

INTEROCEPTION

How are you feeling?

Body and Mind

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Introduction



INTEROCEPTION: our sense of how we feel inside our bodies - it encompasses both physical feelings & emotional states



This book introduces *interoception* - a sensory system that should be explored with all children, but especially those with Autism Spectrum Disorder, sensory or behavioral challenges or social emotional difficulties.



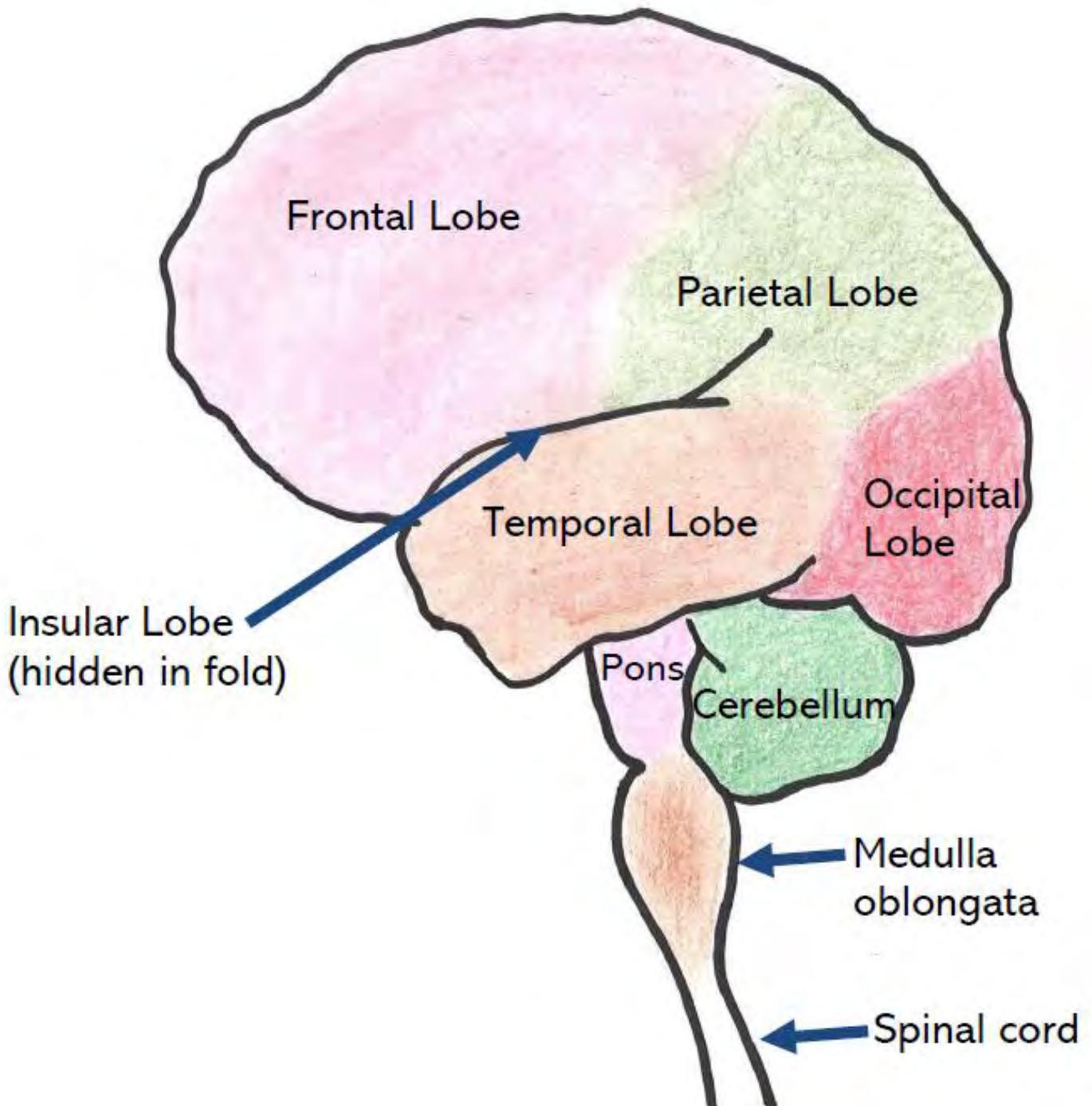
Research data on interoception was first available in 2009, so this is a recent area of study in neuroscience. It provides an important framework and many important tools for supporting children as they grow and learn

Overview

The locus of interoceptive processing in the brain is an area of called the insula.

