Updates in Sensory Integration Theory and Practice

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Updates in Sensory Integration Theory and Practice

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Finding Evidence to Support Practice

- PubMed
- Useful search engine
- Often includes abstract
- Search using authors name or title of article
- Bookmark it!
- http://www.ncbi.nlm.nih.gov/entrez/query.fcgi

The Theory of Sensory Integration

- Developed by A. J. Ayres – 1960's – 1980's
- Occupational Therapists and Neuroscientist
- Theory made relations among the neural processes of receiving, modulating and integrating sensory input and the resulting output, which she called **adaptive behavior**

Theory of Sensory Integration

- The theory postulates that adequate processing and integration of sensory information is needed for normal adaptive behavior to occur.

Evolution of the Theory

- Theory has evolved over the past 50 years
- Now includes additional subtypes
- Focus on Sensory Modulation
- Theory = Theory of Sensory Integration
- Treatment = Occupational Therapy using a Sensory Integrative Approach
- Disorder = Sensory Processing Disorder

Terminology
Typology
Theory Development and Advances

Terminology

- Common use of terminology will facilitate communication within and among professionals.
- Common understanding allows better understanding by parents and clients.
- See AOTA SISIS Newsletter series March – September 2000 for clarification of terminology

Distinguish between the neural process and the behavior observed

- Neural events of sensory processing
- Receiving information at the receptor and transduction of information, reaching threshold, generating action potentials, conducting neural signals & synapse with other neurons, cell bodies and organs

- Behavioral event of sensory processing
- Observed in behavior and interpretations are made based on theory (i.e.: child covers ears when school bell rings may mean auditory over responsivity

Modulation

- The neural event
- At the synapse and every other level of the CNS influences on the signal vary the degree and intensity of the signal. A change in reactivity of the neuron or organ results.
- Due to Neurotransmission, neural activity (+ or -), 1st and 2nd messenger system

- The behavioral event
- "the capacity to regulate and organize the degree, intensity and nature of response to sensory input in a graded and adaptive manner…and achieve and maintain and an optimal range of performance necessary to adapt to challenges in life" (Lane, et. al., 2000).

Sensory Processing

- Encompassing term that refers to the way in which the CNS and the peripheral nervous system manage incoming sensory information.
- Includes the reception, modulation, integration and organization of sensory stimuli AND the the behavioral responses to sensory input.

Sensory Processing and Sensory Integration

- Miller proposes that we use SPD as the overarching term to describe the disorder and Sensory Integration as the theoretical approach
  (Miller, Cermak, Lane, Anzalone, Koomar,2004: SPDnetwork.org)

- "At this time, we believe that Sensory Processing Disorder constitutes a more effective label for facilitating communication between OTs and other professionals, we propose that:
- The *theory* is referred to as "Sensory Integration theory based on the work of Dr. A. Jean Ayres."
- The *diagnostic* label is Sensory Processing Disorder (SPD)".

Sensory Integration

"What's in a name? That which we call a rose by any other word would smell as sweet"

Shakespeare
Romeo and Juliet II.2.43

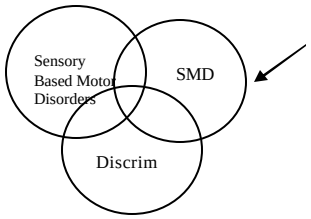
Taxonomy of SPD

SENSORY PROCESSING DISORDER (SPD)

- Sensory Modulation Dysfunction
  - SOR
  - SUR
  - SS
- Sensory Discrimination Dysfunction
- Sensory-Based Motor Dysfunction
  - Postural Disorder
  - Dyspraxia

SOR = Sensory Over-Responsivity
SUR = Sensory Under-Responsivity
SS = Sensory Seeking/Craving

Patterns of Sensory Processing Disorders May Overlap



Focus on Sensory Modulation

Definitions, Research, Implications for Practice

What is Poor Sensory Modulation?

Problem in the capacity to regulate and organize the degree, intensity and nature of response to sensory input in a graded and adaptive manner…(that) disrupts ability to achieve and maintain and an optimal range of performance necessary to adapt to challenges in life" (Miller and Lane, 2000)

Poor SM affect family and child

Child's sensitivities affect families ability to participate in their every day activities

Prevalence

- 5% of non-disabled population (Ahn, K and Miller,L.J 2005).
  (hyper-responsive type is most prevalent)
- 3-30% of population of individuals with developmental disabilities (Baranek, G et al, 1997) .

