



Brain, Mind, and Voice Therapy Cognitive Science Concepts for Voice Practitioners

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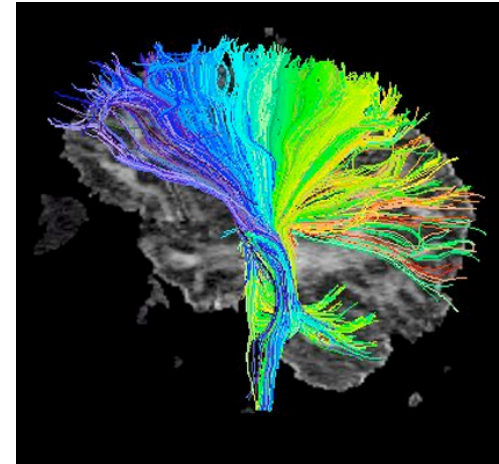
Brain, Mind, and Voice Therapy

No disclosures



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- The nature of the problem
- Overview of cognitive science
- Selected cogn sci concepts that appear relevant to voice work
- Areas for future research



The nature of the problem

- Most voice science to date addresses the "hardware" of the vocal mechanism: laryngeal physiology, local neurology, and acoustics.
- Experientially, however, voice therapy and training seem to require change in the "software," adjusting the client's internal control of a uniquely-hard-to-access region of the body, one that is mediated simultaneously by airway reflexes, emotion, and social identity, as well as communication and/or artistic requirements.
- Voice therapy literature includes some investigations of this "software" but lacks a comprehensive conceptual scheme.
- Perspectives from cognitive science won't answer everything, but may help us ask better questions.



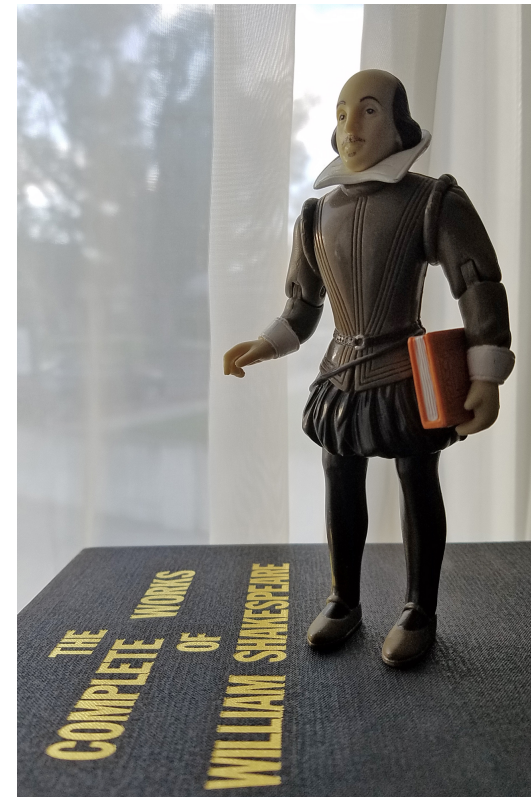
The nature of the problem

Narrative: my first voice lesson

I was 11 years old, and believe it or not, I was a rather quiet, shut-down, shy kid.

But I loved music and drama, so I was thrilled when my family moved to a new city, where there was a theater teacher who rounded up the neighborhood kids every summer to put on a Shakespeare play.

And I got to audition.



The nature of the problem

Narrative: my first voice lesson

A group of kids spent the afternoon in the teacher's backyard—this isn't it, but it looked a bit like this—and we played theater games, read lines, tried stuff.

As it was getting dark, she said that everyone could go home, but she asked me to stay behind.

When things had quieted down, the teacher came over to me and said, thoughtfully, "Now, dear, do you think you could talk louder, without shouting?"

In that moment I felt something turn over, flip over somewhere in the middle of my body.

And when I read the lines again, I was, indeed, talking louder, without shouting.

I got a big part in the play.



The nature of the problem

Narrative: my first voice lesson

*Here I am the next year, age 12,
playing Ariel in The Tempest.*



The nature of the problem

*And here I am decades later, still asking: **How did that happen?***

How did a simple verbal cue, to “talk louder without shouting,” trigger such a profound change in a part of my body (probably my diaphragm) that I didn’t know I had?

- What was going on between the words, or behind them?
- Why do our cues to our clients sometimes seem to “land,” or “get in,” easily, just as in that moment?
- And why is it that sometimes we (and our clients) can’t quite access the place that needs to change, even though we try every cue we can think of?