Interoceptive receptors are located deep within body tissues, including muscles, internal organs and skin. These receptors provide information to the brain that allows us to assess internal states - both body states and mental states. A key component of mental state is how we sense (perceive) and view our emotions.

The Insular Lobe



Insula

The locus of interoception processing in the brain



Emotions

- Happiness
- Sadness
- Anger
- Fear
- Embarrassment

Autonomic Functions

- Heart Rate
- Breathing Rate
- Blood Pressure

Touch Sensations

- Light Touch
- Firm Touch
- Itching
- Tickling



Hunger/Satiety

Nausea

Need for bathroom

Sexual Arousal

Musculo-Skeletal

- Muscle Tension
- Joint Pain
- Fatigue

Interoception Throughout the Body

Efficient Interoception Supports Self-Regulation

There are several ways we self-regulate to remain comfortable and in control.

- Body state regulation – noticing cold, hunger, fatigue, etc. and finding ways to address those needs so we remain regulated
- Sensory regulation – modulation and discrimination of sensory input which affects the ability to attend, sleep, and interact successfully with peers
- Regulation of attention – being able to pay attention and shift attention appropriately
- Energy regulation – being able to sustain and to maintain energy levels appropriate to the situation
- Regulation of emotions – being able to regulate the intensity of emotional responses

Faulty or inefficient interoception makes it hard for a child to regulate, which can be a tremendous barrier to functioning at home or at school. The poorly regulated child may have trouble independently managing sensations, emotions or social interactions.

How do I know what I want if I am not having accurate perceptions about what's bothering me?



How can I regulate myself if I only become aware of my internal sensations after they feel overwhelming?



Research on Interoception and Autism Spectrum Disorder (ASD)

There is a growing body of data showing differences in the structure (lower volume of gray matter) and function (limited connectivity) of the insula in individuals with ASD. These differences lower the amount of interoceptive information processing in the brain which would interfere with efficient interoceptive function. This makes it hard for the child to correctly identify physical sensations and emotions and respond to them appropriately.

In a large study of adolescents and adults, there was significantly less connectivity within subdivisions of the insula and between the insula and other areas of the brain, in individuals with ASD than in typical control subjects. (DiMartino, 2014)



More Research on Interoception and ASD

Across 24 studies of activity in the insula, individuals with Autism Spectrum Disorder (ASD) consistently had less activity within the insula than individuals without ASD. (Di Martino, A. R., 2009)

Examination of insular structure showed reduced gray matter volume in the insulas of individuals with ASD as compared to typically developing control subjects. (Radeloff, 2014)



3 Main Patterns of Interoceptive Dysfunction

- Interoceptive Over-responsivity
- Interoceptive Under-responsivity
- Interoceptive Discrimination Difficulty



Interoceptive Over-responsivity

Individuals with over responsiveness are going to feel internal sensations more intensely than is typical. This can make it hard for them to determine which sensations are most salient because they are often flooded with sensations. Some people with this response style describe it as being “noisy” in their brains.

This is the child who thinks it is an emergency every time he senses the need to go to the bathroom. Or it could be the child who thinks she has broken her toe when she has a mild toe stub.

Interoceptive Under-responsivity

Individuals with under responsive interoception will only notice interoceptive signals when they have become intense. This is the child who doesn't notice she needs to go to the bathroom until she's about to wet her pants.

Under responders often do not feel internal states or emotions. This will be the child who really has no idea what he is feeling when asked. This child can also have a lot of trouble understanding how other children are feeling or why someone is upset with them.

Another common pattern for under responders is to not notice their feelings and then suddenly explode because they are overwhelmed by intense sensations. For parents, teachers and peers, interacting with a classmate who has this pattern can be very challenging.

Interoceptive Discrimination Difficulties

Individuals who are having difficulty with discrimination of their feelings have a vague sense that something is amiss or that they need or want something, but they cannot determine exactly what it is. They have trouble perceiving the difference between similar but discreet feelings. Not knowing what one is feeling makes it a challenge to get what one needs.