Current Research to further delineate Sensory Modulation

- Until recently SM has only been studied from a **behavioral** perspective.
- Provided valuable data for categorizing behavioral symptoms into subtypes (hypo-responsive, hyper-responsive, sensory seeker/avoider).
- Does not allow differential diagnosis of SM from other clinical groups that share common symptoms (i.e. ADHD).
- Provides only speculation about neural substrates.

Current Knowledge Regarding Physiological Functioning In SM

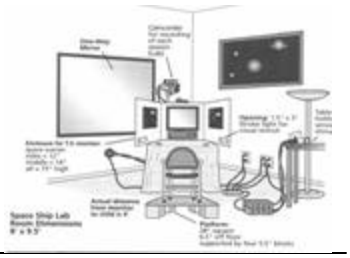
- Sympathetic functions in SM (McIntosh, D. Miller, et al; Reisman, J and Gross).
- Results suggest that children with poor SM show evidence of sympathetic over-reactivity using EDR as the sympathetic measure.
- Provided first physiological evidence that SM has distinct physiological characteristics.

The Sensory Challenge Protocol

- A non-invasive lab protocol: spaceship.
- Evaluates physiologic response to sensory stimuli.
- 50 sensory stimuli, 10 in each of 5 domains (olfactory, visual, auditory, tactile, vestib).

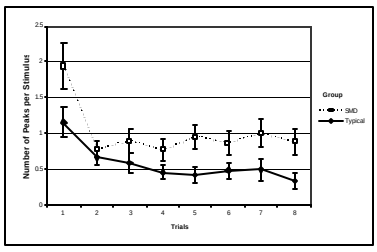
Sensory Challenge Protocol

- Each stimuli lasts 3 seconds; 15-19s apart.
- Randomized sequence of stimuli application.

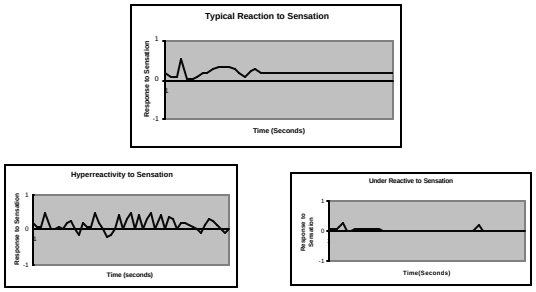


Number of EDR Peaks in SMD and TYP

(LJMiller, 1999)



Sample EDR Reactivity (Miller, et al, 2001)



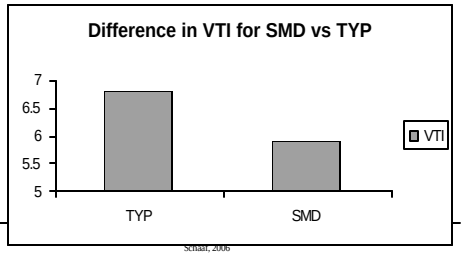
Role of Parasympathetic System

- PsNS modulates self-regulation, arousal level, reactivity and recovery from stressors/challenges.
- May be our primary behavioral regulator.
- Maintains/regains homeostasis.

High Parasympathetic Activity

- characterizes homeostasis;
- reflects a greater range of adaptive responsiveness and behavioral flexibility
- Low PsNS activity is related to risk status (Porges, S. et al)

Do Children with SMD demonstrate lower vagal tone than TYP Subjects?



Currently Five Labs Collecting Data

Denver, CO	Lucy Jane Miller, PhD, OTR
Philadelphia, PA	Roseann Schaaf, PhD, OTR
Boston, MA	Jane Koomar, PhD, OTR; Teresa May-Benson, OTR
Los Angeles, CA	Diane Parham, PhD, OTR
Richmond, VA	Shelly Lane, PhD, OTR (in process)

Future Research Trends

- Mechanisms of SPD (neural and genetic)
- Homogeneous groups ****
- Intervention effectiveness
- Poor Sensory Processing as part of other diagnosis: Autism, OCD, Fragile x, ADHD
- Age trends in sensory processing and physiologic markers
- SPD in DSM V

Ongoing Research

- NIH/ SP research group work
  - **A Rodent Model for Tactile Defensiveness (***Edward Levin Ph.D.)*
  - **Developmental Sensory Disorder: Contributions From A Clinical Perspective (***Edward Goldson, M.D.)*
  - **Differentiation of Sensory Processing Disorder Subtypes Using Non-Invasive Neurophysiology Measures of Sensory Gating (***Michael A. Kisley)*
  - **Sensory Processing Disorder: Possible Pathways to DSM-V** *(Michael B. First, M.D)*
  - **Twin Studies of Tactile and Auditory Defensiveness (***Hill Goldsmith; University of Wisconsin -Madison*
- Other Work:
  - Merzenich, Michael: work on brain plasticity
  - Brett-Green, Schoen & Miller; Schaaf, Miller & Benevides: Psychophysiological markers of sensory reactivity

Support for the SI Approach

- Fairly strong evidence exists to support the idea that participation in meaningful sensory-motor activities enhance brain function.

