



STAR Institute

Navigating the Unseen Path & Following the Child's Lead in Motor Apraxia



Visit Our Website
sensoryhealth.org



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STAR Institute

A 501(c)3 non-profit

Vision: Sensory Health and Wellness for the State, the Nation, and the World.

Mission: To impact quality of life by developing and promoting best practices for sensory health and wellness through treatment, education, and research.

Values: I-identity and We-identity | Equity and justice. | Achievement informed by humility. | Generous and generative.

Director Emeritus

Dr. Lucy Jane Miller founded STAR Institute based on over 40 years of research and clinical experience. She retired in 2019.



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Meet Your Instructor



Virginia Spielmann, PhD, OTR/L, is the Executive Director of [STAR Institute for Sensory Processing](#). She is a published author, researcher, sometime-university-professor, and masterful international speaker. Virginia is also a therapeutic foster parent and dedicated to her family and dogs. Dr. Spielmann delivered [a TEDx Mile High](#) (Denver, Co) talk in December 2021. She consults on television and other media projects; co-founded & authored the [Critical Core therapeutic role-playing game](#); and co-developed the [Palaana sensory lounge](#) with SLACK Lifestyle.

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Outline:

- Different dyspraxia phenotypes
- Developmental Motor Apraxia in Autism
- Following the Child's Lead



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Main Points

- There are many presentations of dyspraxia
- Developmental motor apraxia in autism needs more research
- This sensory-motor profile indicates need for specific techniques



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Praxis

- **Action based on will**
- Intention ↔ action
- Organizing a plan for purposeful behavior
- Requires
 - Knowledge of actions and objects
 - Motivation
 - Intention



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Principals Commonly Applied in Dyspraxia

- Sensory discrimination
- Scaffolded trial-and-error
- Minimizing language demands
- Slowing down and optimizing feedback experiences
- Practice-can-make-perfect discretely
- Increasing proprioceptive loading
- Improve somatosensory discrimination and body schema