Left Unaddressed

Initially, a child will simply find it hard to identify their emotional states and regulate emotional responses. It may be difficult for them to accurately perceive physical sensations related to their body states. They may have difficulty potty training or getting to sleep at night. They could have difficulty understanding the perspectives of others. Inefficient interoceptive processing could interfere with good decision making and flexible thinking.

Over time, after repeatedly engaging in negative social interaction loops (with little insight into why this is happening) these children may find themselves becoming socially isolated. The inability to recognize feelings of others interferes with the process of establishing and maintaining friendships. Individuals with this interaction style seem to lack empathy and are often less likely to be sought out as friends.

What Can be Done? Yoga & Other Movement Activities

Increase Your Awareness - The more you know about this topic, the easier it will be for you to create group lessons that benefit all the children in your community and individualized supports for specific children.

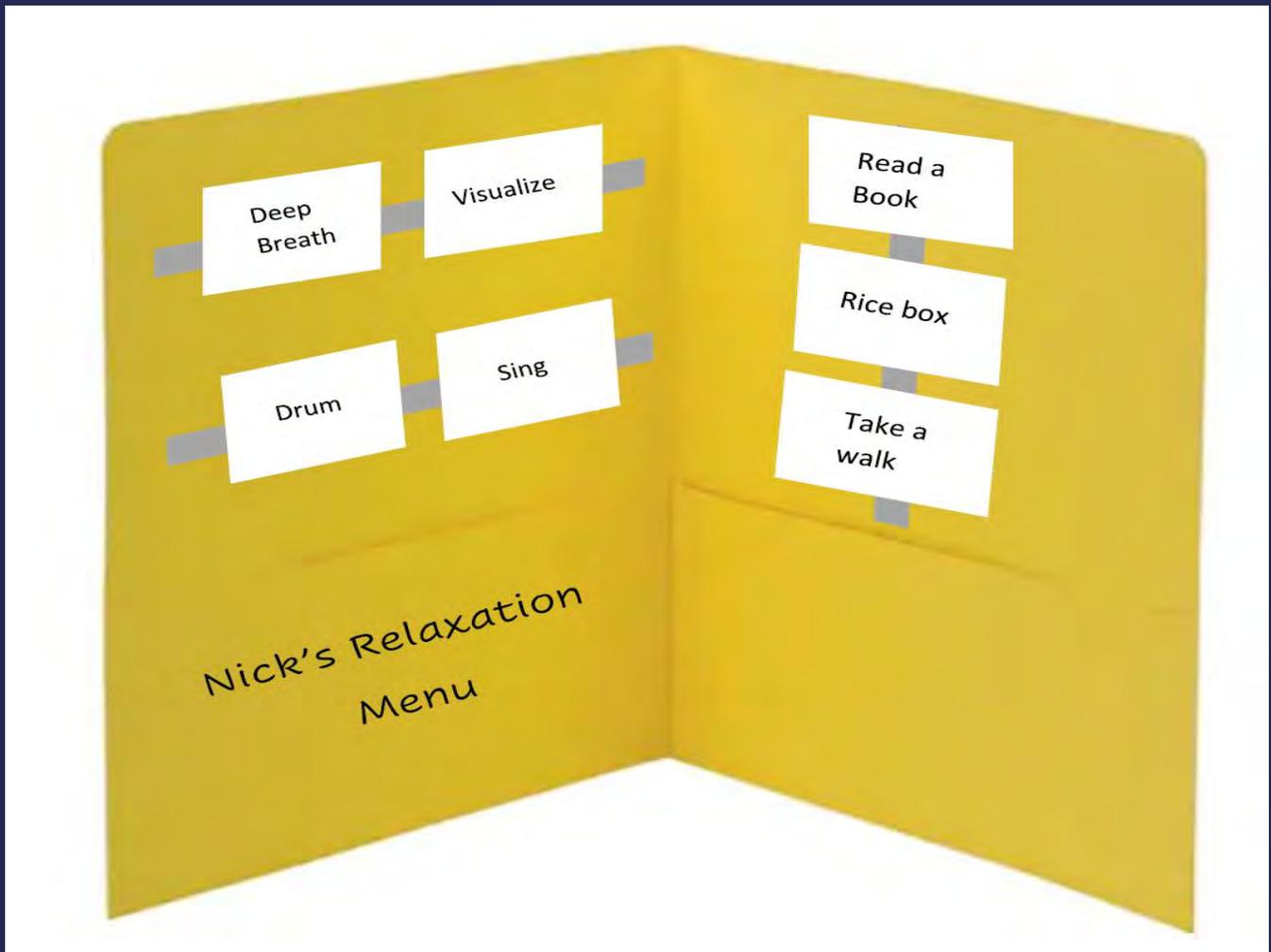
Research has shown that mindfulness activities enhance Interoceptive Awareness. (Daubenmier, 2013) The insula is strongly activated during meditation and consistent engagement in mindfulness activities has been shown to improve the structure and the function of the insula.