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Potential Mechanisms of Change in Brain Functions

In Response to Purposeful Activity

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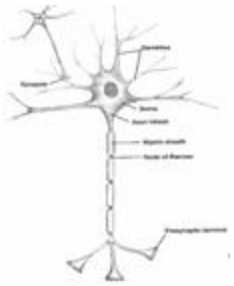
Activity Dependent Learning

- Detailed wiring of the brain is dependent upon specific interactions between organism and environment (Greenough, et al, 1987)
- "Neurons that fire together, wire together"



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Activity Dependent

Changes in synaptic strength and physical properties occur **in response to activity** of neurons

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Proposed Mechanisms of Neuroplasticity

Neurogenesis
Sensitization and habituation

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Neurogenesis

- Regulated by a variety of growth factors
  - Brain Derived Neurotrophic Factor (BDNF)
    - Plays a role in creating new neurons
  - Sonic Hedgehog
    - Shown in animals to regulate the ability of immature neruons to proliferate

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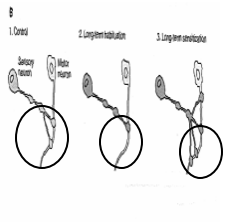
Structural Changes: Habituation and Sensitization

- Long-term habituation leads to a loss of synapses.
- Long term sensitization leads to an increase in synapses.



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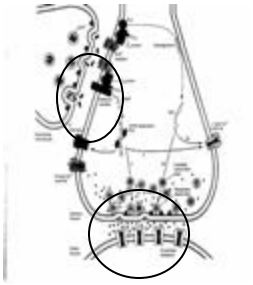
Mechanisms of Activity Dependent Change

- Synaptic strength is enhanced when modulatory interneurons (e.g.: serotonergic neurons) trigger a chain of events resulting in enhanced release of transmitter from pre-synaptic terminal



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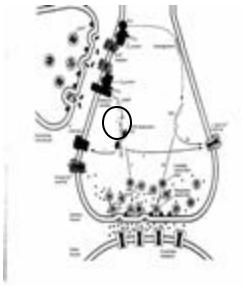
Mechanisms of Change

- Mechanisms include persistent activity of second messenger (e.g.: cAMP) that results in a cascade effect in the cell leading to conformational change in neuron



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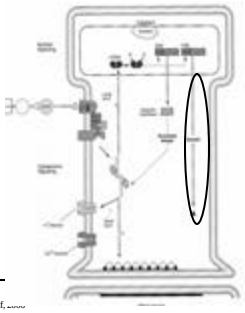
Changes Are Long-Term

- For Example, long term sensitization results in structural changes that activate BDNF and leads to growth of new synaptic connections



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Neurogenisis is Activity Dependent

Changes in synaptic strength and physical properties occur **in response to activity** of neurons

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The Developmental Trajectory is influenced by experience

- "The considerable developmental plasticity in an immature organism is embodied in the capacity of its cells to adapt in very specific ways…to the changing demands. Neurons grow new axons, sprout new dendrites, form new synapses , and modify (existing circuitry)…based on varied experiences
  (Shonkoff, J. and Phillips, D.A. (2000) From Neurons to Neighborhoods)

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Sensory Input as a mediator of Plasticity

- Sensory input has been found to be particularly potent in terms of enhancing brain plasticity

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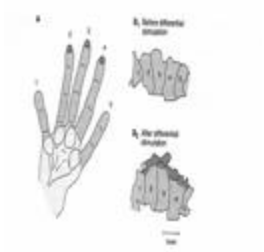
Neural Development is Experience Dependent

- Genetic maps play a significant role in determination of brain and behavior function but..
- Strong evidence exists to support role of environment or "activity dependent" development.



