





**2023 STAR**  
Sensory Symposium

# Optimal Engagement Band Model


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# Optimal Engagement Band Model of Sensory Processing



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## Objectives

- To understand the importance of engagement for young children's development
- To describe the Optimal Engagement Band Model of sensory processing
- To explain the utility of this framework for OT assessment and intervention

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## Background: Engagement and Development

- *Physical engagement* is the active sensory-motor exploration of the physical environment and objects.
- *Dyadic engagement* is an observable pattern of mutual focus, active participation, and reciprocity within a socially interactive context. (Parents and Infants Engaged Handbook, 2021)
  - Parent-child dyadic engagement is foundational for the child's communication, cognitive, emotional, and play development (Field, 1994; Robinson et al., 2021; Tamis-LeMonda et al., 2004)
- *Triadic engagement* (joint attention) involves two or more people (e.g., child+caregiver) sharing attention around an object or event.
  - Joint attention is especially critical for development of intentional communication and social-cognition (Brandone et al., 2020; Gabouer & Bortfeld, 2021), and is an early marker for elevated likelihood for autism (Montagut-Asuncion et al., 2022).
- Infants' daily experiences and routines are inherently *parent-mediated*, shaping engagement and development (Neel et al., 2019; Stack et al., 2010).

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## Background: Sensory Processing and Engagement

- Sensory processing supports engagement, which in turn is pivotal for development across domains.
- Sensory features affect engagement in daily routines and interactions (Hilton et al., 2023; Little et al., 2015; Kirby et al., 2019; Mammen et al., 2016)
- Sensory hyporesponsiveness and seeking are associated with more severe social-communication difficulties and lower adaptive behavior in children with autism (Ausderau et al., 2016; Watson et al., 2011)
  - Parents' degree of responsiveness to infants mitigates the negative impact of sensory hyporesponsiveness on later social communication (Grzadzinski et al., 2021)
- Sensory hyperresponsiveness is associated with internalizing behaviors, anxiety, and certain types of restricted/repetitive behaviors (Boyd et al., 2010; Feldman et al., 2020).

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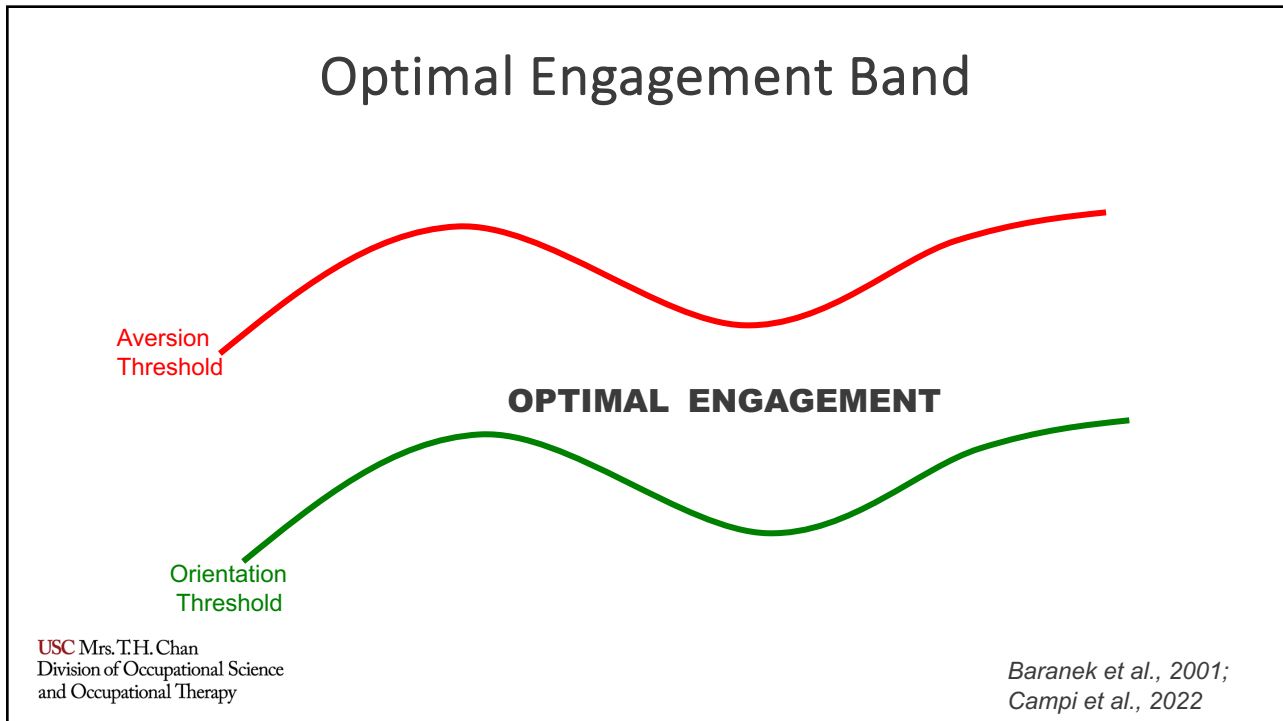
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## Background: Contributions of the Optimal Engagement Band Model (Dynamic Model of Sensory Processing)