Structurally, it becomes thicker and functionally, it is more active. (Farb, 2007) This is a strategy that will activities based on benefit your entire community – adults included. Exercises and principles of mindfulness and movement are quick and easy to implement.



Tips for Creating and Using Individualized Supports

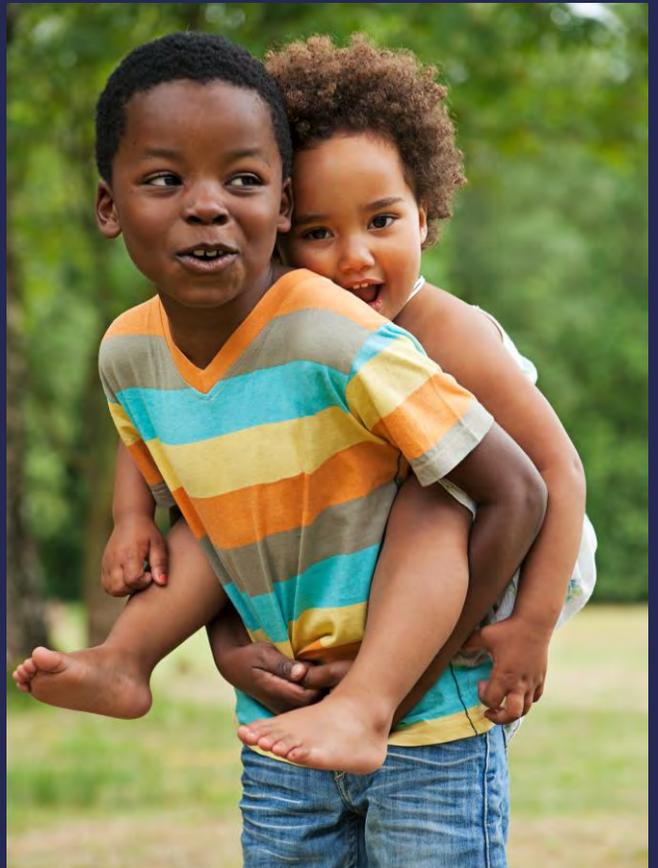
- Create a support and then create a lesson to introduce it to the child.
- Use Visual Aids and Social Stories
- Keep it simple - target one issue at a time.
- Use photos of the child and his or her personal belongings in real settings.
- Choose strategies that match the age and learning style of the individual.



Co-Regulation

One strategy to address dysregulation is to use co- regulation. This is when we rely on another person to help our system become better regulated. We are all born totally dependent on others to help us regulate sensations like hunger, thirst, body temperature, sensory overwhelm, frustration, or anxiety, to name a few. As we grow, we develop our ability to notice these sensations and their corresponding emotions, connect to them,

and adjust our responses. Ultimately, as we improve our interoceptive awareness and processing capabilities, we become independent at regulating ourselves and our responses. This progression towards independence is a result of support from the environment and the people around us through co- regulation. (Rosanbalm, K. D., 2017)



When students of different ages or skill levels are paired, we are inviting co-regulation between the two students. By working together, the older or more accomplished student will support her partner, in many cases without any adult prompting. This is an excellent strategy for improving interoceptive processing and regulation.