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Dyspraxia per Ayres

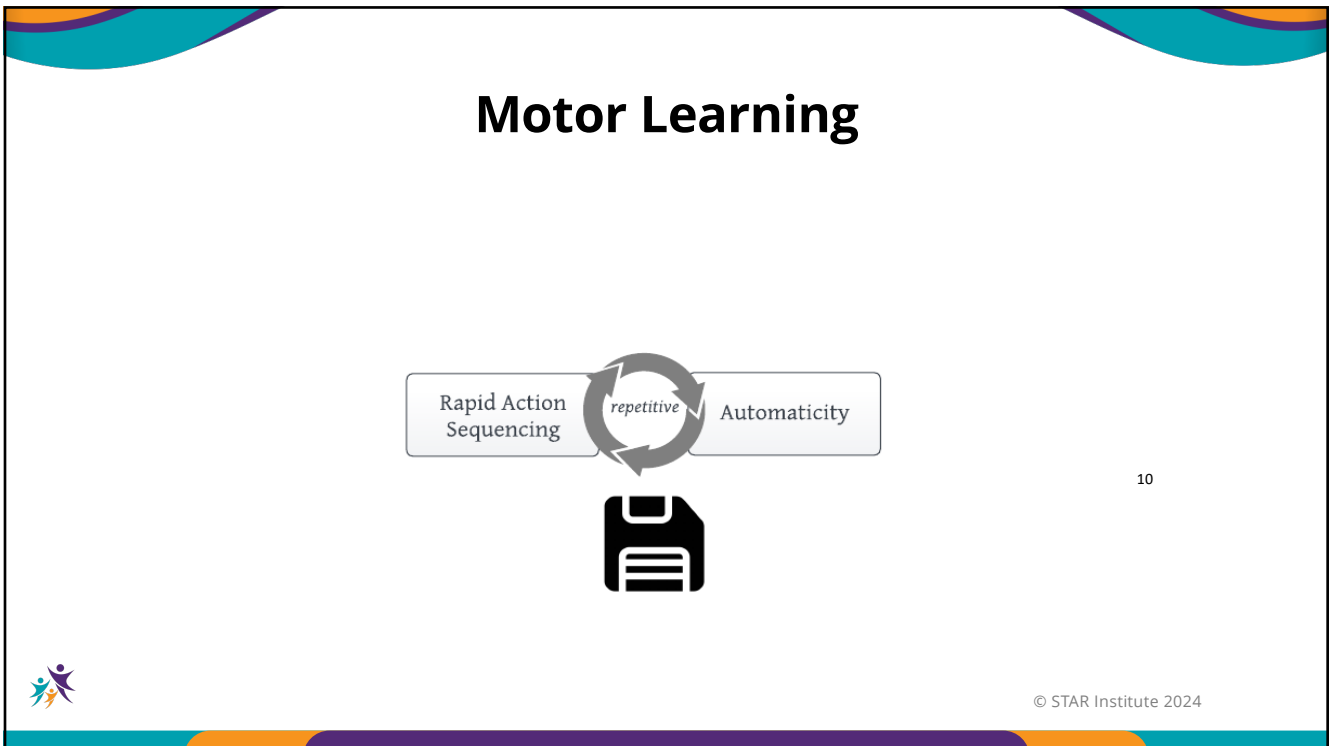


- Visuodyspraxia
- Somatodyspraxia
- Language-based dyspraxia
- Ideational dyspraxia
- Vestibular bilateral integration and sequencing deficits

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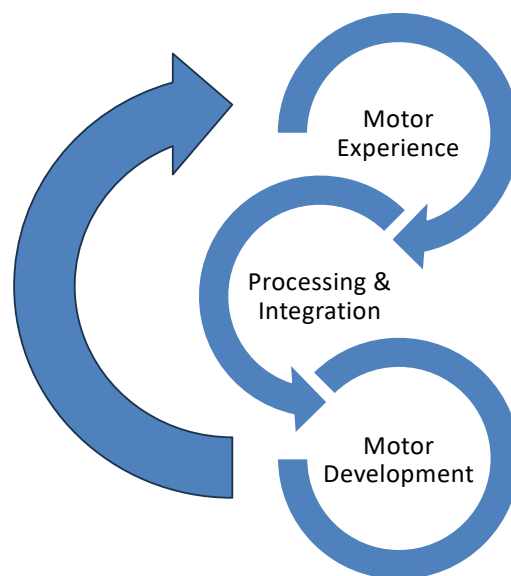
Praxis and Learned Motor Plans

- Learned motor plans are automatic schemes of action that do not require conscious attention.
- Praxis refers to nonhabitual conceptualization, planning and execution of action (motor plans).
- However, generating increasingly complex motor actions requires an internal database of learned motor actions. These are called motor engrams.



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Developmental Motor Apraxia

- *Not all motor outputs are intentional*
- Error-minimized learning
- Cognitive challenge at least at age level
- Repetition with titrated change just before a new loop forms
- Consideration of gestalt motor processing
- Teaching mastery of tiny discrete motor units



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Terminology: Apraxia

- Use with this population possibly stemmed from *apraxia of speech*
- *A disorder of learned movement in which the difficulty with the movement is not caused by paralysis, weakness, or spasticity/incoordination*
- Differences in production of purposeful motor movement *are* likely tangible via neuroimaging/wearable biosensory devices**



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Developmental Motor Apraxia

- Reflection of significance of motor differences
 - Autosave function not available . . . Due to excess noise
 - Absence of error-correction based learning
 - Where motor noise and randomness disrupt **clarity of sensory motor data**
 - Motor disinhibition interrupts purposeful action (spontaneous, involuntary, reflexive motor)

