Reference List

Episode 8: Katie’s Take on Sensory Processing

The Athenaeum Podcast

Sensory Integration Theory: Origins and Development

Referenced claims: Ayres developed SI theory in the 1960s–1970s; she was an OT and neuropsychologist; she developed a manualized approach; she died in 1988; Dunn’s neurological threshold model; Miller’s push for SPD as a distinct diagnosis.

Ayres, A. J. (1972). *Sensory integration and the child*. Western Psychological Services.

Foundational text establishing SI theory.

Dunn, W. (1997). The impact of sensory processing abilities on the daily lives of young children and their families: A conceptual model. *Infants and Young Children*, *9*(4), 23–35.

Introduces the neurological threshold model and four-quadrant framework.

Dunn, W. (2001). The sensations of everyday life: Empirical, theoretical, and pragmatic considerations. *American Journal of Occupational Therapy*, *55*(6), 608–620. https://doi.org/10.5014/ajot.55.6.608

Summarizes Dunn’s model; describes seeking, avoiding, sensitivity, and low registration patterns.

Miller, L. J., Anzalone, M. E., Lane, S. J., Cermak, S. A., & Osten, E. T. (2007). Concept evolution in sensory integration: A proposed nosology for diagnosis. *American Journal of Occupational Therapy*, *61*(2), 135–140. https://doi.org/10.5014/ajot.61.2.135

Miller’s proposed diagnostic classification for SPD.

Gorman, D. (2017). A. Jean Ayres and the development of sensory integration: A case study in the development and fragmentation of a scientific therapy network. *Social Epistemology*, *31*(2), 158–177. https://doi.org/10.1080/02691728.2016.1241322

Historical analysis of Ayres’ career and the SI community’s fragmentation after her death.

SPD Exclusion from DSM-5 and AAP Policy Statement

Referenced claims: SPD was rejected from the DSM in 2012; AAP said there’s not enough evidence; SPD is not an actual diagnosis.

American Academy of Pediatrics, Section on Complementary and Integrative Medicine, & Council on Children with Disabilities. (2012). Sensory integration therapies for children with developmental and behavioral disorders. *Pediatrics*, *129*(6), 1186–1189. https://doi.org/10.1542/peds.2012-0876

AAP policy statement recommending against using SPD as a diagnosis and noting limited evidence for sensory therapies.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

DSM-5 excludes SPD as a standalone diagnosis; includes sensory hyper/hyporeactivity as ASD criterion.

Research on Response Differences and the Threshold Construct

Referenced claims: Research showed response differences between groups but not that the reason is sensory or neurological; correlation is not causation.

Rost, G. C., Riquelme, I., Engel-Yeger, B., Bartlett, D., & Bodison, S. C. (2019). Dunn's model of sensory processing: An investigation of the axes of the four-quadrant model in healthy adults. *Brain Sciences, 9*(35). https://doi.org/10.3390/brainsci9020035

No relationship found between Sensory Profile scores and EEG-measured somatosensory evoked potentials in healthy adults.

Brown, C., Tollefson, N., Dunn, W., Cromwell, R., & Filion, D. (2001). The Adult Sensory Profile: Measuring patterns of sensory processing. *American Journal of Occupational Therapy, 55*(1), 75–82. https://doi.org/10.5014/ajot.55.1.75

Used skin conductance as a proxy for neurological threshold; partial support with significant limitations.

Autistic Children Experience Sensory Information Differently

Referenced claims: Robust neuroscience shows autistic children experience sensory information differently, primarily tactile, auditory, and visual; the difference appears to be in filtering/gating.

Marco, E. J., Hinkley, L. B. N., Hill, S. S., & Nagarajan, S. S. (2011). Sensory processing in autism: A review of neurophysiologic findings. *Pediatric Research, 69*(5), 48R–54R. https://doi.org/10.1203/PDR.0b013e3182130c54

Comprehensive review of EEG, MEG, and fMRI evidence for atypical sensory processing in autism.

Green, S. A., Hernandez, L., Bookheimer, S. Y., & Dapretto, M. (2017). Reduced modulation of thalamocortical connectivity during exposure to sensory stimuli in ASD. *NeuroImage: Clinical, 13*, 18–27. https://doi.org/10.1016/j.nicl.2016.11.009

Demonstrated reduced thalamic gating and slower neural habituation in autistic youth.