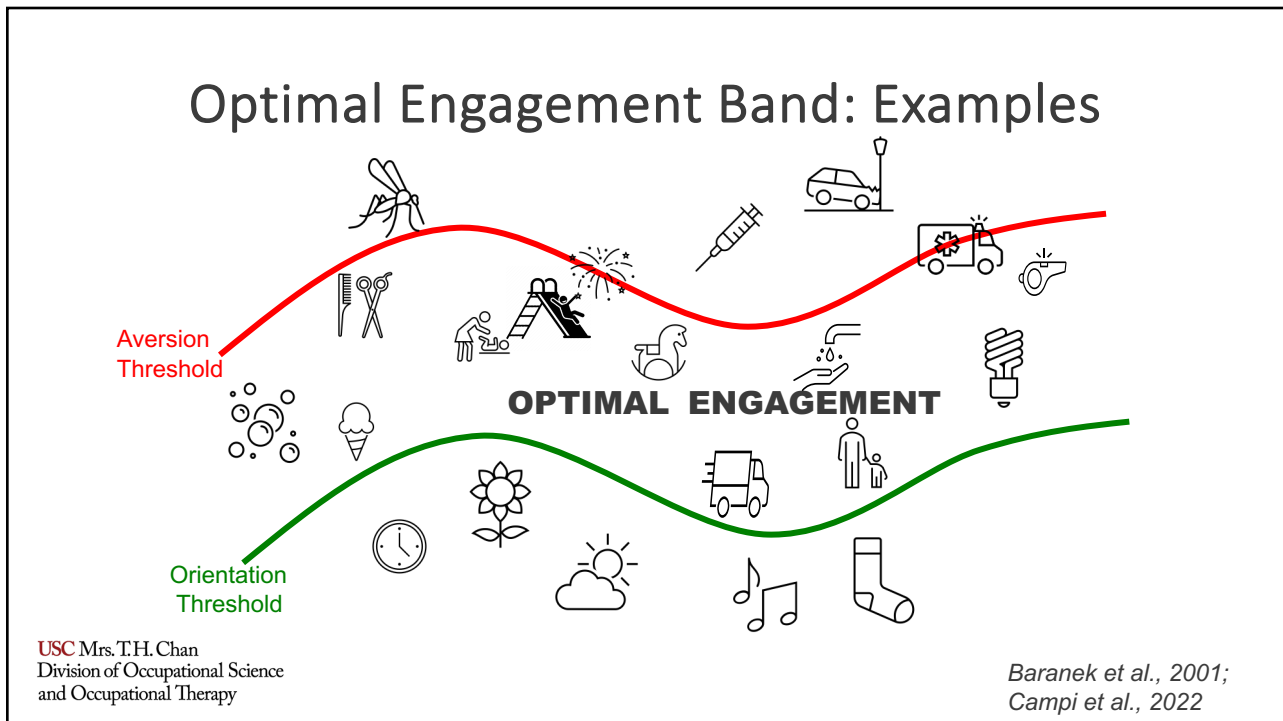
- Originally conceptualized to explain how sensory processing supports engagement in play for infants, toddlers, and preschoolers with elevated likelihood for or with a diagnosis of autism (Baranek et al., 2001; Campi et al., 2022).
  - Based on early work of Tiffany Field (1982) demonstrating that pre-term (high-risk) infants (as compared to full-term) had narrower bands of engagement, and used gaze to modulate arousal and affect when overstimulated (Field, 1982).
  - Children with autism may show high levels of both hypo- and hyper-responsiveness that may narrow their ability to stay engaged (Campi et al., 2022).
    - It may be harder to initially orient or "tune-in" to stimuli because they are not registered/salient, and yet they may "tune-out" sooner because stimuli are not tolerated (don't habituate) and stimuli quickly become aversive.
    - Hyper-responsiveness moderates the effects of hypo-responsiveness on caregiver's abilities to be responsive to their infants (Campi et al., 2022).
    - Sensory seeking behaviors may then be used as strategies to modulate arousal and expand engagement.
- This model demonstrates the relationship between sensory processing and the child's ability to engage with the social and physical environment (Baranek et al., 2001; Campi et al., 2022).