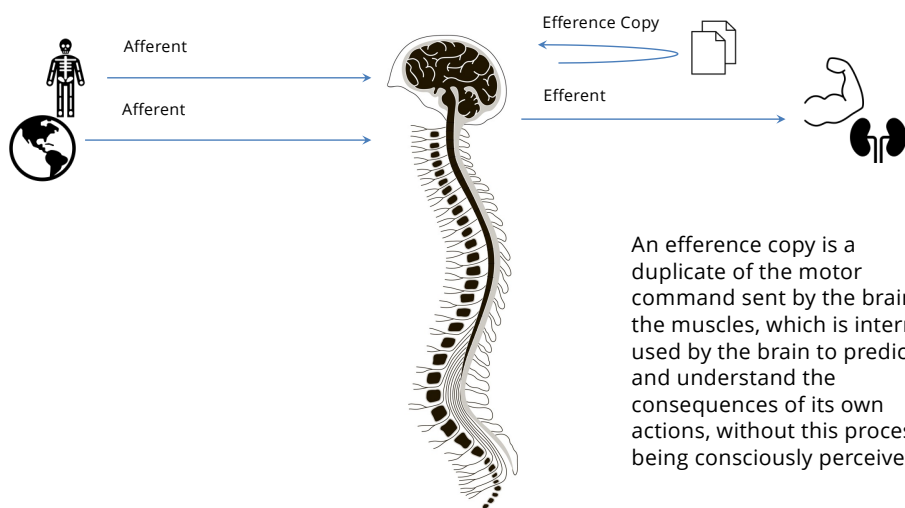


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Efferent, Afferent, What Now?



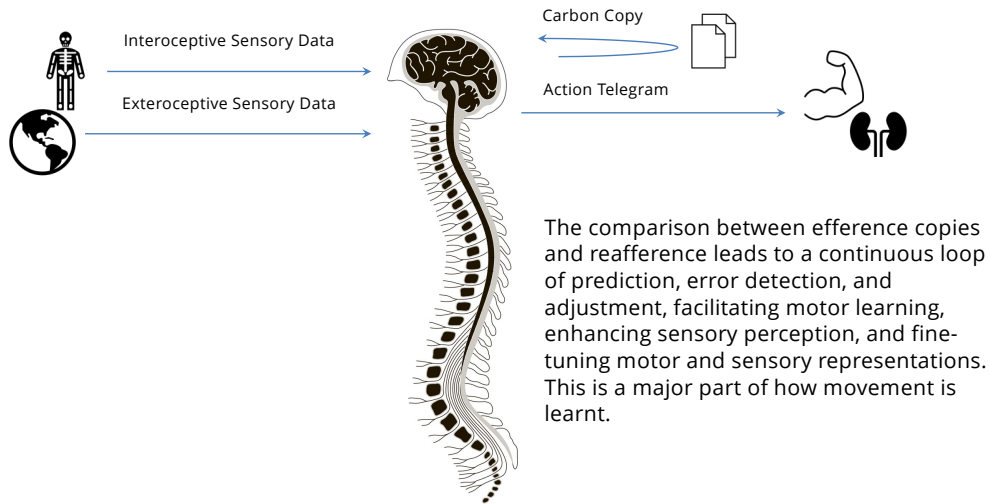
An efference copy is a duplicate of the motor command sent by the brain to the muscles, which is internally used by the brain to predict and understand the consequences of its own actions, without this process being consciously perceived.