Humphreys, J. S., Grahame, V., Engstrom, E., Belmonte, M. K., & Keehn, B. (2022). Brainstem white matter microstructure is associated with hyporesponsiveness and overall sensory features in autistic children. *Molecular Autism, 13*, 52. https://doi.org/10.1186/s13229-022-00524-3

Brainstem white matter differences linked to sensory features in autism.

Ausderau, K. K., Furlong, M., Sideris, J., Bulluck, J., Little, L. M., Watson, L. R., Boyd, B. A., Belger, A., Dickie, V. A., & Baranek, G. T. (2014). Sensory subtypes in children with autism spectrum disorder. *Journal of Child Psychology and Psychiatry, 55*(8), 935–944. https://doi.org/10.1111/jcpp.12219

White matter correlates of sensory processing; tactile defensiveness associated with specific tract differences.

Vestibular and Proprioceptive Systems

Referenced claims: Proprioception is important; proprioceptive input is calming and pleasant; evidence does not support "propriceptive seeking" as a construct.

Crespi, C., Chen, L., & Bhatt, J. (2024). Vestibular function and postural control in children with autism spectrum disorder. *Journal of Clinical Medicine, 13*(17), 5323. https://doi.org/10.3390/jcm13175323

Peripheral vestibular function normal in autistic children; differences reflect central integration problems.

Haswell, C. C., Izawa, J., Dowell, L. R., Mostofsky, S. H., & Shadmehr, R. (2009). Representation of internal models of action in the autistic brain. *Nature Neuroscience*, *12*(8), 970–972. https://doi.org/10.1038/nn.2356

Autistic children over-rely on proprioception, not under-rely on it.

Panagiotidi, M., Overton, P. G., & Stafford, T. (2020). Pleasant deep pressure: Expanding the social touch hypothesis. *Neuroscience*, *442*, 100–111. https://doi.org/10.1016/j.neuroscience.2020.07.050

Deep pressure activates pleasant-touch brain pathways—supports that proprioceptive input is calming.

Sex Differences in Physical Activity

Referenced claims: Boys are much more physically active; normal mammalian behavior across species; linked to hormone exposure in utero.

Hines, M., & Kaufman, F. R. (1994). Androgen and the development of human sex-typical behavior: Rough-and-tumble play and sex of preferred playmates in children with congenital adrenal hyperplasia (CAH). *Child Development*, *65*(4), 1042–1053. https://doi.org/10.1111/j.1467-8624.1994.tb00801.x

CAH research demonstrating prenatal androgen influence on play behavior.

McCarthy, M. M., Woolley, C. S., & Arnold, A. P. (2021). Developmental origins of sex differences in the neural circuitry of play. *Current Topics in Behavioral Neurosciences*, *47*, 19–37. https://doi.org/10.1007/7854_2020_195

Cross-species review of sex differences in rough-and-tumble play.

Berenbaum, S. A., Martin, C. L., Hanish, L. D., Briggs, P. T., & Fabes, R. A. (2008). Sex differences in children's play. In J. B. Becker et al. (Eds.), *Sex differences in the brain: From genes to behavior* (pp. 275–290). Oxford University Press.

Boys' play is more active, dominance-oriented, and physically assertive, emerging by age 2–3.

Pica and Mouthing in Autism

Referenced claims: Pica prevalence 23–30% in autism vs. 3.5% general population; iron/zinc deficiency; developmental exploration; repetitive behavior.

Fields, V. L., Soke, G. N., Reynolds, A., Tian, L. H., Wiggins, L., Maenner, M., DiGuiseppi, C., Kral, T. V. E., Hightshoe, K., & Schieve, L. A. (2021). Pica, autism, and other disabilities. *Pediatrics*, *147*(2), e2020016089. https://doi.org/10.1542/peds.2020-016089

Epidemiological data on pica prevalence in ASD.

Weighted Vests

Referenced claim: Weighted vests are actively discouraged.