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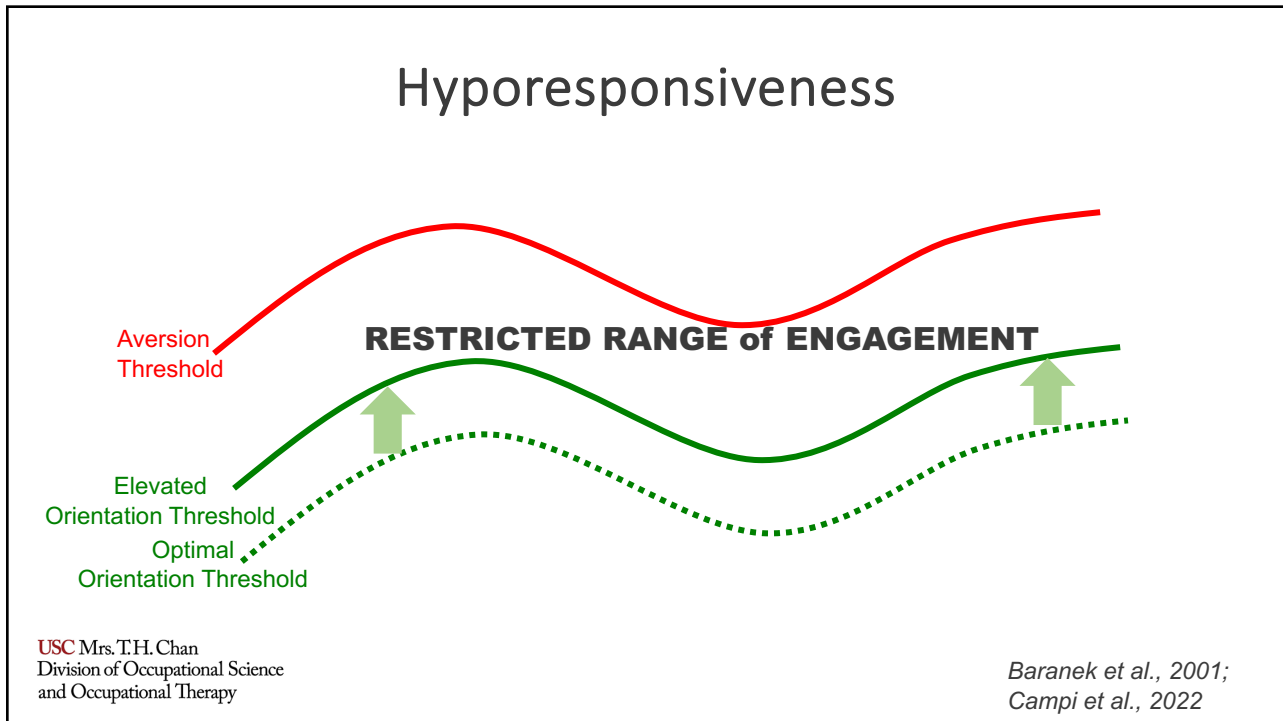
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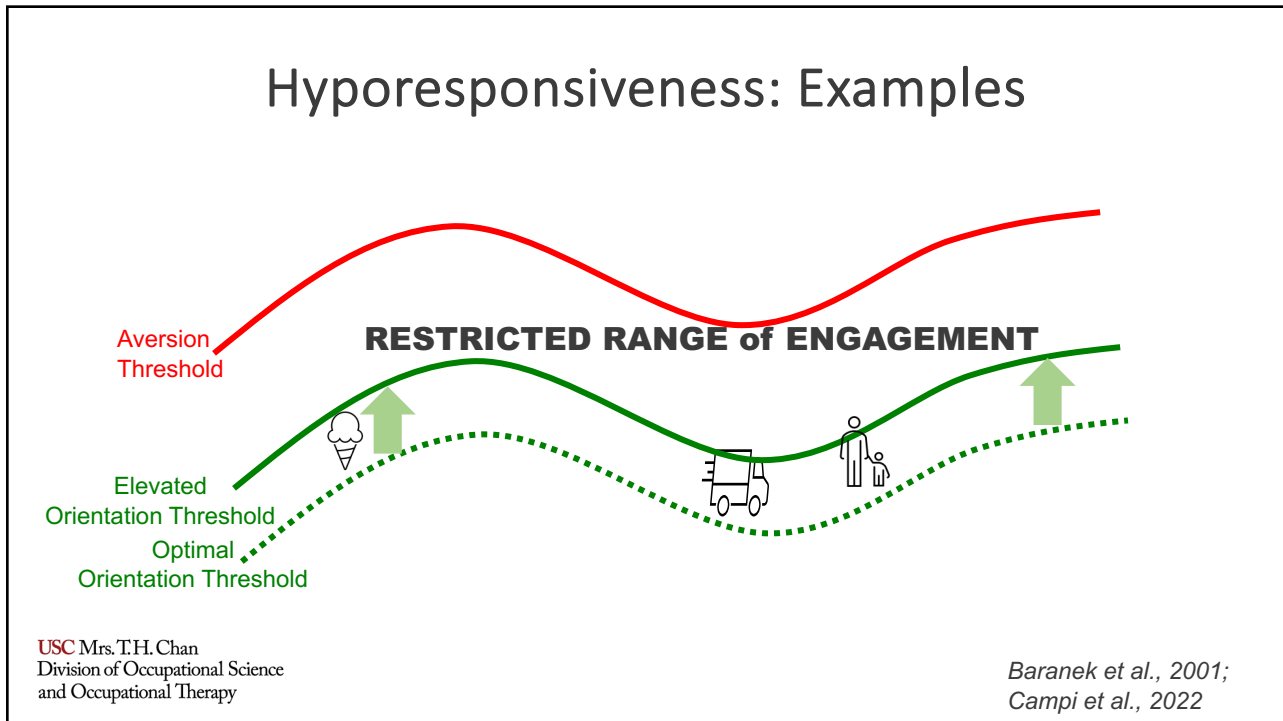
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## Hyporesponsiveness: Video Example

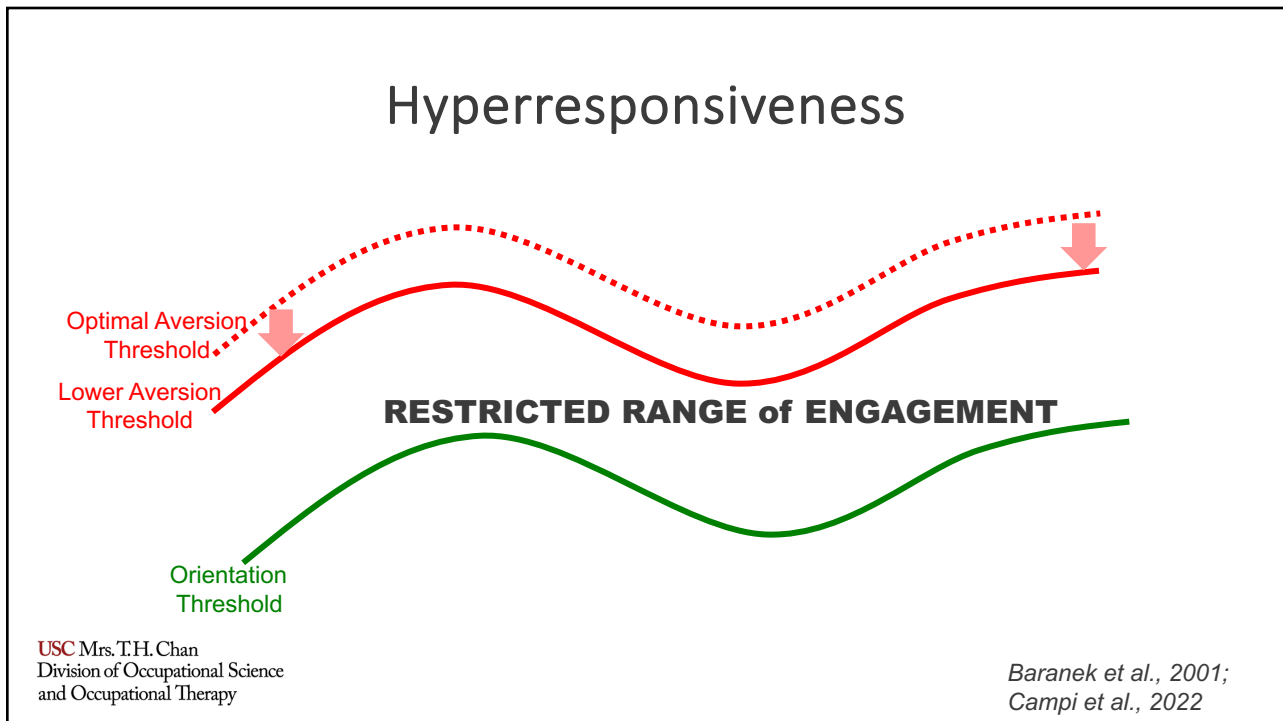
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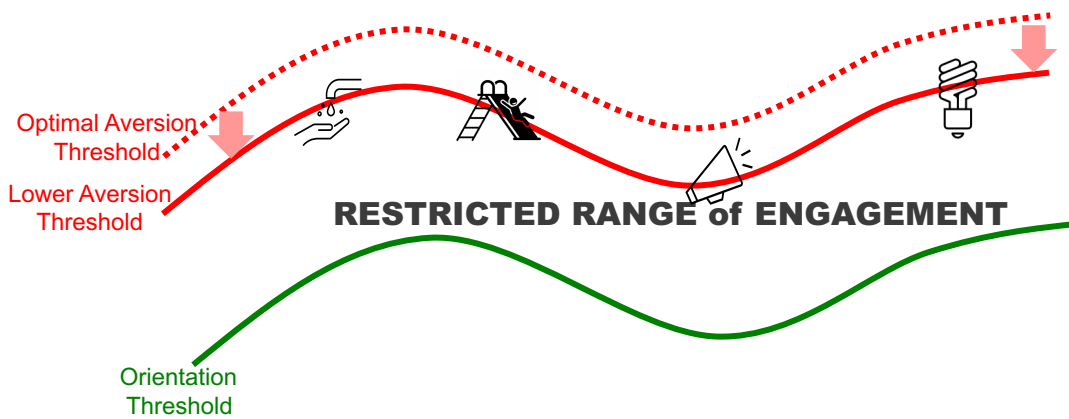
## Hyperresponsiveness: Video Example