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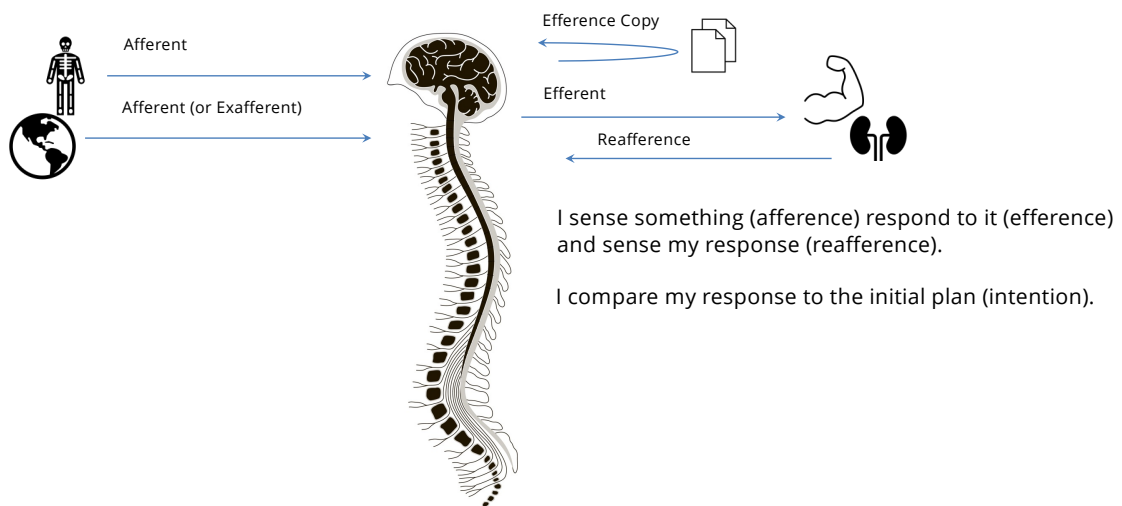
Efferent, Afferent, What Now?



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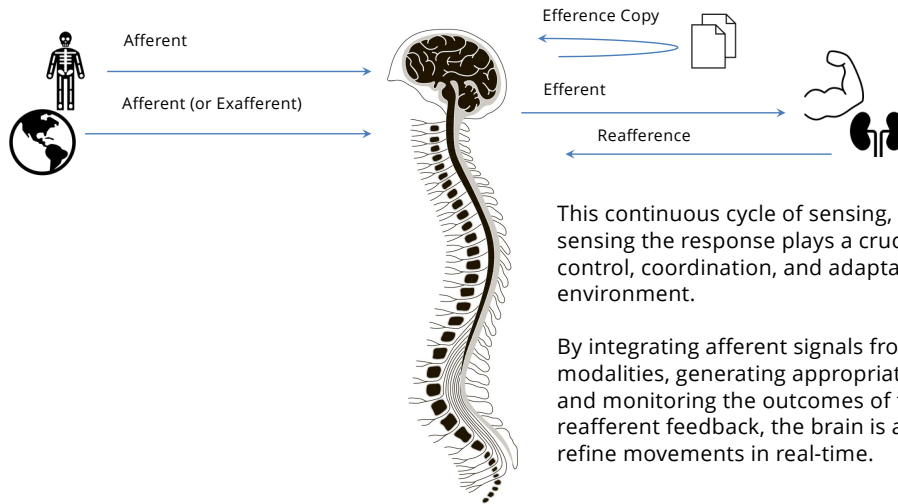
Sensorimotor (Feedback) Loops



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Sensorimotor (Feedback) Loops



This continuous cycle of sensing, responding, and sensing the response plays a crucial role in motor control, coordination, and adaptation to the environment.

By integrating afferent signals from various sensory modalities, generating appropriate motor commands, and monitoring the outcomes of those actions through reafferent feedback, the brain is able to adjust and refine movements in real-time.



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Movement is more than goal directed action

- "When reading the literature on motor control, one could be misled into believing that all movement is goal directed and under high-level intentional control. However, such types of movements actually represent a rather small fraction of our overall body movements." (pp.5-6)



Autism: The Movement Sensing Perspective



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(More Than) Four Types of Motor Response

Motor output systems evolve from reflexive to intentional. Given the appropriate, attuned, environmental supports the system self-discovers intentionality.