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Nervous System Changes in Response to Meaningful Activity

- Literature suggests a similar mechanism occurs when individuals are engaged in meaningful activity
- Synaptic growth and neuronal expression is enhanced

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Complexity and Novelty are Important Factors

- Novelty of complex stimuli is necessary to promote neurogensis
- Need novelty to stimulate new growth (Renner & Rosenzweig, 1987)

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Enrichment Studies

- Demonstrate that enriched environments result in positive changes in brain and behavior

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Enriched Sensory-Motor Environments

- Enriched environments in rodent studies consist of multiple opportunities for sensory and motor activity (Kolb, B et al, 1998)

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Supporting Studies

- Lenn (1990) found that songbirds have increased size of rhinenchephalon when exposed to multiple songs
- Nobel Prize in science (2004) found that olfaction was a powerful sense in terms of stem cell potential and neuroplasticity

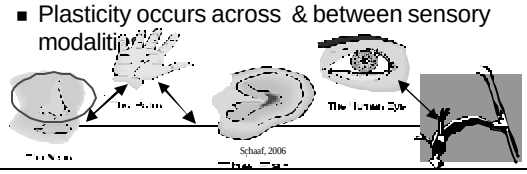
Active Involvement is a Key Factor in Plasticity

- Divided rats into "climbers and non-climbers"
- Climbers had significantly larger brains (Kolb, B & Gibb, 1991)
- Suggests that exposure alone is not sufficient to elicit neuronal (and behavioral) changes; must be active involvement.

S-M activity is especially potent (Kemperman and Gage, 1991 running rats study)

Evidence for Plasticity across Sensory System

- Literature provides support for interaction among sensory modalities
- Current research challenges the previously held view that sensory modalities are separate and independent
- Plasticity occurs across & between sensory modalities



Summary: Occupation/Brain Function/Sensory Integration

- Our daily life activities and choices (occupation)are influenced by our sensory preferences and processing.
- Participation in meaningful activities (occupation), especially those rich in sensory-motor experiences, influence brain activity.
- Occupational Therapy using a sensory integrative approach may impact brain function and occupational choices.

Lunch

Enjoy

Theory Development: State of Theory on Sensory Modulation

- Evolved from a linear model (Royeen and Lane, to a complex multidimensional model that considers the child's processing abilities, emotional and attentional abilities; and the demands of the culture and environment (Miller, et al, 2001)

Behavioral Data

- Linear Model of SM (Royeen & Lane)

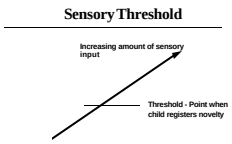
Under-responsive (Dormancy) — Normal — Over-responsivity (Defensiveness)

Dunn's Model of Sensory Processing

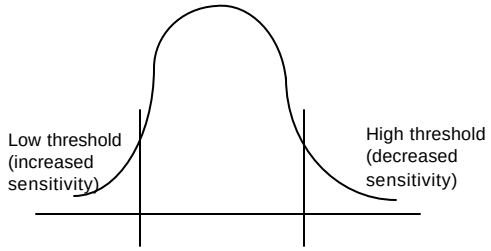
- Considers one's neurological threshold (reactivity) for sensory stimuli
- Considers how the individual responds to sensation and their self-regulation strategies
- Considers the interaction among threshold and responding strategies
  - (Dunn, W. 2001)

Concept of Sensory Threshold

- Point at which individual registers sensory stimuli
- Not a fixed point, but a tendency
- Low thresholds → increased sensitivity
- High thresholds → decreased sensitivity



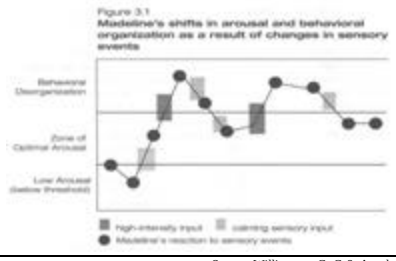
Sensory Threshold Range



Individual's Responding Strategies

- May be either in line with threshold or influenced by coping strategies and/or environmental supports/challenges
  - 1. Child's innate threshold
  - 2. Child's coping and self regulation strategies
  - 3. Social systems to support self regulation and responsivity (i.e.: parent or teacher as modulator)
  - 4. Physical supports/challenges (over/under stimulation)

We Continually Regulate our Arousal & Organization



Source: Williamson, G. G & Anzalone, M 2001

Dunn's Model of SMD

	SENSORY SENSITIVITY	
	Low Threshold	High Threshold
BEHAVIORAL		
RESPONSE	*Increased sensitivity*	*Decreased sensitivity*
Behavioral response in accordance with sensitivity level	**Hyper-responsive** behaviors (i.e.: highly active and reactive)	**Hypo-responsive** behaviors (i.e.: lethargy, passivity) "Low Registration"
Behavioral response to compensate for sensory sensitivity	**Sensory Avoider**	**Sensory Seeker**

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Miller's Patterns of Sensory Modulation Disturbances

- Over-responsive: responses to sensation are greater than those typically demonstrated by others under the same circumstances.
- Under-responsive: responses to sensation are less that those typically demonstrated by others under the same circumstances.
- Sensory Seeking: seeks intense sensory experiences greater than typical

Some children will exhibit more that one type and fluctuate responses to sensation shift.