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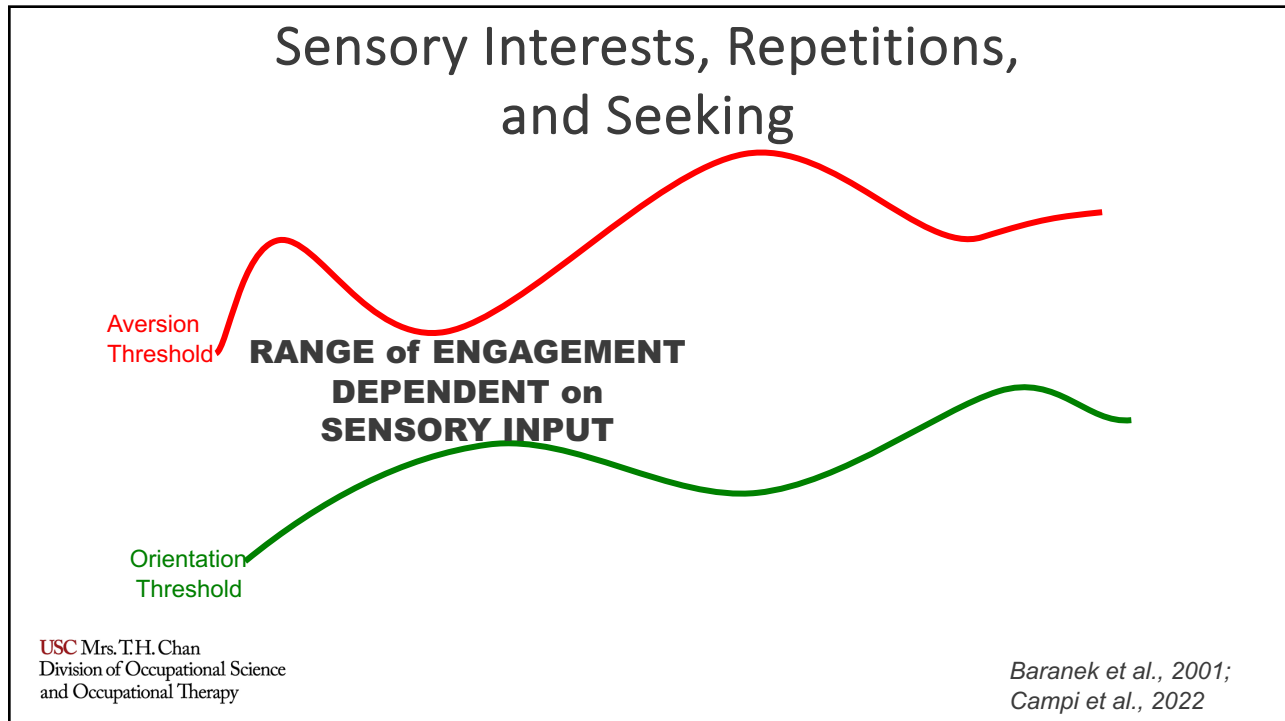
## Hyperresponsiveness: Examples



