver

- ▶ May also be called sensory seeking
- ▶ The nervous system seeks out additional input or sensory stimuli
- ▶ Constantly touching, moving, crashing
- ▶ Little to no awareness of personal space or boundaries
- ▶ May demonstrate decreased safety awareness
- ▶ May appear clumsy or awkward

(Hough, M. 2014)



# SENSORY CRAVER



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# Sensory Based Motor Disorder

- Dyspraxia
- Postural Disorders

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# Dyspraxia

- Difficulty with planning and executing fine and gross motor skills
- Poor balance
- Poor posture
- Clumsiness
- Difficulty with perceptual skills
- Poor hand-eye coordination



# DYSPRAXIA



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# Postural disorders

- ▶ Poor core strength
- ▶ Decreased endurance
- ▶ Have poor body awareness
- ▶ Poor muscle co-contraction
- ▶ Usually co-occurs with sensory under responsivity

(Collins, B. and Miller, L.J., 2012)



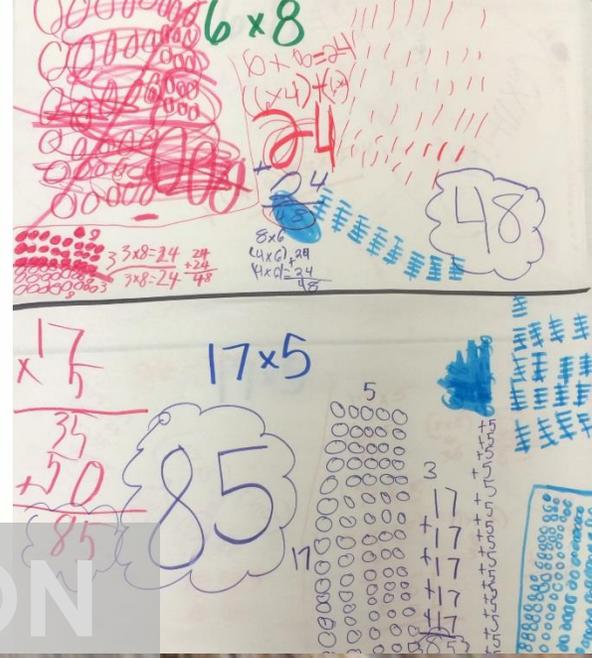
POSTURAL  
DISORDER



# Sensory Discrimination Disorder

- Difficulty interpreting information from one or more of the sensory systems
  - Visual
  - Auditory
  - Proprioceptive
  - Vestibular
  - Tactile (touch)
  - Olfactory (smell)
  - Gustatory (taste)
  - Interoceptive (sensations from internal organs such as the stomach)
- Difficulty understanding words that were heard (auditory)
- Not able to identify items by touch only (tactile)
- Not knowing when they feel full or hungry (interoceptive)

(Miller and Collins, 2012)



# SENSORY DISCRIMINATION DISORDER





# Levels of Evidence

- ▶ **Level I:** Systematic Review, Meta-Analysis, Randomized Control Trials (RCT)
- ▶ **Level II:** Two groups, nonrandomized studies
- ▶ **Level III:** One group, nonrandomized
- ▶ **Level IV:** Descriptive studies (single subject, case series)
- ▶ **Level V:** Case report and expert opinion



# Understanding the results

- ▶ **Was the study valid?**
  - ▶ Subjects randomized?
  - ▶ Baseline data
  - ▶ Type of sampling
- ▶ **What are the results?**
  - ▶ Statistically significant
  - ▶ Confidence intervals
- ▶ **Can they be applied to my learner?**
  - ▶ Effect size
  - ▶ Potential benefit outweighs risk/cost

# Current Evidence

Systematic Reviews: 3  
AB Crossover Design: 1  
One group design: 2  
Single subject: 1





# Performance challenges for children and adolescents with difficulty processing and integrating sensory information: A systematic review

- ▶ Systematic review of 35 studies with the purpose of identifying the performance difficulties that develop from difficulty processing and integrating sensory information (Level I)
- ▶ Grouped difficulties observed into the following categories
  - ▶ play and leisure, social participation, ADLs, IADLs, rest and sleep, education, and work
- ▶ They sighted a failure in the literature to “link sensory issues to actual performance deficits in the areas of occupation”

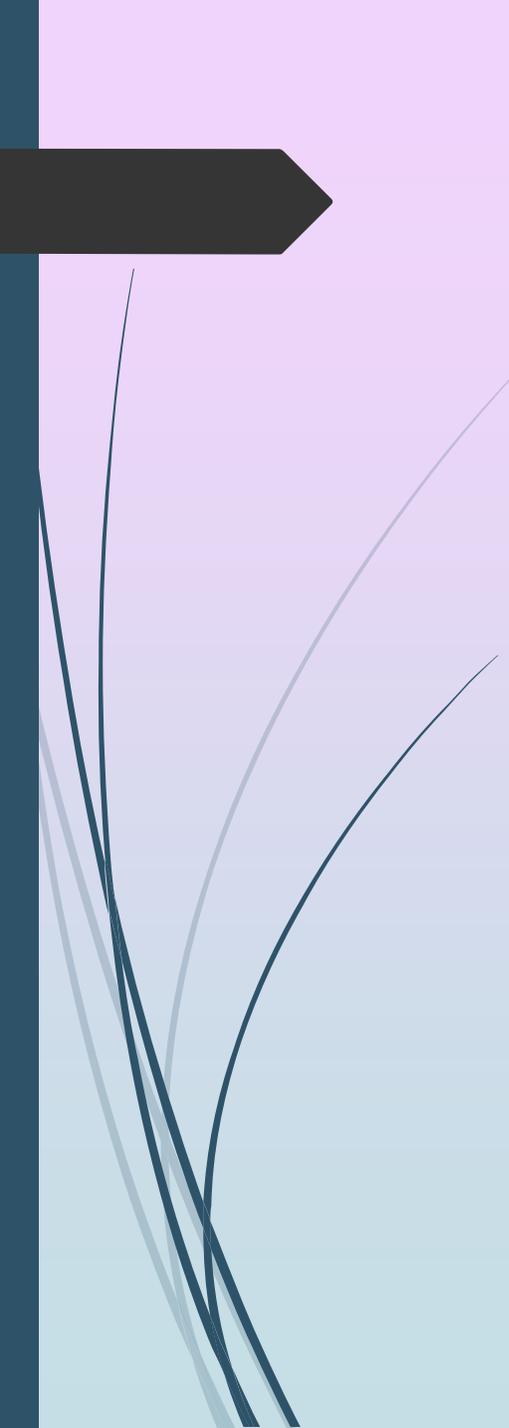
(Koenig, K. P., & Rudney, S. G., 2010)



# Performance challenges for children and adolescents with difficulty processing and integrating sensory information: A systematic review