(responses may differ for each sensory system).

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Sensory Seeker

- Seeks input from environment
- High Activity Level
- May exhibit Self Stimulating behaviors

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Over-responder

- Low threshold with increased sensitivity
- May avoid sensory input (sensory avoider)
- May tune out to avoid input OR
- May be hyper-alert/hyper vigilant to avoid sensory input/overload OR
- May engage in sensory activities in attempt to modulate/organize
- "window" of tolerable input

is small and difficult to stay in

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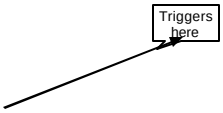
Under-responder



- High Threshold with decreased sensitivity
- May have latency period before registration of input occurs
- Usually have flattened affect
- Low-SLO
- Need high input to get arousal and attention

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What is your Sensory Processing Style???

- Sensory Processing Patterns
- "Are a reflection of who we are: these are not pathology that need fixing" (Dunn, 2001)
- Are not inherently good or bad

- The Adult/ Adolescent SP (Brown & Dunn, 2002: The Psychological Corporation/Therapy Skill Builders)
- Self Questionnaire
- Check the box that BEST describes the frequency with which you perform the following behaviors

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Scoring Scheme

- Almost Never (less than 5% of time)
- Seldom (about 25% of the time)
- Occasionally (about 50% of time)
- Frequently (about 75% of time)
- Almost Always (about 95% of time)

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Taste Smell

1. I leave or move to another section when I smell a strong odor such as perfume, bath products and candles.
2. I add spice to my food
3. I don't smell things that others do
4. I enjoy being close to people who wear perfume or cologne
5. I only eat familiar foods
6. Many foods taste bland to me
7. I don't like strong tastes (mints, sour candy)
8. I go over to smell fresh flower that I see

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Movement Processing

9. I am afraid of heights
10. I enjoy how it feels to move about like dancing or running)
11. I avoid elevators/escalators b/c I dislike movement
12. I trip or bump into things
13. I dislike the movement of riding in a car
14. I choose to engage in physical activities
15. I am unsure of footing when walking on stairs
16. I become dizzy easily

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Visual Processing

17. I like to go places that have bright lights and that are colorful
18. I keep the shades down during the day when I am home
19. I like to wear colorful clothing
20. I become frustrated when trying to find something in a crowded drawer or messy room
21. I miss the street, building, or room signs when trying to go somewhere new

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Visual Processing

22. I am bothered by unsteady or fast moving visual images in TV or movies
23. I don't notice when people come into the room
24. I choose to shop in smaller stores b.c I'm overwhelmed in large stores
25. I become bothered when I see lots of movement around me (mall, parade)
26. I limit distractions when I am working

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Touch Processing

27. I dislike having my back rubbed
28. I like how it feels to get my hair cut
29. I avoid or wear gloves during messy activities
30. I touch others when I am talking
31. I am bothered by the feeling in my mouth when I wake up in the AM
32. I like to go barefoot
33. I'm uncomfortable wearing certain fabrics

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Touch Processing

34. I don't like particular food textures
35. I move away when others get too close to me
36. I don't seem to notice when my face or hands are dirty
37. I get scrapes or bruises but don't remember how
38. I avoid standing in line or close to others
39. I don't seem to notice when someone touches my arm or back

Activity Level

40. I work on 2 or more tasks at the same time
41. It takes me more time than others to wake up
42. I do things on the spur of the moment
43. I find time to get away from my busy life and spend time by myself
44. I seem slower than others when trying to follow and activity or task

Activity Level

45. I don't get jokes as quickly as others
46. I stay away fro crowds
47. I find activities to perform in front of others
48. I find it hard to concentrate for the whole time when sitting in a class or meeting
49. I avoid situations where unexpected things might happen (new situations and people)

Auditory Processing

50. I hum, whistle or make other noises
51. I startle easily at sounds
52. I have trouble following what people are saying when they talk fast or about an unfamiliar topic
53. I leave the room when others are watching TV or ask them to turn it down
54. I am distracted if there is a lot of noise around

Auditory Processing

55. I don't notice when my name is called
56. I use strategies to drown out sounds (close the door, ear plugs)
57. I stay away from noisy settings
58. I like to attend events with a lot of music
59. I have to ask people to repeat things
60. I find it difficult to work with background noise

Scoring the ASP

What are your unique SP styles?
How are these observed/What behaviors do you use that relate to these
What coping mechanisms or adaptations do you use?