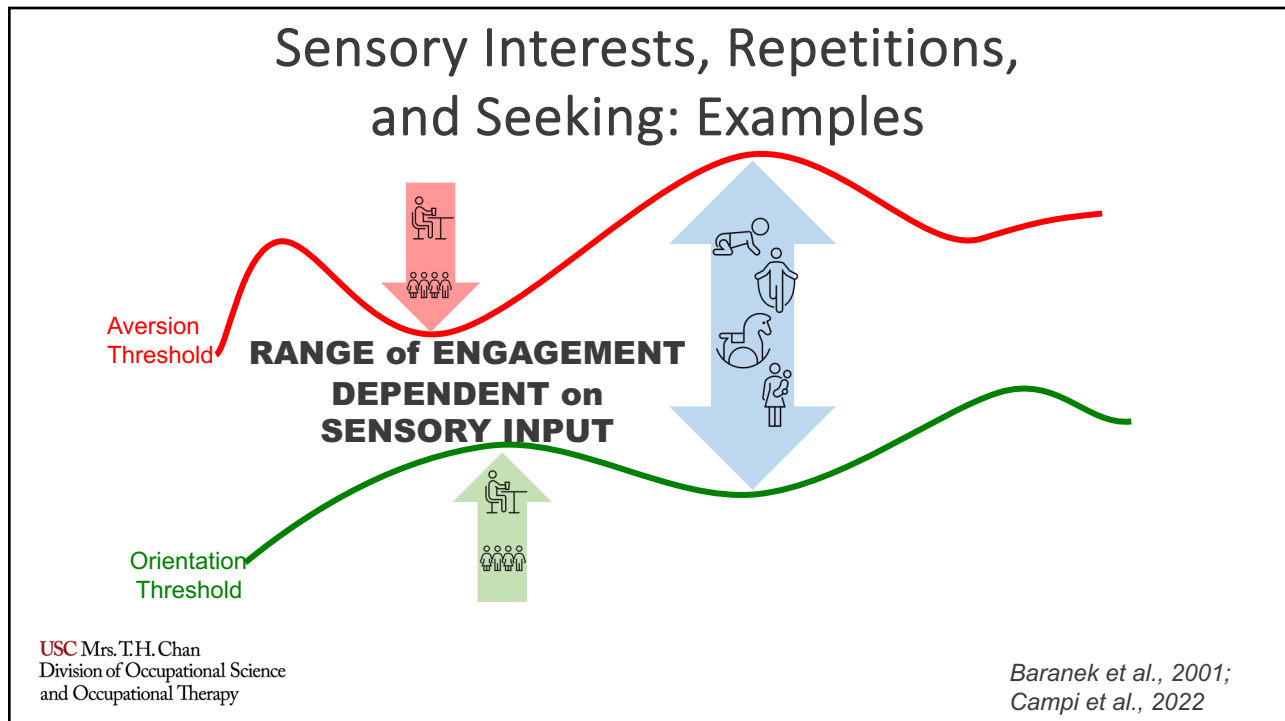
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*Baranek et al., 2001;  
Campi et al., 2022*

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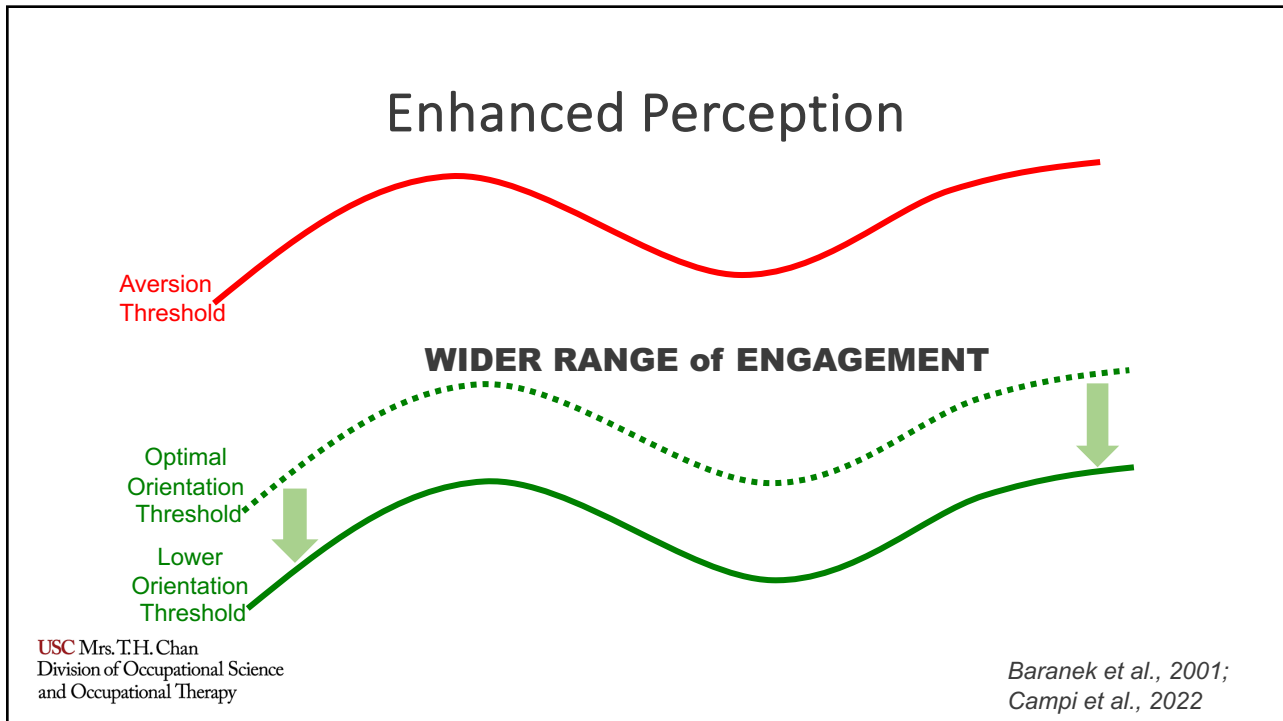