- ↑ Voluntary
- ↑ Automatic
- ↑ Spontaneous
- ↑ Involuntary
- ↑ Reflex
- ↑ Autonomic



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(More Than) Four Types of Motor Response

Motor output systems evolve from reflexive to intentional. Given the appropriate, attuned, environmental supports the system self-discovers intentionality.

- | | |
|--------------------|---|
| ↑ Voluntary | frontal cortex , basal ganglia, efferent & afferent |
| ↑ Automatic ... | cerebellum, SMA, PFC |
| ↑ Spontaneous ... | subcortical, effortfully cortical, striatum* |
| ↑ Involuntary | reinforced motor programs**, MOTOR NOISE |
| ↑ Reflexive | reflex arc, spinal/brainstem route |
| ↑ (Autonomic) | (vagal, oculomotor, facial) |



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* Also mediates movement inhibition

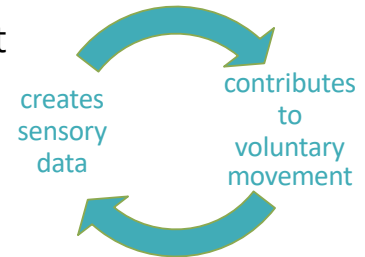
**2 kinds: 1) completely non-cortical, 2) somewhat modulated at cortical level

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Movement As Input

- Our movements are sensed and serve as input
- The quality of this sensory input is important
 - Useful?
 - Noisy?
 - Random?
 - Confusing?
- Movement is embodied – anatomically distributed
- Are a person's movements predictable?



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We generate sensory data all the time – not just when we move

Raw sensory input is not simply a passive reflection of the external world, but always sensed throughout one's own active movements. P.6



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Excess Reafferent Noise in Autism

- You learn based on error correction
- i.e., I reach and point/touch and retract from the purposeful movement
- In autism during the retraction there is elevated noise and randomness
- This noise and randomness impedes the creation of predictive code

Torres et al 2013

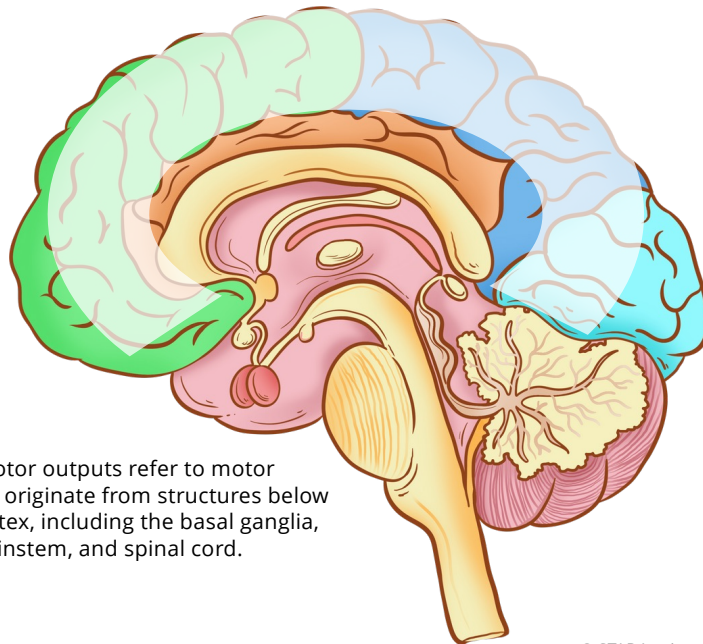


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Cortical motor outputs originate from the motor areas of the cerebral cortex, including the primary motor cortex, premotor cortex, and supplementary motor areas.