Losinski, M., Sanders, S. A., & Wiseman, N. M. (2016). Examining the use of deep touch pressure to improve the educational performance of students with disabilities: A meta-analysis. *Research and Practice for Persons with Severe Disabilities*, *41*(1), 3–18. https://doi.org/10.1177/1540796915624889

DTP interventions (weighted vests) are of generally poor quality; effects do not validate current use.

Watkins, L., Ledbetter-Cho, K., O'Reilly, M., Cannon, L., Sigafoos, J., & Lancioni, G. E. (2017). A systematic review of weighted vests with individuals with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *37*, 49–60. https://doi.org/10.1016/j.rasd.2017.03.003

Using What Works Clearinghouse standards: weighted vests for ASD are not evidence-based.

Ayres Sensory Integration RCT Evidence

Referenced claim: Recent RCT found moderate evidence for Ayres' manualized approach for autistic children; mechanism of change is unclear.

Schaaf, R. C., Dumont, R. L., Arbesman, M., & May-Benson, T. A. (2018). Efficacy of occupational therapy using Ayres Sensory Integration®: A systematic review. *American Journal of Occupational Therapy*, *72*(1), 7201190010. https://doi.org/10.5014/ajot.2018.028431

Moderate evidence for ASI improving individualized functional goals in autistic children.

Watling, R., & Hauer, S. (2015). Effectiveness of Ayres Sensory Integration® and sensory-based interventions for people with autism spectrum disorder: A systematic review. *American Journal of Occupational Therapy*, *69*(5), 6905180030. https://doi.org/10.5014/ajot.2015.015180

Distinguishes manualized ASI (some evidence) from informal sensory-based interventions (weak evidence).

Sensory Processing as Industry

Referenced claim: Sensory processing has become big business.

FutureDataStats. (2025). *Sensory toy market size & industry growth 2030*. https://www.futuredatastats.com/sensory-toy-market

Global sensory toy market estimated at $19 billion in 2025, projected $35 billion by 2033.

Receptive Language and Challenging Behavior

Referenced claims: Many behaviors attributed to sensory may be better explained by communication deficits.

Matson, J. L., Mahan, S., Kozlowski, A. M., & Shoemaker, M. (2010). The relation of communication and challenging behaviors in infants and toddlers with autism spectrum disorders. *Journal of Developmental and Physical Disabilities*, *22*, 219–230. https://doi.org/10.1007/s10882-009-9140-1

Lower receptive communication alone predicted higher stereotypies, self-injury, and aggression in ASD toddlers.

Sigafoos, J. (2000). Communication development and aberrant behavior in children with developmental disabilities. *Education and Training in Mental Retardation and Developmental Disabilities, 35*(2), 168–176.

More severe receptive language deficits relative to expressive language are associated with challenging behavior.

Physical Activity and Brain Development

Referenced claims: Children need to be really active; physical activity supports brain development.

Ureña-Molina, M. P., Aibar-Almazán, A., & Martínez-Amat, A. (2025). Exercise as modulator of brain-derived neurotrophic factor (BDNF) in children: A systematic review of randomized controlled trials. *Life*, *15*(7), 1147. https://doi.org/10.3390/life15071147

Structured physical exercise enhances BDNF in children; neuromotor activities most effective.

Additional Recommended Reading

These sources were not directly cited in the episode but informed the research and may be useful for members who want to go deeper.

Bird, G., & Cook, R. (2016). Alexithymia, not autism, is associated with impaired interoception. *Cortex*, *81*, 215–220. https://doi.org/10.1016/j.cortex.2016.03.013

Controlling for alexithymia eliminates the autism-interoception link.

Reeves, R. V. (2022). *Of boys and men: Why the modern male is struggling, why it matters, and what to do about it*. Brookings Institution Press.

On pathologizing normal male behavior; relevant to boys and activity levels.

Sapolsky, R. M. (2017). *Behave: The biology of humans at our best and worst*. Penguin Press.

Framework for understanding behavior through nested layers of causation.

Woo, C. C., Donnelly, J. P., Steinberg-Epstein, R., & Leon, M. (2015). Environmental enrichment as a therapy for autism: A clinical trial replication and extension. *Behavioral Neuroscience*, *129*(6), 848–856. https://doi.org/10.1037/bne0000112

Sensory enrichment therapy: a neuroplasticity-based alternative to the deficit model.