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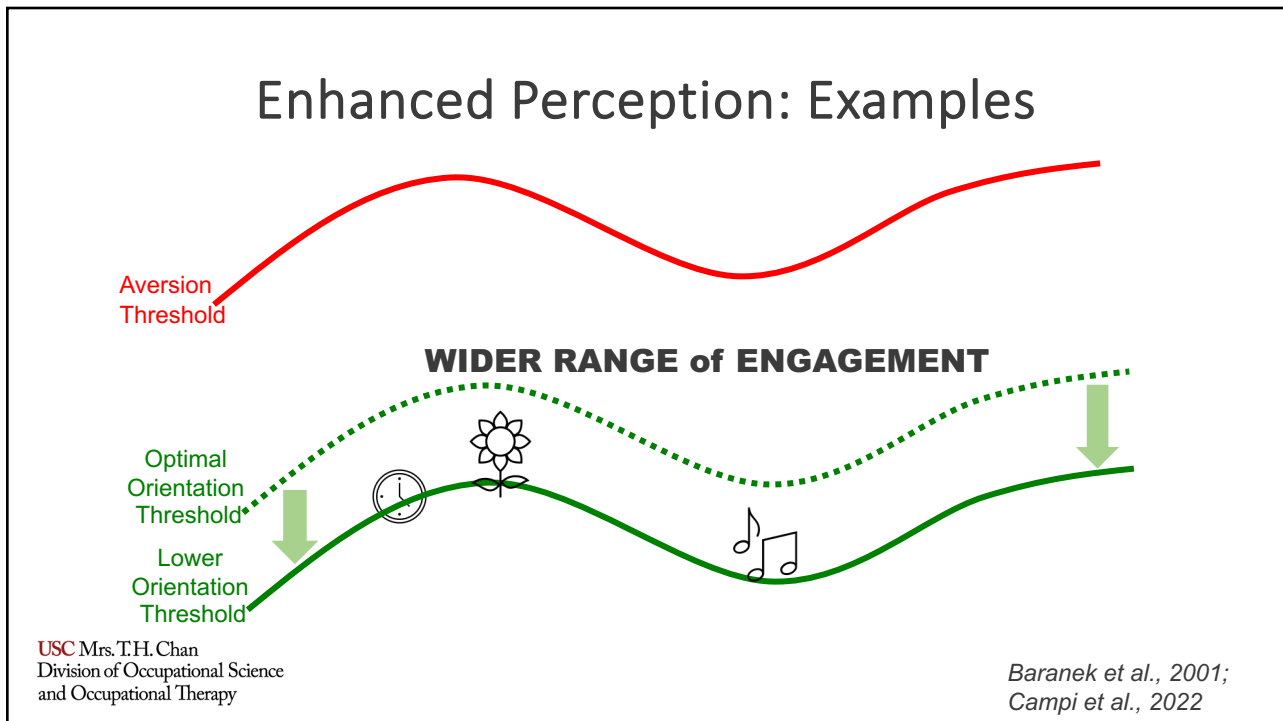


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## Utility of the Model for Assessing Sensory Processing: Sensory Experiences Questionnaire (SEQ)

- Sensory Experiences Questionnaire (parent report) (Baranek et al., 1999; 2009)
  - Version 2.1 for 6-month-olds through preschool (43 items)
    - Three sensory response patterns (HYPO, HYPER, SIRS)
    - Two contexts (social/nonsocial)
    - Five modality categories
  - Version 3.0 for 2-12 year-olds (105 items)
    - Four sensory response patterns (HYPO, HYPER, SIRS, EP)
    - Two contexts (social/nonsocial)
    - Six modality categories

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## Utility of the Model for Assessing Sensory Processing:

### Sensory Experiences Questionnaire (SEQ), cont.

- Validated for use with children with autism, other neurodevelopmental conditions, and typical development (Ausderau et al., 2014; Baranek et al., 2008; Baranek et al., 2006; Lee et al., 2022; Walz & Baranek, 2006)
- Subtyping to capture the heterogeneity of sensory features in people with autism (Ausderau et al., 2016)
  - Predictive of adaptive behavior, maladaptive behavior, and parenting stress
- Administration
  - Takes 15-20 minutes for respondents to complete questionnaire
  - Includes information about respondent's attempts to change behavior

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## Utility of the Model for Assessing Sensory Processing: Sensory Processing Assessment (SPA)

- Sensory Processing Assessment (semi-structured observation) (Baranek, 1999)
  - 6 months-9 years
    - Three sensory response patterns (HYPO, HYPER, SIRS)
    - Orientation, approach/avoidance, defensiveness, habituation, stereotypies/sensory seeking
- Reliability and validity
  - Inter-rater reliability .91-.99
  - Discriminates between children with autism, developmental delay, and typical development (Baranek et al., 2013; Baranek et al., 2007)
- Administration
  - 15-20 minutes of semi-structured play
  - Presentation of novel toys
  - Administration of unexpected sensory stimuli across visual, auditory, and tactile modalities and social and non-social contexts

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## Utility of the Model for Early Intervention

- Parents and Infants Engaged Study (Watson/Baranek MPIs; NICHD Grant #R21 HD091547)
  - Targeting infants at-elevated likelihood of autism and other neurodevelopmental conditions, identified with First Years Inventory (Baranek et al., 2023)
  - Uses a parent coaching model (Rush & Shelden, 2011) to support parents' recognition of their infants' sensory reactivity and social communication cues in everyday routines
  - Equips parents with understanding of the role of their child's sensory features in the context of the family's priorities
  - Emphasizes the importance of dyadic engagement as the outcome of effective parental responses to child cues

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## Key Takeaways

- Sensory processing supports engagement, which is pivotal to development across domains.
- Children with or at-elevated likelihood for autism show narrower engagement in physical, dyadic and triadic interactions.
- The Optimal Engagement Band Model helps to visualize sensory features in terms of orienting and aversion thresholds, which may fluctuate over any given period of time.
- The SEQ and SPA assessments have research and clinical utility for assessing with sensory features within this framework.
- The interplay between sensory features and dyadic engagement as represented in the optimal engagement band model supports parent-mediated intervention for young children.

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# Praxis and Posture – Integration Through Movement

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STAR SENSORY SYMPOSIUM  
October 5-7, 2023  
Polaris Finding true North



**Dyspraxia and Posture:  
Integration Through  
Movement**

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Professor of Pediatrics, USC Keck School of Medicine

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## Disclosures

- None

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## Objectives

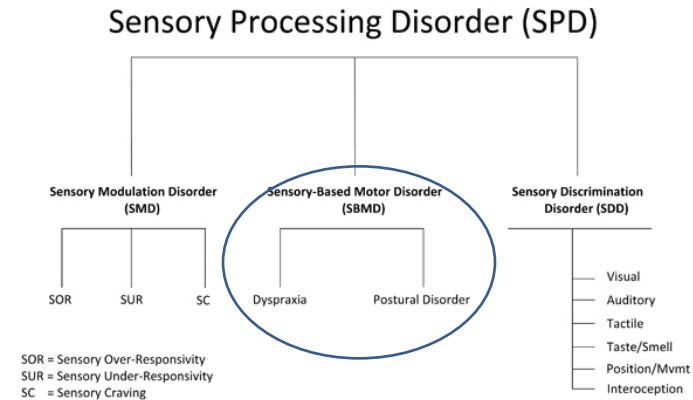
- Describe why early identification is important
- Become familiar with the developmental cascade framework and its application in ASD
- Describe ways in which early motor differences have been identified in ASD
- Identify early motor differences and their impact on development and diagnosis in ASD
- Discuss integration of praxis and posture through movement and its relation to Ayres sensory integration and the adaptive response

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## Sensory processing disorder nosology



© 2012

Miller LI et al., 2012

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## Why is early identification of ASD and DCD/dyspraxia important? Why is praxis and posture relevant?