- ▶ Limitations of the review:
  - ▶ lack of randomization
  - ▶ lack of control groups
  - ▶ small sample sizes
  - ▶ use of parent-report measures
  - ▶ minimal use of functional performance measures to examine differences between typically developing children and children with difficulties processing and integrating sensory information

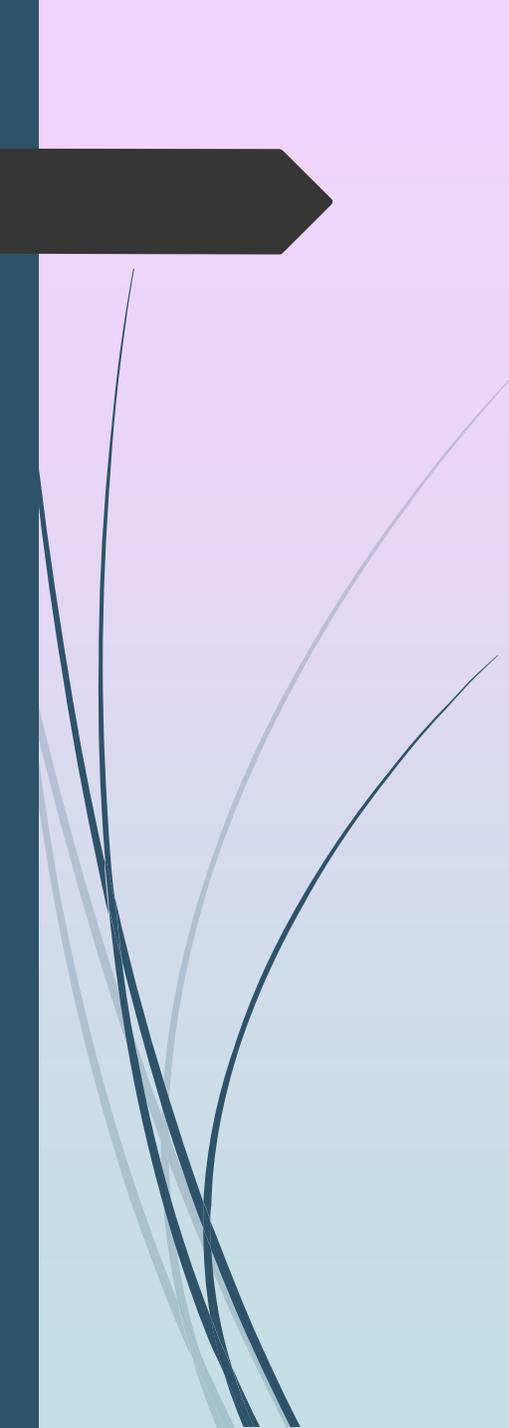
(Koenig, K. P., & Rudney, S. G., 2010)



# A Systematic Review of Ayres Sensory Integration Intervention for Children with Autism

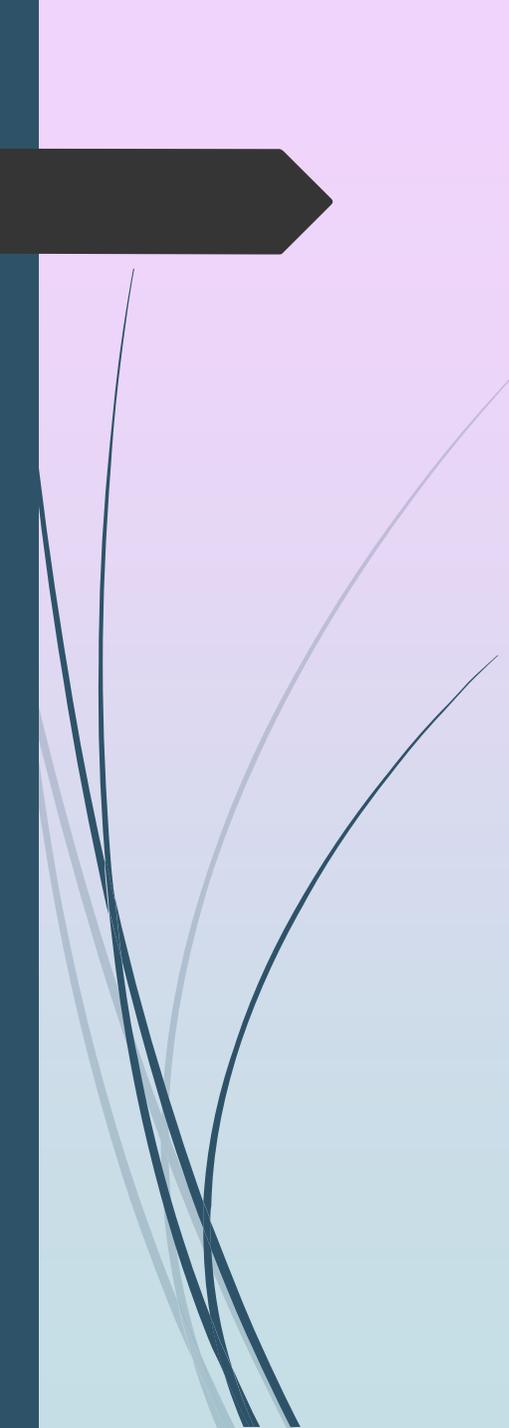
- ▶ Systematic Review (Level I)
- ▶ Number of studies included: 3
- ▶ In the last round, 3 studies were excluded
  - ▶ One because it was not using ASI
  - ▶ One because it was a descriptive study with no statistical analyses
  - ▶ One because it included SI in both groups so the effects of SI could not clearly be measured
- ▶ Reviewers used the CEC standards for evidenced-based practices in special education
  - ▶ Each of the eight QIs is operationalized using specific criteria that can be rated to evaluate the methodological rigor of an intervention research study

(Schoen, S.A., et al, 2019)