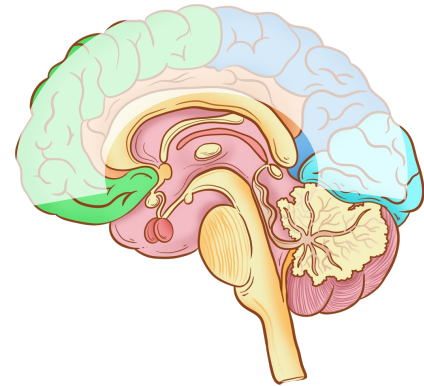
Sub-cortical motor outputs refer to motor commands that originate from structures below the cerebral cortex, including the basal ganglia, cerebellum, brainstem, and spinal cord.



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TLDR: Cortical motor outputs are directly associated with the intent and planning of purposeful movements, while sub-cortical motor outputs play a supportive role in ensuring these movements are executed smoothly and efficiently. Their integrated function is essential for the seamless performance of both simple and complex motor activities.



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Sensory Salience

- A part of discrimination
- The unconscious integrative processes of identifying salient sensory information:
 - Therefore ... Our perception of the external world in a sense always involves an active “subtraction of self”.
 - Subtraction of motor redundancies.



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Perception Involves Subtraction of Self

- To get to perception of the world beyond the expected effects of one's own self-produced movement , various subtractions seem to take place.
- To identify the salient data regarding the world your body sensory integrative processes involve identifying and filtering out erroneous generated in the body



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Sensing and Moving Without Vision

- Proprioception = silent feedback that makes it possible to execute movement without constant visual confirmation.
 - **Affordances:** oral-tactile/tactile/proprioceptive exploration of objects facilitates generation of our affordance database and generalization of object properties that enables prediction.
 - **Body map:** how we can move through the world without needing to consciously think about our body's position or how to coordinate our limbs.
 - **Peripersonal space:** informs the brain about the body's current posture and reach, thus influencing how we perceive objects in relation to ourselves and how we might interact with them.
 - **Spatial perception:** navigation, object interaction/manipulation, adaptation & learning, broader environmental awareness and anticipation.

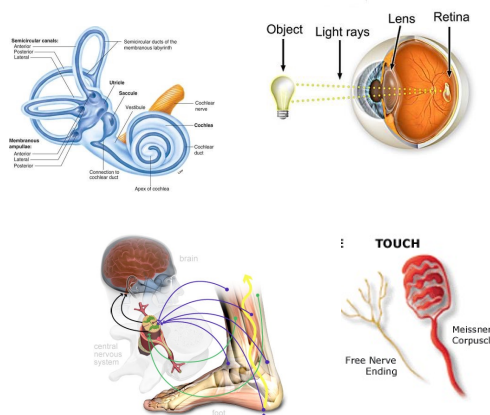


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Commonly Held OT / SI view of Perceptuomotor Processes

- Vestibular
- Proprioceptive
- Tactile
- Visual
 - depth perception
 - figure ground



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Critical Take Away:
The eyes lead
movement



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Optic Flow

- Visual proprioception is our understanding of our own self-movement in space – beyond somatosensory and vestibular systems.
- This understanding is derived primarily from the flow field or optic flow
- It informs postural stability, interception, and - more widely - motor planning.

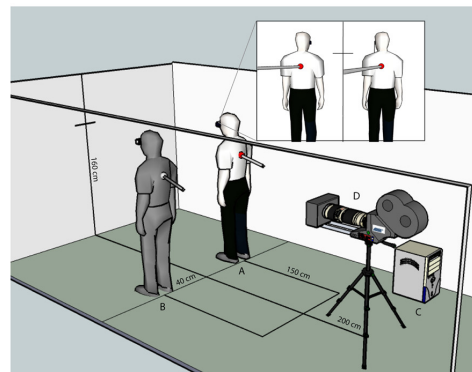


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Visual Capture

- Evolutionary Purpose
- Sensory Integration & Sensory Conflict Resolution
- Adaptation & Plasticity



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**Critical Take Away:
There are multiple
forms of involuntary
movement**