- Motor delays may be the first sign of a developmental disorder
- Earlier identification of motor delays allows for timely referral for diagnostic evaluations and developmental interventions
- Reduce social, psychological and behavioral sequela that accompany poor praxis
  - Strong evidence that children with “mild” motor problems go on to experience serious (secondary) social and emotional problems

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## Cascading effects hypothesis

- Developmental cascades perspective: In a complex developing system, even small changes in one domain can have far-reaching effects on development in other domains.
  - Use ASD literature to provide examples
  - Relationship of early motor symptoms in ASD to later function (cascading effects)
  - Bradshaw et al. 2022; Iverson, 2018; Iverson, 2022

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## Developmental cascades framework applied to ASD

- Early identification is challenging
  - There are not sensitive and specific biological or behavioral markers prior to 12 months
  - May be due in part to our conceptualization of ASD which has been considered a social-cognitive disorder with the major problems being challenges in social communication.
  - These areas may emerge later in development.

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## ASD Sensory, Motor

- Although social-communication features are considered core features of ASD, parents, teachers, therapists and individuals with ASD have consistently reported early disturbances in sensation and movement.
- This was a key feature of Ayres work.

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## Early identification of ASD

- ASD typically not dx at very young age.
- Two approaches to identifying early motor features
  - 1) Compare siblings of children with ASD (who are considered high-risk for ASD) to siblings of neurotypical children (considered low risk)
  - 2) Look at high risk siblings and then continue to follow to see who develops ASD and who does not and compare to control group of low-risk infants (longitudinal)

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## Early motor delays/differences as diagnostic clues in ASD (Harris, 2017)

- Look for converging evidence using different approaches
  - Standardized test
  - Parent report
  - Retrospective data (home video)

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## Early motor delays as diagnostic clues in ASD: Standardized Tests (Harris, 2017):

- Two prospective cohort studies examined motor development in infant siblings of children with ASD. Both studies used Alberta Infant Motor Scale (AIMS), a standardized test of gross motor development.
- Bhat and colleagues (AIMS at 3 mo, 6 mo, to 24 high risk and 24 low risk sibs)- greater delay in high risk
- LeBarton & Iverson- AIMS admin at to 37 sibs of ASD. Higher percentage w motor delay.



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## Early Motor Differences in ASD: Infant Sibs

- High-risk infants (infant sibs)
  - Delays in motor development have been a consistent finding (Rogers, 2009)
    - Atypical Sensory and motor behaviors appear earlier than social and communication
- Early motor delays as diagnostic criteria (even earlier than social)

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## Longitudinal studies: Le Barton & Landa, 2019

- Motor skill at 6 months predicted ASD status at 24-36 months
- Motor skill at 6 months predicted expressive language at 30 and 36 months

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## Systematic Review: Lim et al., 2021 Early motor signs in later NDD

n=25 studies

Children with NDD assessed 0-24 mo.; later follow-up for ASD or other NDD with standardized diagnostic test.

Conclusions (21 of 25 studies)

Early motor impairments are evident in children later diagnosed with ASD and other NDD (ADHD, DCD, FASD)

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## Early motor delays as diagnostic clues in ASD- Parent report

- Prospective study- at risk infants (older sibling w ASD)- parents interviewed quarterly 6 to 24 mo; at age 3, dx evaluation.
- Parental motor development concerns at 6 months were significant predictors of ASD diagnosis, but concerns about social communication and repetitive motor behaviors were not predictive of ASD until after 12 months of age
- Atypical sensory and motor behaviors appear earlier than social and communication

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## Early motor differences as diagnostic clues in ASD- Early Home Videos

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## Early Motor Indicators in ASD

### Motor

- Delays in motor milestones (gross and fine motor), reduced motor activity (Bhat, Landa & Galloway 2011)
- Head lag (Flanagan et al., 2012)
- Hypotonia (Adrien, 1993)
- Asymmetry when lying and crawling, asymmetry in posture (Teitelbaum et al., 1998; Esposito, 2009)
- Poor transitional movements (Teitelbaum et al., 1998)
- Decreased stability in sitting (Teitelbaum et al., 1998)
- Decreased anticipatory responses (Gallese, 2006)
  - postural accommodations (Teitelbaum et al., 1998; Bhat, Landa & Galloway, 2011)
  - open mouth for spoon feeding



*Early motor signs may be diagnostic clue for ASD as motor and sensory behaviors appear earlier than social and communication (Harris, 2017)*

Image Source: [https://commons.wikimedia.org/wiki/File:From\\_Babies\\_with\\_Love\\_product\\_image.jpg](https://commons.wikimedia.org/wiki/File:From_Babies_with_Love_product_image.jpg)

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## Intervention: Movement as an Integrator

- Ayres: The Adaptive Response- central to intervention for dyspraxia
- Ayres- the adaptive response as an integrator of sensations and motor

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## Praxis is more than motor

- Motor behavior is not separable from cognitive, communicative, and sensory behavior



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## Sensorimotor interactions with the Environment

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## Learning about the world

- We learn about the world through our interactions in the world
- Piaget:  
During this earliest sensorimotor stage of cognitive development, infants and toddlers acquire knowledge through **sensory experiences and manipulating objects.**

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## Motor and Sensory

- Reciprocal inter-relationship between sensory and motor
- Movement is also a form of sensory input that flows as kinesthetic reafferent information (Torres & Donnellan, 2015)
- Hand manipulation in stereognosis
  - Need good sensory discrimination contributes to praxis ..... But also
  - Need good manipulation abilities (motor) to gather sensory information

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## Postural control

- Postural control in infancy has been associated with self-exploratory behaviors (Rocha & Tudella, 2008), reaching (Thelen & Spencer, 1998), spontaneous motility, symmetry, and hand function (Samsom & de Groot, 2000).
- Abnormality in postural control in early infancy “disrupts the development of adequate motor behavior and sensorimotor interaction, which can result in a faulty perception–action cycle, thus influencing social and later cognitive development” (de Groot, 2000, p. 65).