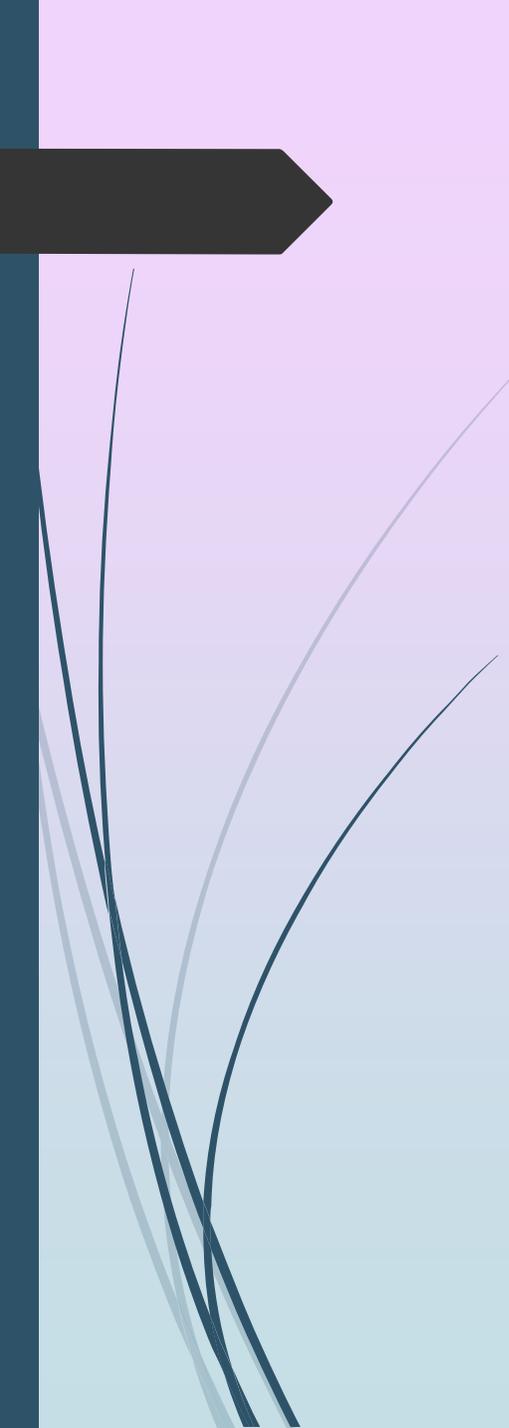
# A Systematic Review of Ayres Sensory Integration Intervention for Children with Autism

- ▶ Study 1: Iwanaga et al. [2014], set in Japan, compared 9 months of SI therapy to 9 months of group social skills intervention, nonrandomized study (Level II)
  - ▶ SI therapy was done in a facility consistent with SI procedures
  - ▶ Fidelity checks were not reported for either group
  - ▶ Results indicate positive and statistically significant gains for the SI group on 5 out of 6 outcome measures
  - ▶ However, average effect size was .23 below the .25 criteria for the What Works Clearinghouse guidelines



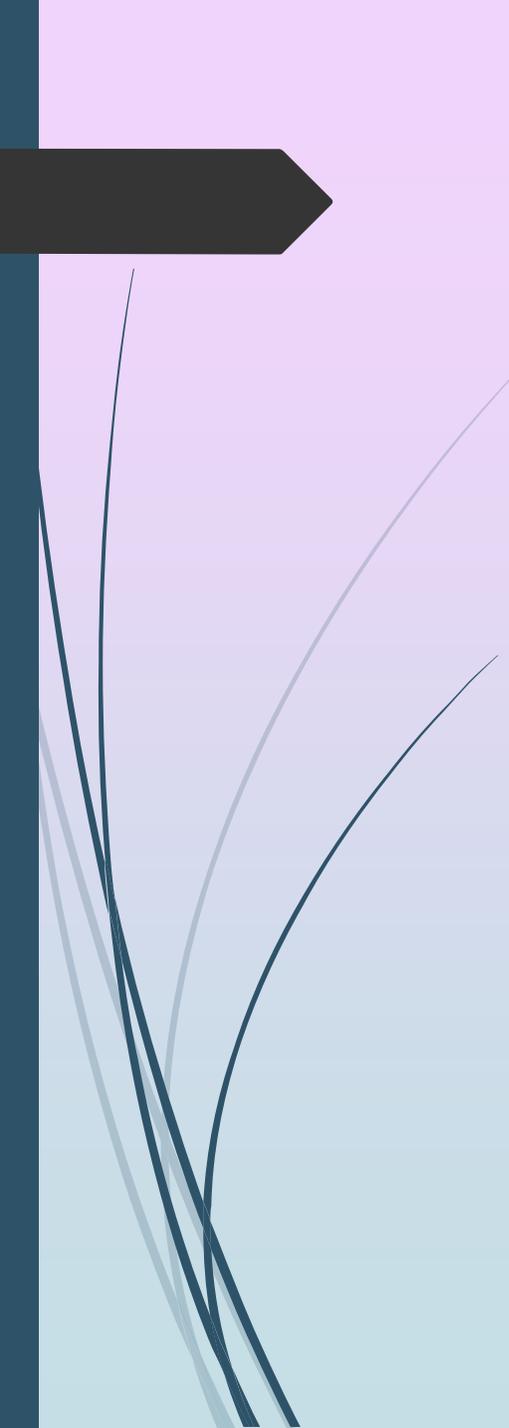
# A Systematic Review of Ayres Sensory Integration Intervention for Children with Autism

- ▶ Study 2: Pfeiffer et al. [2011] randomized controlled trial, compared ASI and fine motor training (Level I)
  - ▶ Fidelity measures were used for both groups
  - ▶ Both groups made statistically significant improvements
  - ▶ ASI group showed greater improvement in GAS goals and decreased autism mannerisms
  - ▶ However, average effect size was .21 below the .25 criteria for the What Works Clearinghouse guidelines



# A Systematic Review of Ayres Sensory Integration Intervention for Children with Autism

- ▶ Study 3: Schaaf et al. [2014], randomized controlled trial, two groups, ASI and routine care (Level I)
  - ▶ Fidelity checks were done throughout the process
  - ▶ The ASI group showed strong positive results for both the GAS as well as on the PEDI for self care and social activity scales
  - ▶ Average effect size was .933 well above the .25 criteria for the What Works Clearinghouse guidelines



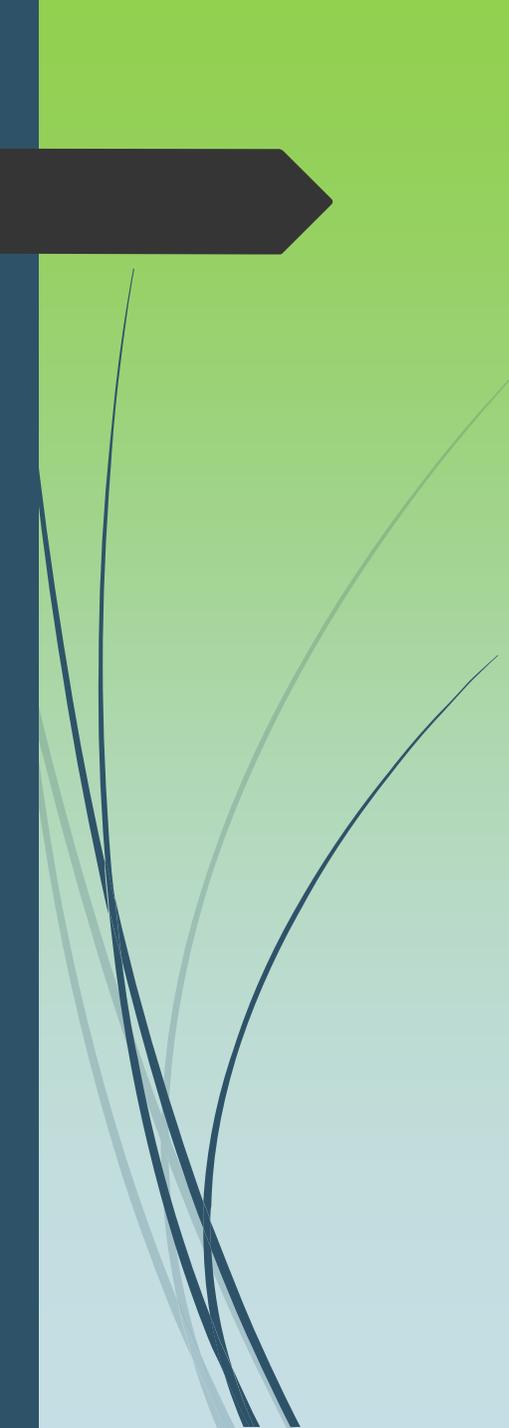
# A Systematic Review of Ayres Sensory Integration Intervention for Children with Autism