Motor Disinhibition

- Motor outputs may be impulsive, inappropriate for the context, or performed without conscious intention. These can include sudden, unplanned actions or verbal outbursts.
- Reduction in the brain's ability to suppress inappropriate or unwanted motor actions

Neurological Basis

- Often observed in conditions affecting the brain's frontal regions (i.e., frontotemporal dementia, Parkinson's)
- Dysfunction in neural pathways responsible for inhibiting motor actions, such as those involving the frontal lobes and basal ganglia

Motor Compulsion

- Compulsive actions: repetitive behaviors or mental acts that an individual feels driven to perform in response to an obsession or according to rules that must be applied rigidly.
- Action or speech
- Difficult to control, ritualistic, may have started as attempt to soothe anxiety or distress caused by obsessive/intrusive thoughts

Neurological Basis

- Often linked to abnormalities in the orbitofrontal cortex, anterior cingulate cortex, and basal ganglia.



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Motor Tics

- Sudden, rapid, recurrent, nonrhythmic motor movements or vocalizations. They are often experienced as an irresistible urge that can be temporarily suppressed with effort.
- Vary widely in complexity, frequency, and severity.

Neurological Basis

- Possibly result from dysfunctions in cortical-striatal-thalamo-cortical circuits within the brain, involving areas responsible for motor control and inhibition.



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Stereotypies

What the research says:

- Considered part of repetitive and restricted behaviors and interests that characterize autism
- Repetitive, “non-functional motor movements or vocalizations that can include hand flapping, rocking, spinning objects, or echolalia”

Neurological basis

- “We don’t know”
- Levels of distress/awareness mostly measured from observation



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Diagnostic Overshadowing & Generalizations

- Overgeneralization of "Stimming": The term "stimming" is broadly used to describe a wide range of behaviors leading to an oversimplification of diverse motor outputs with different underlying mechanisms.
- Diagnostic overshadowing, where the presence of a primary diagnosis leads to the attribution of all symptoms to that diagnosis, might contribute to a lack of nuanced understanding of these behaviors.



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**Critical Take Away:
Not all movement is
voluntary and not all
involuntary
movement is the
same**



Presuming Competence

- The individual has boundless potential regardless of their physical or cognitive differences.
- Challenges assumptions about intellect based on motor outputs and erroneous guesses about "developmental age."
- Recognizes and respects the inherent abilities and capacities of every individual, regardless of their perceived limitations.
- Shifts the focus from deficits to strengths, empowering individuals to explore their limitless potential and participate in meaningful occupations.

Presuming Competence

- Encourages us to see beyond surface-level appearances and stereotypes, valuing each person's unique abilities and contributions.
- Promotes a culture of high expectations and support, fostering a sense of belonging and inclusion.
- Creates opportunities for growth, learning, and self-advocacy, enabling individuals to thrive and succeed in diverse settings.



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The Least Dangerous Assumption

"In the absence of CONCLUSIVE data, educational decisions should be based on assumptions which, if incorrect, will have the least dangerous effect on the student".

Anne M. Donnelan



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The Least Dangerous Assumption

- Vignette



Image by STAR Institute using Canva

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The Least Dangerous Assumption

- Vignette



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**Critical Take Away:
You cannot use IQ
tests to predict
cognitive ability in
any dyspraxic
population**



What does this mean?

- Evaluations should be holistic and establish the “readiness potential of the individual”
- Presume competence (be more age appropriate)
- Don’t condition = coach
- Don’t do it for the child

Supporting Agency and Autonomy by Supporting Motor Mastery

- Enabling our clients to act purposefully on their world on their own terms
- Supporting development of motor mastery through
 - Praxis
 - Posture
 - Motor skill acquisition



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Following the Child's Lead

- Probably means you aren't following what their body is doing
- Means taking time to provide communication supports
- Means introducing the idea that their body sometimes has different ideas
- Means presuming competence and being age appropriate
- Means sometimes getting it wrong and practicing repair



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Thank You
For Your Attention



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