Try to develop some activities and lessons expressly for improving regulation. They can be “regular Montessori” activities but sometimes it may make sense to engage in less traditional activities in order to provide both muscle work and rhythm simultaneously. Doing wall pushups with a partner is an example.

There would be a lesson, presented to the class, explaining how to do wall

pushups with a consistent rhythm.

The mentor child can help his partner to maintain a steady rhythm by simply doing pushups at slow and even pace. This models for the other child and invites her to match the pace and rhythm that has been established. That is co-regulation at work.



An indoor spot for wall pushups-
on the side of the bookshelf

Be in Nature

Water the garden, take a walk, have a picnic, read a book or play a game outside. There are so many ways to get outside and get moving.

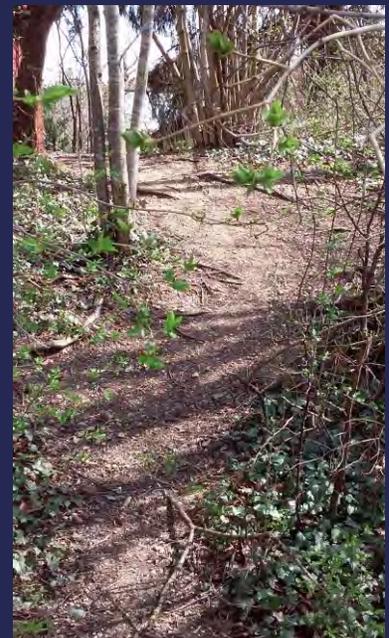
Be sure to call attention to the many smells, sights and sounds you encounter and share how they make you feel. Ask your students what they are feeling too.



Playing and working in nature



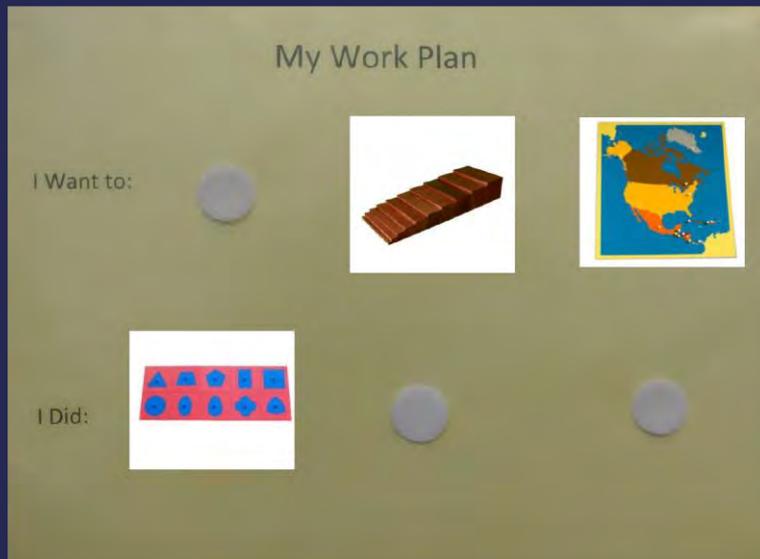
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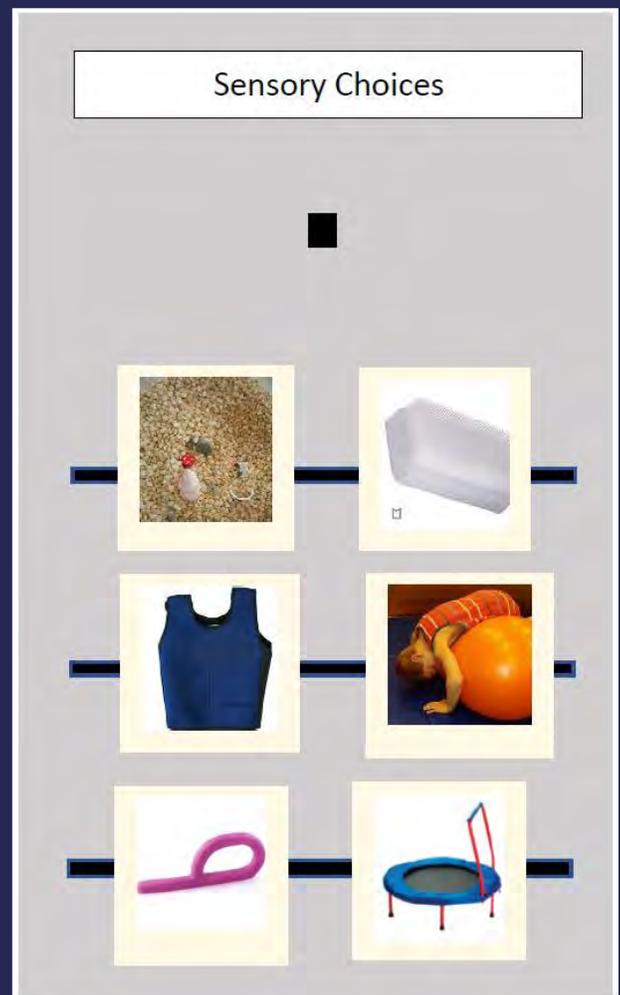
Picture or Visual Schedule Choice Menus