- Indicates that ASI meets the criteria for evidenced based intervention specifically for individuals with autism aged 4-12
- Studies included used a manualized approach to ASI that is consistent with textbooks that delineate the characteristics of ASI therapy
- The ASI Fidelity measure was used in two of the three studies

# Comparison of behavioral intervention and sensory integration therapy on challenging behavior of children with autism

- ▶ An AB crossover design was used for the 10 participants (Level I)
- ▶ Each participant received 2 interventions: sensory integration therapy (SIT) and behavioral intervention (BI)
- ▶ The order of interventions was varied to eliminate the potential for carryover effects
- ▶ Operational definitions for challenging behavior were written for each participant
- ▶ SIT recommendations were given by the school OT, assessment using the Short Sensory Profile, direct observation and parent input
  - ▶ Consisted of 22 recommendations that would be used 1 at a time at the start of the day and if negative behavior occurred
  - ▶ Limitation: did not specify what level of training the OT had in SIT and implementation was done by paraprofessionals that had been trained by the OT

(Lydon H., Healy O., Grey I., 2017)



# Comparison of behavioral intervention and sensory integration therapy on challenging behavior of children with autism

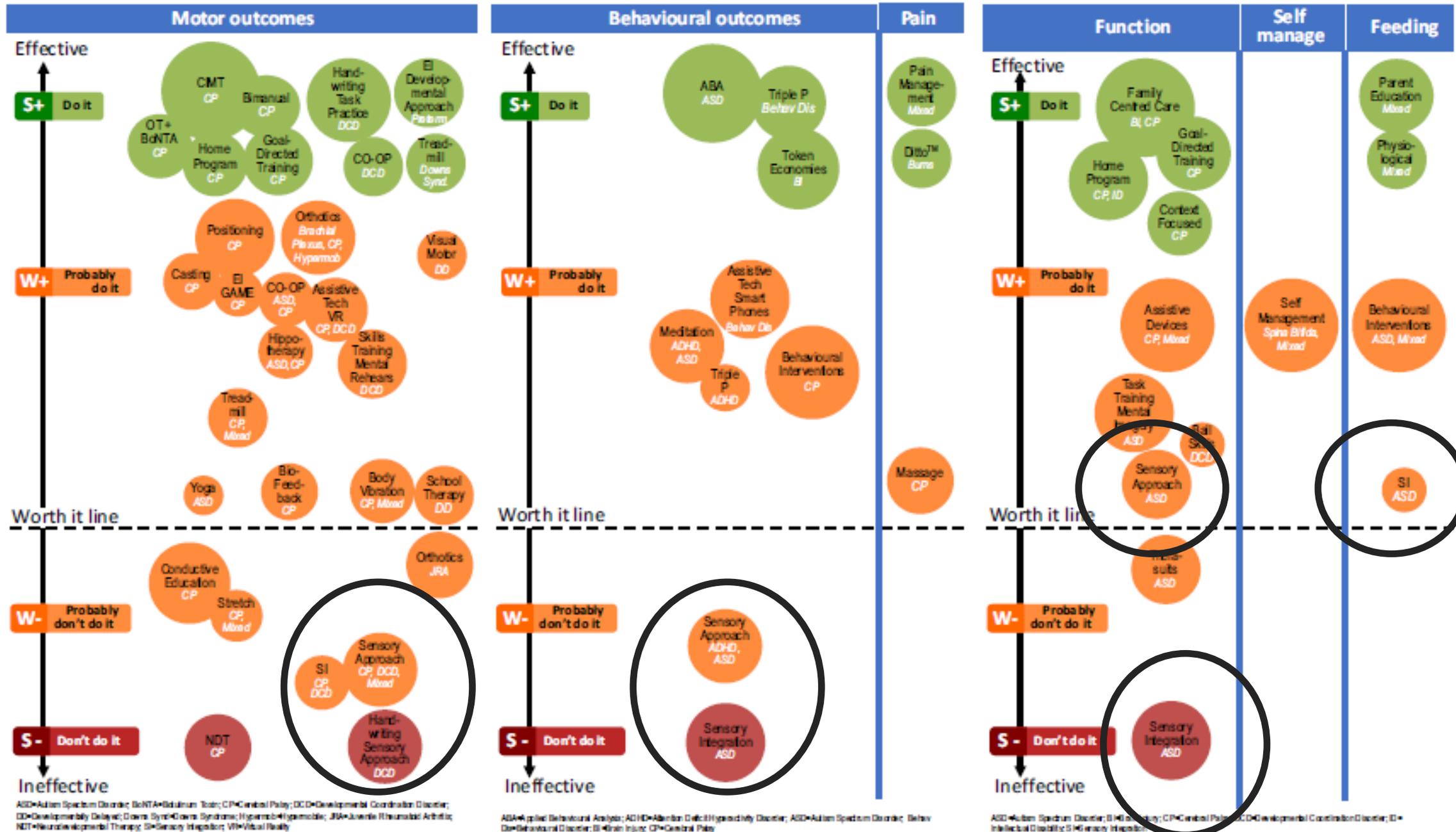
- ▶ BI began with a brief functional analysis
- ▶ Behavior Support Plans included environmental accommodations, direct interventions, skills teaching, and reactive strategies
- ▶ Results: all 10 participants had decreased negative behavior in the behavioral intervention condition. For 8 of the participants their negative behaviors were increased in the SIT sessions. The remaining two participants had nearly the same rate of negative behaviors in the SIT condition when compared to the BI condition.