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## Impact of Motor Deficits on Communication and Social Functions

- Motor deficits have implications for communicative and social functioning as these skills rely on the organization of sensory and motor responses (Donnellan et al., 2015).
- Cascading effects affects developmental trajectory

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- Through the sensations of our own movements and the movements of others as we sense them kinesthetically and visually, we learn to mentally navigate actions, to acquire a sense of agency and autonomy, and imagine what it would be like to perform a physical action without actually having to do it (mirror neurons/ theory of mind)

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## Embodied Sensorimotor Foundations

- The understanding of our own actions through our sensations helps us scaffold social cognition by establishing sense of self and then sense of others and their relative motions

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## Early motor delays/differences have cascading effects on social-language development

- In a systematic review of infant sibs , Iverson (2012) concluded
- “variation in infant motor and communicative development appears to have cascading effects on development, both on the emergence of behavior in other domains and on the broader learning environment”

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## Early motor contributions (Iverson, 2012)

- Advances in communicative and language
- development are supported by advances in motor skill.
- When these advances are slowed and/or when new skills are not consolidated and remain challenging for the infant, the enhanced potential for exploration afforded by new abilities and the concomitant increase in opportunities for learning are reduced

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## Space Affordances, Adaptive Responses and Sensory Integration by Autistic Children

Paramita Atmodiwirjo, 2014

- Author *Department of Architecture, Faculty of Engineering, Universitas Indonesia, Depok, Indonesia*
- Role of the spatial environment in promoting the development of the sensory integration
- Uses Gibson's concepts of affordances of space and objects to promote sensory integration:
- Transactional relationship between body and environment

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## The Bottom Line




gg64745406 GoGraph ©

- Early identification is critical
- BUT identification is not sufficient; services must be provided
- Movement is a key integrator



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## Conclusions

- Close relationship of motor, sensory, social-emotional, and cognitive
- May help to explain co-morbidity
- Early identification /intervention is critical: Motor (and sensory) signs may help with earlier identification
- Comprehensive motor evaluations are warranted for children with ASDs and infants at risk for ASDs.
- There is an urgent need to develop novel embodied interventions grounded in movement and motor learning principles for children with autism.(Bhat 2010)
- intervention using a SI frame of reference is in high accord with the importance of integration through movement

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## Research Studies- Can you Help??

**IMPACT FOR DCD-USA STUDY**

This letter explains the DCD Impact study to therapists. The QR code in this letter is for therapists only and provides resources to therapists to thank you for letting clients know about the study .

The QR code on the purple flier is the link to the survey for parents. Resources for parents are provided at the end of the survey.

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Dear Occupational Therapist and Physical Therapist,


I am currently conducting a research study to examine the impact of dyspraxia/Developmental Coordination Disorder (DCD)/motor challenges on five areas of life: diagnosis, school, social emotional, activity/participation, and therapy. I am asking for your help in letting your client's family know about the study. (Note: we are not making a distinction between dyspraxia and DCD). This study was originally conducted in Australia and is now being conducted in the US.

We are looking for parents of children ages 5-18 with motor concerns such as dyspraxia or Developmental Coordination Disorder. A formal diagnosis is not needed. Children with cerebral palsy and/or muscular dystrophy are not included in this study.


Parents are asked to complete a questionnaire about the impact of their child's motor skills on the five areas of life stated above. The survey will take approximately 30 minutes to complete. To thank parents for their participation, we will provide a set of materials about DCD/dyspraxia.

The attached purple parent recruitment flyer (also included for you as a pdf) includes a QR code so you can either email the flyer to families or provide them with a physical copy of the flyer. Families can use the QR code or the link on the flyer to access the survey. Please let families know that their participation is voluntary.


To thank you for your help, we are providing you with a set of key articles and resources on dyspraxia/DCD available via the QR code located at the bottom of this letter. We also will provide parents with a set of resources on dyspraxia/DCD.

Sincerely,  



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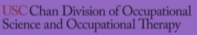

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## Please share this with parents of children with motor concerns

The QR code on the purple flier is the link to the survey for parents. Resources for parents are provided at the end of the survey.

### IMPACT FOR DCD - USA STUDY






DO YOU HAVE A CHILD WITH MOVEMENT-RELATED DIFFICULTIES OR DEVELOPMENTAL COORDINATION DISORDER (DCD) OR DYSPRAXIA AND LIVE IN THE USA?

IF SO, THIS STUDY WANTS TO UNDERSTAND THE IMPACT OF MOVEMENT RELATED DIFFICULTIES IN THIS COUNTRY.


**CRITERIA:**  
PARENT OF A CHILD AGED 5-18 YEARS WITH MOVEMENT DIFFICULTIES NOT ASSOCIATED WITH ANOTHER MOVEMENT-RELATED CONDITION (E.G., CEREBRAL PALSY, MUSCULAR DYSTROPHY)

SURVEY LINK:  
<https://impactfordcd-usa.questionpro.com>



Contact:  
Dr. Priscila Tamplain priscila.tamplain@uta.edu (817) 272-3233  
Dr. Sharon Cermak cermakeusc.edu (310) 433-4131

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## HANDWRITING INSTRUCTION IN EARLY ELEMENTARY SCHOOL: TEACHER TRAINING, PRACTICES, AND BELIEFS

**Teachers Are Important!**  
We are looking for kindergarten-3rd grade teachers to participate in a research study on handwriting.



**What is involved?**

- Complete an online 20 minute survey
- Compensation and resources will be provided

**If you are eligible and interested in participating please visit:**

[bit.ly/teacherhwsurvey](https://bit.ly/teacherhwsurvey)

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