How does SP affect daily routines?

- Bathing
- Dressing
- Mealtime
- Playing
- Waking
- Outings

- What adaptations can be made to social and physical environment to facilitate SP during these activities?

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Back to the Research

Recap – discussing terminology, typology, current research

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Studies with Children with Autism

Miller, LJ, Brett-Green, B., & Shoen, S
(Colorado Lab)
Schaaf, RC & Benevides, T
Philadelphia Lab)

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Sensory Processing Problems in Children with ASD

Faces of Autism: PA Training and Technical Assistance Network

PA Dept of Education

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Children with Autism Fall into 3 Subgroups Based on Physiologic Reactivity

- Highly Reactive
- Low Reactivity
- Average Reactivity

(Miller, Schoen & Brett-Green –CAN Foundation 2005)

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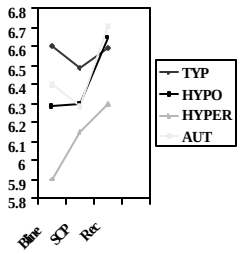
Children with Autism (Schaaf, 2002)



- 2 subjects with Autism
- PsNS similar to Hypo group (lower than TYP).
- Miller, et al found Hypo reactive SNS with behavioral hyper
- ANS may not be functioning to regulate responses to stimuli in AUT

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Poor Adaptive Behavior

- Children with Autism demonstrate poor adaptive behavior (measured by Vineland Adaptive Behavior Scales) AND lower vagal tone
- Suggests adaptive behavior is related to regulation
- (Miller, et al, in preparation; Benevides, T. & Schaaf, R.C., 2004)

Relation of Physiologic and Functional Variables in Autistic Spectrum Disorder: Vagal tone related to adaptive behavior most robust finding

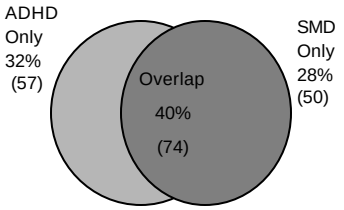
Correlations Between Vagal Tone Index and the Vineland Adaptive Behavior Scale

	BaselineVTI	ToneVTI	VisVTI	AuditVTI	OlfacVTI	TctlVTI	MvtVTI	RecoveryVTI
BaselineVTI	----							
toneVTI	.933*							
visVTI	.957*	.935*						
auditVTI	.939*	.921*	.936*					
OlfacVTI	.927*	.902*	.912*	.905*				
TctlVTI	.916*	.906*	.900*	.896*	.922*			
MvtVTI	.837*	.846*	.934*	.868*	.844*	.877*		
RecoveryVTI	.947*	.941*	.927*	.948*	.919*	.913*	.881*	
vincs3	.523*	.612*	.528*	.517*	.543*	.627*	.600*	.622*
vindss3	.374*	.399*	.290	.404*	.400*	.435*	.407*	.421*
vinsss3	.635*	.718*	.598*	.626*	.617*	.721*	.625*	.690*
vinabc3	.599*	.661*	.543*	.599*	.610*	.705*	.633*	.662*

Divergent Evidence of the Disorder: Differentiation From Other Conditions

- Typically Developing
- ADHD
- Generalized Anxiety Disorder
- Learning Disabilities
- Autistic Spectrum Disorder
- Other Psychiatric Diagnoses

Relation of SMD and ADHD in a National Sample (Miller, L.J., et al spdnetwork.org)



Is This an Effective Intervention Approach?

- Miller Outcome study (Lucy Jane Miller, 00-03)
  - First randomized clinical trial of effectiveness of occupational therapy using a sensory integrative approach.
  - Found greatest gains in individual goals
  - Uses STEP-SI Model (Miller & Summers, 2000 in Smith Roley, S., Blanche, E & Schaaf, R.C. 2001)
    - Each step represents a question that the therapist asks before, during and after each activity.
    - Helps clinician assess intervention and adjust to child's needs.
    - AJOT – Spring 2006

Effects of sensory integration intervention on self-stimulating and self-injurious behaviors. Smith SA, Press B, Koenig KP, Kinnealey M

- **Compared effects of OT/SI to table top control in reducing self stim and injurious behaviors in children with autism.**
- **OT/SI significantly reduced self-stimulating behaviors by 11% one hour after SI intervention**

SI and Self Injurious Behaviors

- Single subject design
- Documents the efficacy of multiple short treatment sessions spread throughout the day
- Shows decrease in self injurious behaviors
- Reisman, J (1992)