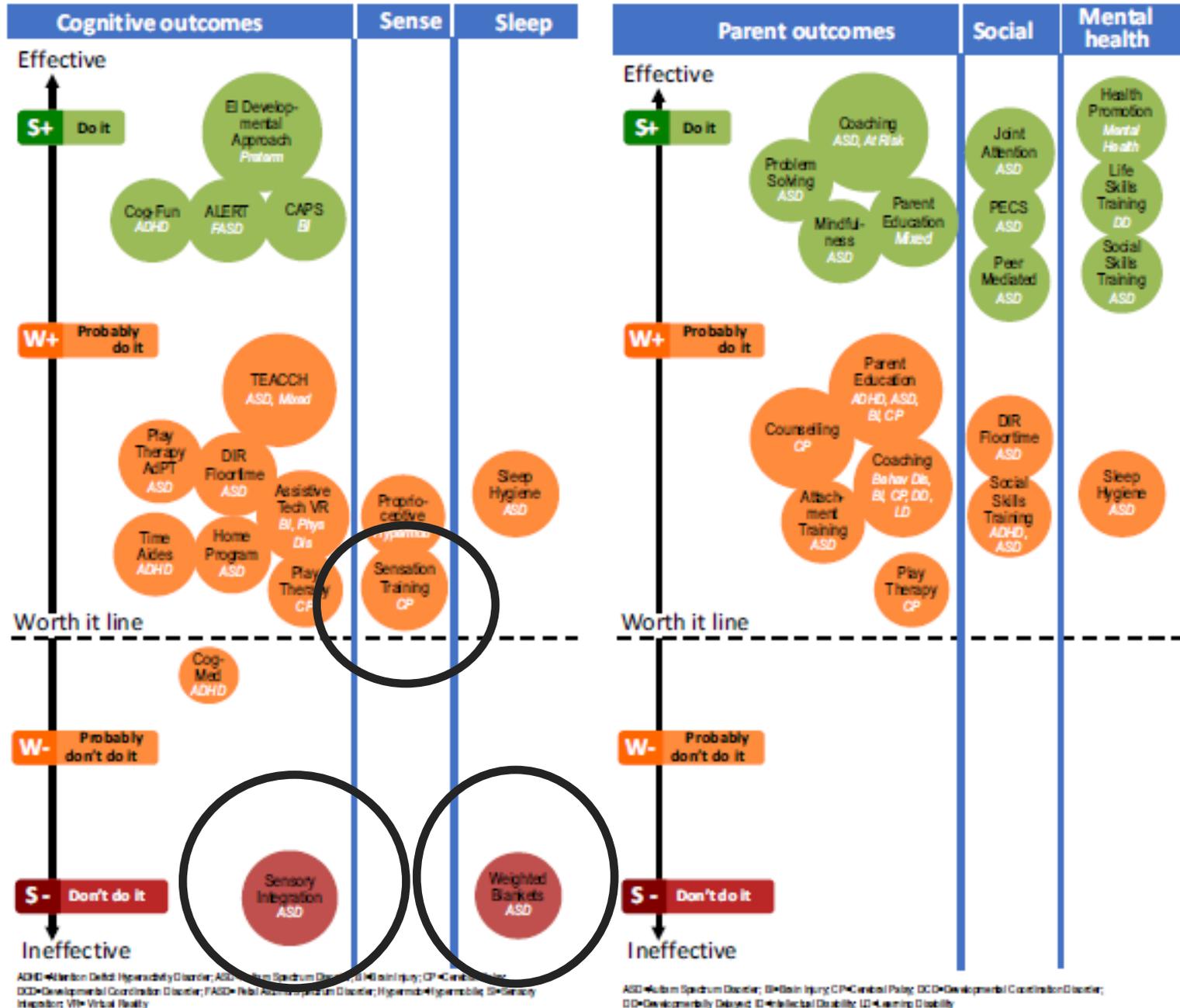
# Effectiveness of paediatric occupational therapy for children with disabilities: A systematic review

- ▶ OT's value EBP however implementation can lag
- ▶ Translation of the latest evidence into clinical care can take 10-20 years
- ▶ For children this is their entire childhood!
- ▶ Included systematic reviews and RCT (Level I)
- ▶ Reviewed and included 129 articles
- ▶ Measured the effectiveness of 52 interventions across 22 diagnoses

(Novak, I. and Honan, I., 2019)



(Novak, I. and Honan, I., 2019)



ADHD=Attention Deficit Hyperactivity Disorder; ASD=Autism Spectrum Disorder; BI=Brain Injury; CP=Cerebral Palsy; DD=Developmental Delay; FASD=Fetal Alcohol Spectrum Disorder; Hyper/Hyp=Hyper/Hypersensitive; SI=Sensory Integration; W=Virtual Reality

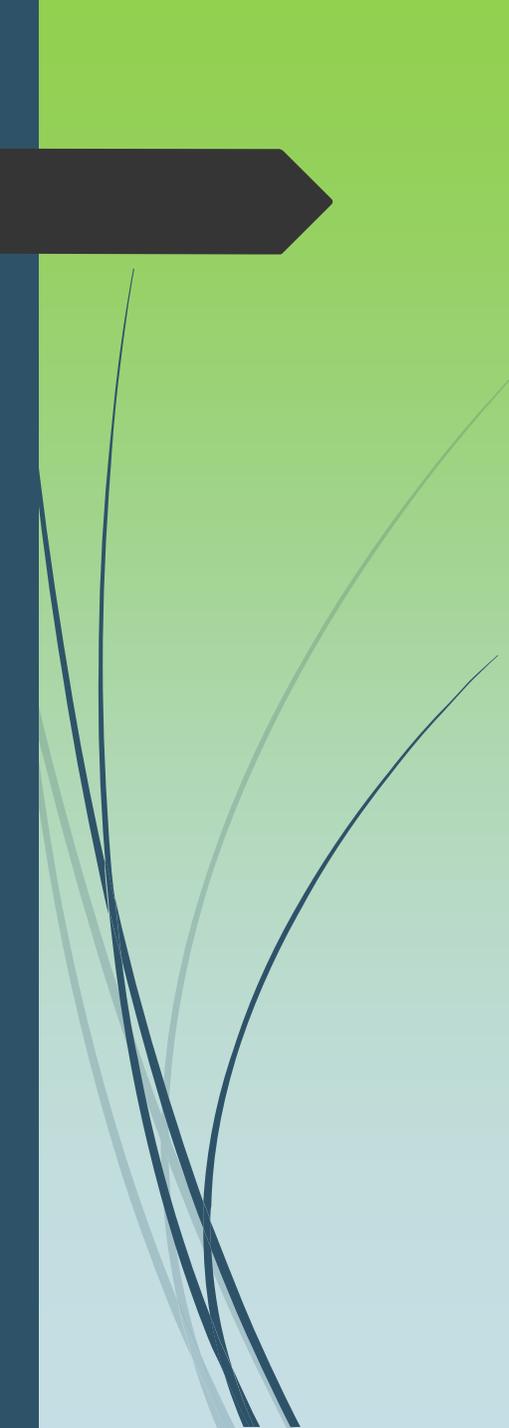
ASD=Autism Spectrum Disorder; BI=Brain Injury; CP=Cerebral Palsy; DD=Developmental Delay; LD=Learning Disability