Work Plan Board



Support the child who can't decide what he needs or wants, by making visual schedules and choice boards. You may find that you need to choose for the child at first, but eventually, they will begin recognizing what they like and what makes them feel good.

Sensory Choices Board



Body Scan: Sample Activity

To help children gain insight into how they are feeling in their bodies, have everyone trace their bodies on big paper or use a small body outline on paper that you hand out. Have the children think about each body part and how it is feeling. Then have them color with strokes and colors that illustrate their feelings. This can be adapted for different age groups by breaking it down into a multi-day project for younger children and requesting more written descriptions in addition to the coloring, on their work, for a more sophisticated assessment of feelings.

Body Part	Suggested terms, if needed
Brain	Focused, cloudy, fuzzy, busy, calm
Eyes	Heavy, blurry, teary, tired, itchy, squinty
Nose	Stuffy, runny, itchy, tickly
Cheeks	Hot, cold, ok, tight, loose
Mouth	Dry, wet, happy, tight jaw
Voice	Loud, yelling, content, shut off, fast, slow
Ears	Sensitive, hot, itchy, shut off, sore
Skin	Hot, cold, itchy, bumpy, sweaty, dry
Breathing	Fast, slow, normal, tight, short, panting
Heart	Good, pounding, fast, slow, aching
Stomach	Happy, grumbly, hungry, hurt
Muscles	Tight, loose, tired, weak, shaky, sore, hot
Hands/fingers	Wiggling, tapping, clapping, punching
Feet/toes	Tapping, fidgeting, still, stomping, hot, cold

References

- Daubenmier, J. S. (2013). Follow uor breath: Respiratory interoceptive accuracy in experienced meditators. *Phychophysiology*, *50*(8), 77-789.
- DiMartino, A. R. (2009). Functional brain correlates of social and nonsocial processes in autism spectrum disorders: An activation likelihood estimation meta-analysis. *Biological Psychiatry*, *65*, 63-74.
- DiMartino, A. Y. (2014). The autism brain imaging data exchange: Towards a large-scale evaluation of the intrinsic brain architecture in autism. *Molecular Psychiatry*, *19*(6), 659667.
- Farb, N. A. (2007). Attending to the present: Mindfulness meditation reveals distinct neural modes of self-reference. *Social Cognitive and Affective Neruoscience*, *2*(4), 313-322.
- Kelly Mahler, M. O. (2017). *Interoception- The Eighth Sensory System*. Lenexa: AAPC Publishing.
- Radeloff, D. C. (2014). Structural alterations of the social brain: A comparison between schizophrenia and autism. *PloS One*, *9*(9), e106539.
- Rosanbalm, K.D., & Murray, D.W. (2017). *Caregiver Co-regulation Across Development: A Practice Brief*. OPRE Brief #2017-80. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, US. Department of Health and Human Services.

This book has been created with love, to support parents and teachers who are working to understand the children in their lives and find ways to support them on their paths to independence. I hope it fulfills that purpose for you.

I extend thanks my Montessori mentor, Catherine Massie, my OT colleague, Erin Taylor, and especially to all the children who have taught me so much.



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*I invite you to share
this resource with
anyone you think could
benefit from seeing it.*

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