Clearly define Occupational Therapy using a Sensory Integrative Approach

- Fidelity to Treatment Study (Parham, D., Cohn, E., Spitzer, S., Burke, Koomar, May-Benson, Miller, Mailloux, Schaaf, Smith-Roley, Summers)
- Attempt to describe essential characteristics of OT using a SI approach
- First step in the development of an intervention protocol needed to outcome/effectiveness study

Fidelity to OT/SI Intervention

- Provides guidelines for Environment, Clinician Training, Assessment and Intervention.
- Series of items that, if rated highly, indicate that the intervention is OT/SI.
- Will be useful for future effectiveness studies

Fidelity Measure Helps Guide Intervention

- More on Fidelity Measure
- Environment
- Training of Therapist
- Use in clinic, home and schools

Developing Meaningful, Measurable Outcome Goals

- Important component of assessment and intervention

Goals are occupation oriented

- Link impairment to participation
- EG: Decrease oral sensitivity and increase food repertoire as a basis for participation in mealtime with family
- Include underlying basis AND behavior (Mailloux, Z, in Schaaf, R.S., and Smith Roley, S)

Goal Setting

- Goals and objectives are defined by the therapist, family, teacher or significant others;
- Goals are related to funding agencies priorities;
- As a result of the evaluation, the therapist defines areas to be addressed that will improve desired participation in multiple contexts for child and family

Goal Writing (Mailloux, in press)

- Guides intervention and ensures that it has been successful
- Opportunity to collaborate with family and other team members
- Reflection on intermediary steps needed to accomplish goal

The Sensory Basis

- The sensory basis of the problem may not be stated in the goal, but it should be inherent in the possible underlying problem

Presenting Problems have underlying issues

- It is important to make the link between the desired outcome and the **underlying problems** that require remediation in order to achieve the desired functional outcome
- The sensory integrative approach offers a unique perspective that may uncover a hidden explanation for child's difficulties

Example

Presenting Problem	**Underlying Problem**	**Desired Functional Outcome**
Unable to participate in mealtime with family	Hypersensitivity to textures in mouth	Ability to tolerate a variety of food textures for enhanced participation in mealtime

Example

Presenting Problem	**Underlying Problem**	**Desired Functional Outcome**
Not playing with any toys	Poor praxis due to lack of adequate body awareness	Ability to plan and carry out a 2 step play activity

Charting Progress: Goal Attainment Scaling

- Goal Attainment Scaling as a way to measure change/outcomes
  - After assessment develop goals and objectives for intervention in collaboration with parents
  - Identify functional needs and level of importance
  - Write 3-4 primary/most important goals
  - Scale performance on each goal on a 0-4 scale

Goal Attainment Scaling

- Sample GAS

Level	Potential Level of Performance
-1	Regression
0	Current Level of Performance
1	Projected Performance midway through measurement period
2	Projected Performance Expected by End
3	Performance beyond expectation

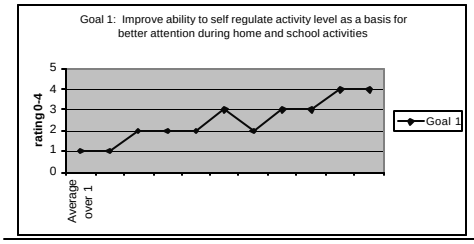
Goal: Regulate arousal and attention as a basis for attention to classroom activities

-1	0	1	2	3
Has a low arousal level and is unable to bring arousal level up to normal levels to support attention even with sensory supports	Maintains appropriate arousal level during sensory activities but has low arousal during school and sedentary activities	Will recognize arousal level (Alert Program) and use 1 strategy to improve arousal level and attention to classroom tasks	Using "Alert" language will recognize arousal level and improve attention 50% of time	Will recognize and regulate arousal level appropriate for situation, with verbal cuing

Advantages

- Quick, easy, quantitative charting
- Allows for qualitative comments
- Visual display shows progress, plateau or regression
- Keeps therapist focused on underlying issues AND occupational performance

Example of GAS Charting



Example of Excel Spreadsheet to Chart

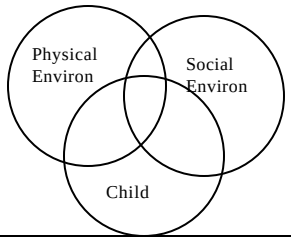
Charting → line graph

0	0	1	0	1	2	2	1	2	3	2	2
week											

Audience Participation: Make a goal and Goal Attainment Scale for one child

- What is the goal (function oriented)
- What is the sensory basis of the behavior?
- Where is the child's current performance level?
- Where do you expect the child to be in three months?
- What will intervention that addresses this goal look like?