# Effectiveness of paediatric occupational therapy for children with disabilities: A systematic review

- ▶ Findings in relation to Sensory Integration:
  - ▶ Eight of the Sensory based therapies, sensory integration, weighted blankets, etc fell into either the Don't do it or Probably Don't do it category
  - ▶ Three approaches fell into the Probably do it category very low and near the worth it line
- ▶ Noted Limitations
  - ▶ Only included systematic reviews and randomized controlled trials (highest level of evidence)
  - ▶ Looked at publications specific to occupational therapy

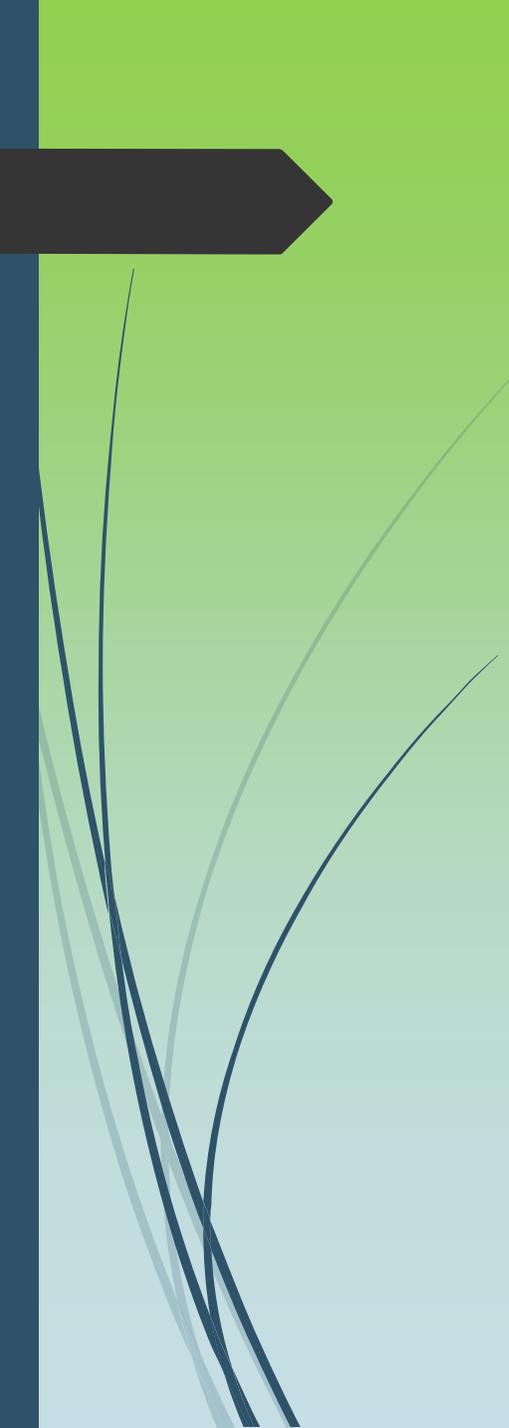
(Novak, I. and Honan, I., 2019)



# Sensory Integration As A Treatment For Automatically Maintained Stereotypy

- ▶ 5 participants (4 presenting with motor stereotypy and 1 with vocal stereotypy)
- ▶ An ABAB design was used
- ▶ Stereotypy was defined for each participant
- ▶ Data was collected using momentary time sampling
- ▶ IOA was collected on 33% of all sessions with an agreement of 85% or above for each participant
- ▶ A functional analysis of stereotypy was conducted for each participant

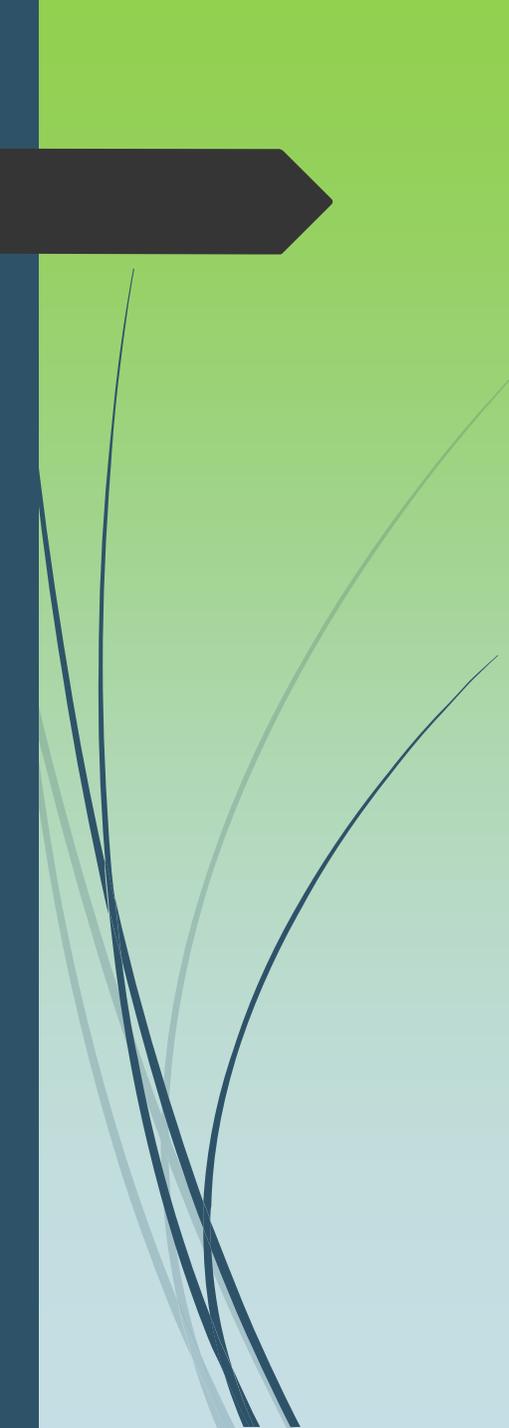
(Moore, K.M., Cividini-Motta, C., Clark, K.M., Ahearn, W.A., 2015)



# Sensory Integration As A Treatment For Automatically Maintained Stereotypy

- ▶ A competing items assessment was completed for all participants
  - ▶ An OT trained in SI chose 10 items for each participant
  - ▶ Engagement and stereotypy were measured for each item
  - ▶ Items that the participant engaged with for 80% of the time and demonstrated stereotypy 20% or less of the time were chosen to be included for that respective participant
- ▶ Data was collected in the morning and afternoon each day (upon arrival and just before departure)
  - ▶ For the treatment conditions it was hypothesized that the morning data collection would yield higher numbers (prior to treatment) compared to the afternoon data collection (after treatment)
  - ▶ Data was collected in a bare treatment room for 10 minutes

(Moore, K.M., Cividini-Motta, C., Clark, K.M., Ahearn, W.A., 2015)



# Sensory Integration As A Treatment For Automatically Maintained Stereotypy

- ▶ All participants showed no effect and in some instances there were increased rates of stereotypy during SI conditions
- ▶ Cautions against the use of sensory diets, brushing and deep pressure therapy for individuals with ASD
- ▶ Noted that the SI conditions sometimes took up to 90 minutes per day for each participant that could have been used on other activities
- ▶ Limitations of the study:
  - ▶ Implementation was done by staff that were trained by a staff member who attended 1 SI workshop
  - ▶ Procedural integrity data was not collected

(Moore, K.M., Cividini-Motta, C., Clark, K.M., Ahearn, W.A., 2015)



# The Behavioral Effects Of A Procedure Used By Pediatric Occupational Therapists

- ▶ Three participants
- ▶ All sessions were conducted in a private room in a clinic
- ▶ Preference assessment was conducted (MSWO)
- ▶ Baseline: a triangle and circle were held for the child and they were instructed to “pick one”...for either shape or no selection the child was given 15 seconds of free time

(McGinnis, A.A., Blakely, E.Q., Harvey, A.C., Hodges, A.C. and Rickards, J.B., 2013)



# The Behavioral Effects Of A Procedure Used By Pediatric Occupational Therapists

- ▶ Contingent preferred activity: one shape led to the preferred activity from the preference assessment and the opposite shape led to being prompted to stand up which ended the trial. There were 10 forced exposure trials followed by 20 choice trials
- ▶ Contingency Reversal: once there was an increase in choice for the preferred activity, the contingency was reversed (opposite shapes)
- ▶ Contingency Reversal: the contingency was reversed to the initial condition

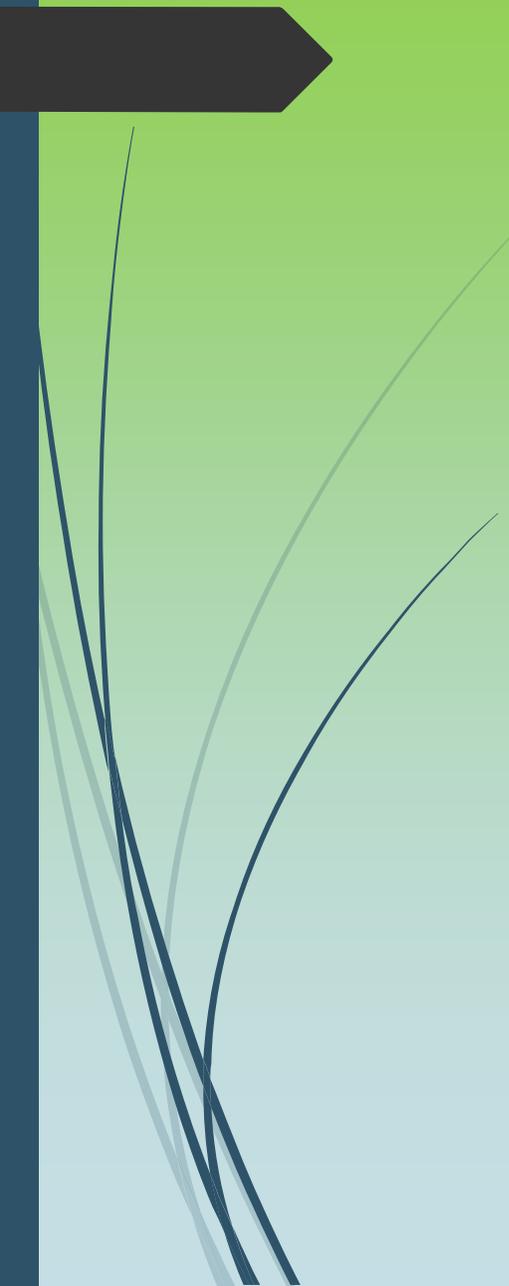
(McGinnis, A.A., Blakely, E.Q., Harvey, A.C., Hodges, A.C. and Rickards, J.B., 2013)



# The Behavioral Effects Of A Procedure Used By Pediatric Occupational Therapists

- ▶ All three participants were able to switch their choice making to choose the shape that corresponded with the preferred activity
- ▶ These activities could function as a reinforcer for individuals with ASD
- ▶ Limitations to the study:
  - ▶ did not take data on other behaviors to know if there was any benefit to the sensory activities other than preference
  - ▶ Small sample size
  - ▶ Potential sample bias as children were selected based on past experiences with sensory input

(McGinnis, A.A., Blakely, E.Q., Harvey, A.C., Hodges, A.C. and Rickards, J.B., 2013)

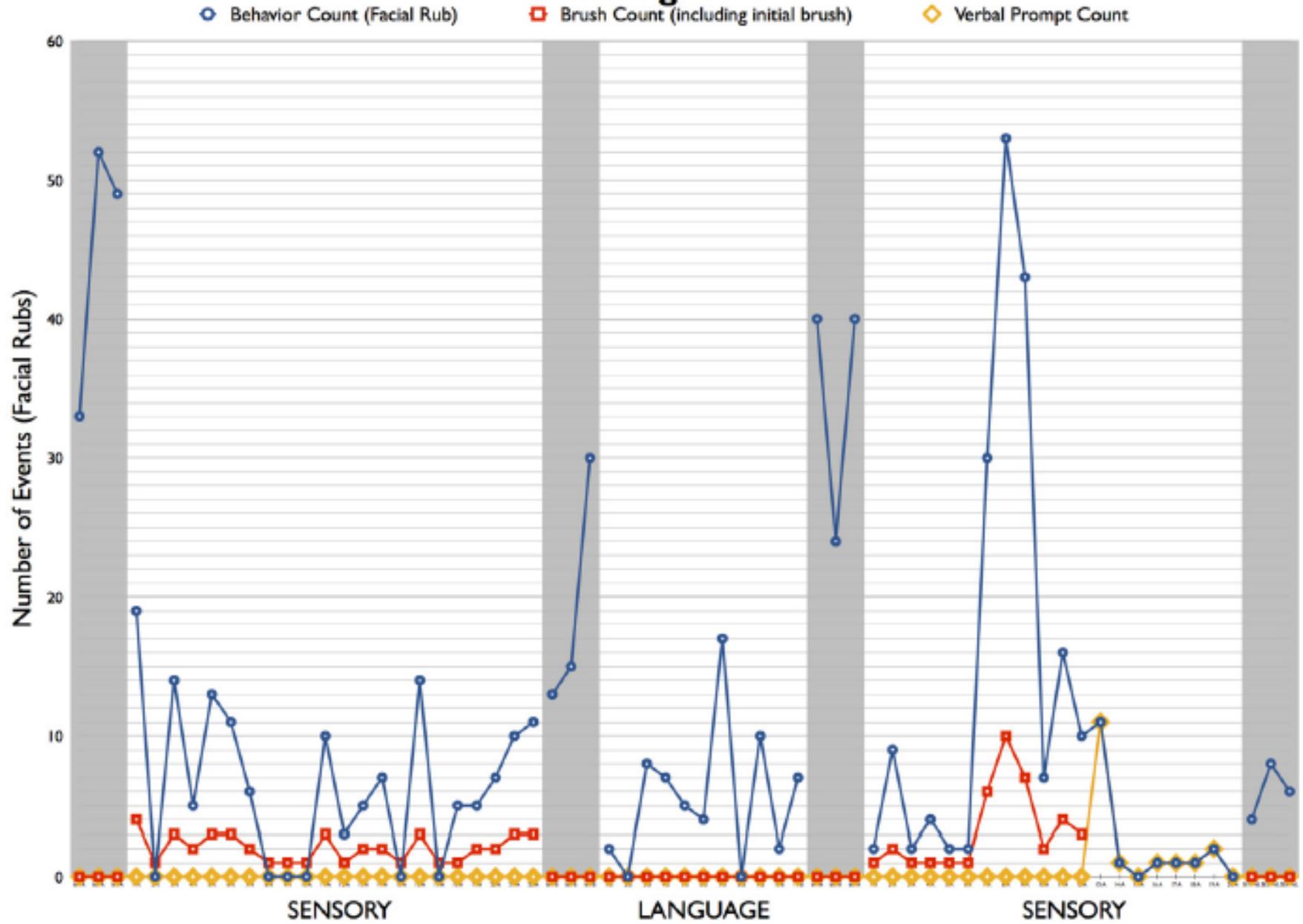
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# Evaluating Sensory Integration/Sensory Processing Treatment: Issues and Analysis