Intervention Model



Environmental Adaptations are First Line of Intervention

- Goodness of Fit: Match between the child and environment
- Good Fit = competent behavior
- EG: If child gets over-stimulated in cafeteria (and therefore can't eat), how can you adapt environment to facilitate success?

Intervention For Child

- Used after adaptations to the environment are made
- May consist of individualized sensory activities that meet child's needs
  - Therapist should monitor and change on an as needed basis (more on this later)
- Direct intervention is useful in more severe cases

Individually Tailored Sensory Based Activities

- Therapeutic use of sensation in the context of activities embedded within the daily routine.
  Activities *Daily routine*
- Carefully constructed activity plan designed to meet the individuals needs. Varies according to goals, preferences, resources and limitations
- Strategy for developing **individualized** programs that are practical, carefully scheduled and based on the concept that controlled, regular sensory input can affect functional abilities/participation in activities.

Supported by Neuroscience Literature

Sensory input affects output (motor, memory, learning)

Repeated stimulation results in lasting changes in brain activity

Mismatch between individual's needs and opportunities for experience can have long lasting affects (enrichment/deprivation environment literature)

Sensory input can affect level of arousal/attention

Choosing Sensory Based Activities

- From Sensory Integration: Applying Clinical Reasoning to Diverse Populations (Schaaf, RC & Smith Roley, S, 2006)
- Audience Participation – choose a sensory based activity to improve this child's behavior
- Choose one activity for home, one for school and one for direct intervention – explain rationale

Courtney

- *Courtney is a 6-year-old child diagnosed with autistic disorder who attends a public school in a semi inclusive classroom for children with special needs. Today, like most other days, Courtney is having difficulty following the class routine. The teacher already reprimanded Courtney several times this morning for "fidgeting" in her seat during circle time, disrupting the other children by making silly noises with her mouth and constantly getting up to wander about the room.*

Doesn't Participate in Snack

- *During snack time, at 10 AM, Courtney had an outburst and refused to eat the graham crackers and milk provided by the school. The ticklish sensation of the milk on her lips was bothersome and the graham crackers were "too rough" for her liking. Instead of participating in snack time, Courtney sat by herself.*

Recess

- *During morning recess at 11AM, Courtney kept to herself and was afraid to play on the slide with the other children. Finally, she ran to the swings, using them to spin in circles so vigorously that she became nauseous.*

Lunch

- *At 11:30 AM, when the lunch bell rang, Courtney placed her hands over her ears and ran into the closet, bothered by the noise. A classmate tried to comfort her, but Courtney shoved her away and hurt the child.*

Cafeteria

- *In the cafeteria, Courtney became increasingly agitated. She sat alone with her hands over her ears until she felt able to negotiate the lunch line. After the crowd subsided, with the help of the classroom aide, Courtney managed to select a few items from the menu and place them on her tray.*

The Culmination

- *On the way back to her seat Courtney tripped over a backpack lying in the isle and spilled her tray. The other children began to laugh. Courtney ran from the cafeteria with her hands covering her ears. The teacher found her in the gym wedged under several gym mats that she had piled on top of herself. Her hands were over her ears and she was rocking.*

Functional Difficulties

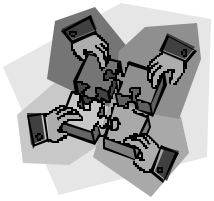
- Difficulty participating in circle
- Bothering other children with "noises and fidgeting"
- Wandering
- Unable to participate in snack
- Unable to play with others on playground

Functional Difficulties

- Unable to stay focused in classroom
- Unable to participate in lunch in cafeteria
  - Due to noise, other children and motor strategies needed
- Poor coping strategies

Putting It all Together

- Sensory Processing may be one component affecting behavior and learning
- Assess SP – keep a focus on function
- Observe behaviors from a sensory perspective
- Create goals that are occupation oriented
- Evaluate and chart outcomes
- Use evidence to support intervention



Our Challenges

- More Research
  - Explore whether unusual sensory responsiveness is a significant factor that limits participation
  - Studies of effectiveness of occupational therapy using a sensory integrative approach (at all levels)
  - Mechanisms of sensory processing
  - FUNDING for research

Your Challenges

- Obtain accurate information
  - www.SPDnetwork.org
- Collaborate with researchers
- Support research
- Keep intervention contextualized within the profession (e.g.: Occupational Therapy using a sensory integrative approach)