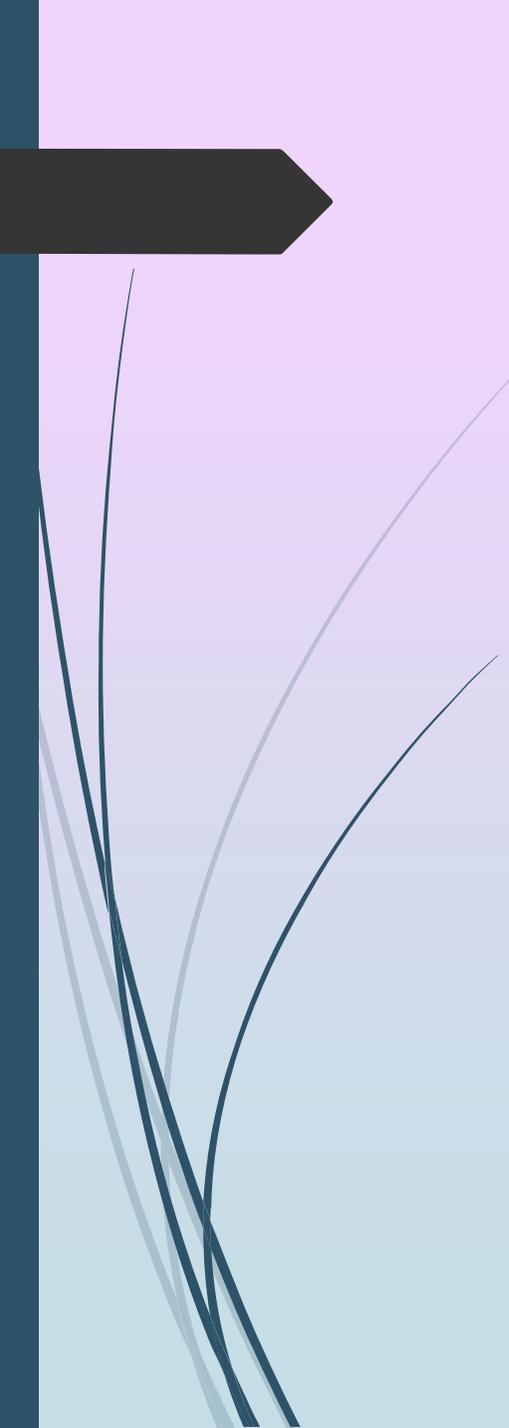
- ▶ Single subject (Level IV)
- ▶ Behavior to be reduced: facial rub
- ▶ Compares brushing to verbal only exchanges and finds similar results for both conditions

(Camarata S, Miller LJ and Wallace MT, 2020)

# Brushing: S115



(Camarata S, Miller LJ and Wallace MT, 2020)



# The evidence-based practices for children, youth, and young adults with autism report: Concerns and critiques

- ▶ The National Clearinghouse on Autism Evidence and Practice (NCAEP) recently published the *Evidence-Based Practices for Children, Youth, and Young Adults with Autism Report* (Steinbrenner et al., 2020)
- ▶ Sensory Integration® has now been included as a new evidence-based practice category in the most recent report (Steinbrenner et al., 2020)
- ▶ Defined SI as “the model developed by Jean Ayers (2005) and not to a variety of unsupported interventions that address sensory issues” (p.41).
- ▶ Critique: Used Sensory Integration and not the trademarked Ayers Sensory Integration which may lead to further confusion as to what qualifies as evidenced based SIT
- ▶ “Ultimately, without including clear language related to what procedures labeled as sensory integration are and are not evidence-based and could create difficulties for the consumers of the report”

(Leaf JB, Sato SK, Javed A, et al. 2021)



# Limitations of current evidence

- ▶ inconsistent terminology between studies
- ▶ limited high-quality evidence
- ▶ design limitations
- ▶ generally poorly designed and do not measure behavior directly

(Miller et al., 2007); (Schaaf et al., 2018)



## Considerations for conducting fair trials/ How to control for potential confounds

- “Mason and Iwata (1990) indicated that the effects of SIT might be solely a function of competing stimulation, rather than the therapeutic benefits of the SIT. A component analysis verified that SIT may provide non-contingent attention thereby reinforcing the problem behavior maintained by attention. Similarly, for automatically reinforced behaviors, SIT may offer competing stimulation, and in the case of escape maintained behaviors, the delivery of SIT results in the removal of the aversive stimuli, thus reinforcing the challenging behavior.” (Lydon, Healy, Grey 2017).

A dark blue arrow points to the right at the top left. Below it, several thin, curved lines in shades of blue and grey sweep across the left side of the slide.

# For Future Research Endeavors

- ▶ Ensure that intervention procedures are manualized and monitored to ensure fidelity that is consistent with ASI and ASIFM
- ▶ participants should be given a comprehensive assessment of sensory integration to confirm that they are appropriate candidates for this intervention
- ▶ If looking to change a negative behavior, a functional analysis should be conducted to determine if ASI would even be appropriate (see statement from Mason and Iwata)



# For Future Research Endeavors

- ▶ Head to head comparisons: different interventions aiming to achieve the same outcomes in well controlled trials with cost effectiveness data would enable determinations about best practices to be made
- ▶ Dose comparison studies: using well controlled high intensity trials would better inform parents as to how much intervention is needed

# Questions???





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