The nature of the problem

- What “place,” in the client’s processing, are we even aiming to reach?
- Voice clinicians talk in general terms about psychology, motivation, and “unknown constraints.”
- We’re starting to talk about self-efficacy and locus of control.
- My questions are, control of what?
- How does vocal software work, to allow that person to change, from the inside, the mechanics of their vocal hardware?



The nature of the problem

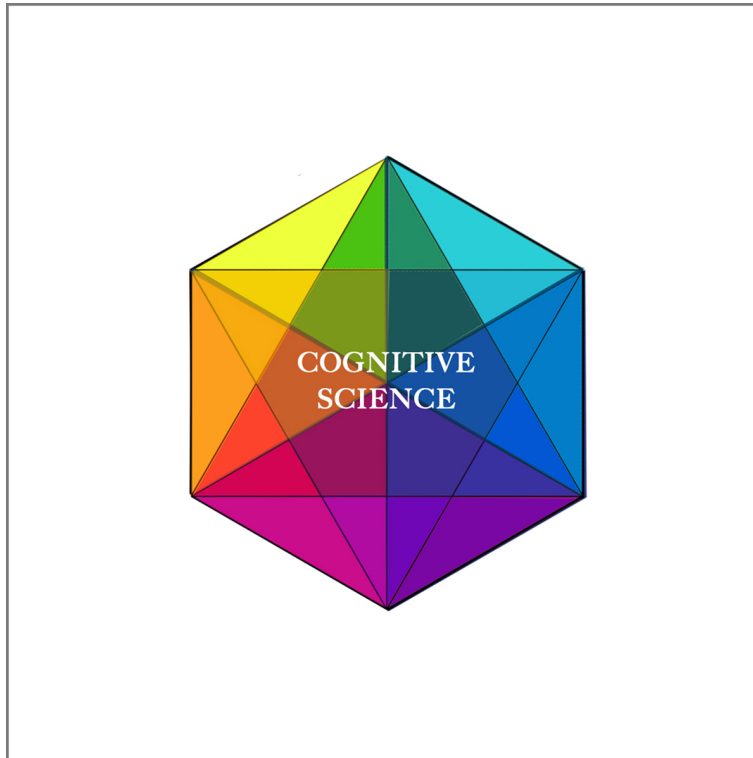
"Functional dysphonias ... [straddle] the territory between mind and body, and that's a territory medicine has a difficult time with right now."
Dr. Nelson Roy, NPR, 2010

- If territory between mind and body is where many disorders “live,” it is also where we work, and we need to understand it.
- Territory is not entirely uncharted;

Cognitive Science is already there.



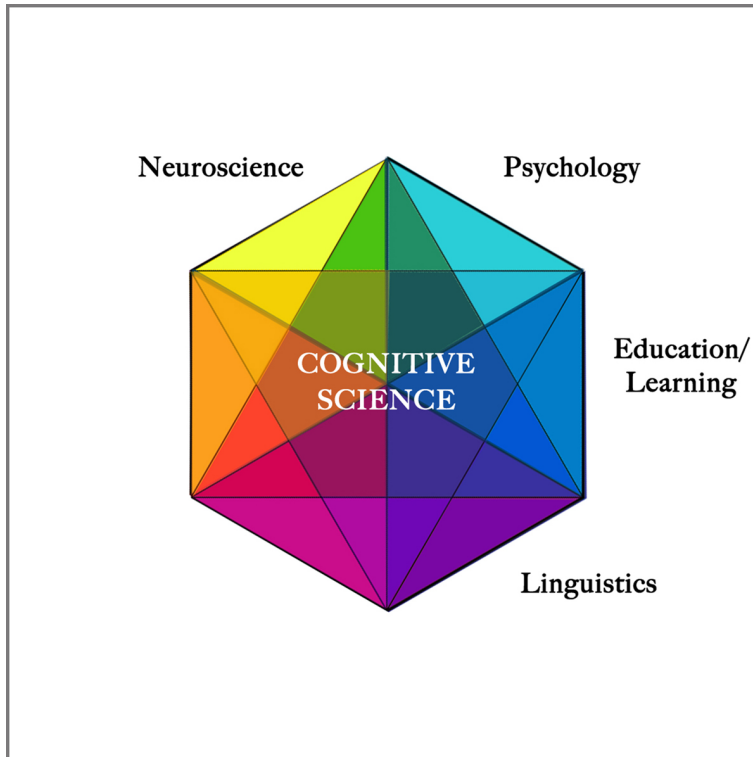
Overview of Cognitive Science



What is Cognitive Science?

cross-disciplinary
investigation of the
nature of mind
(cognition)

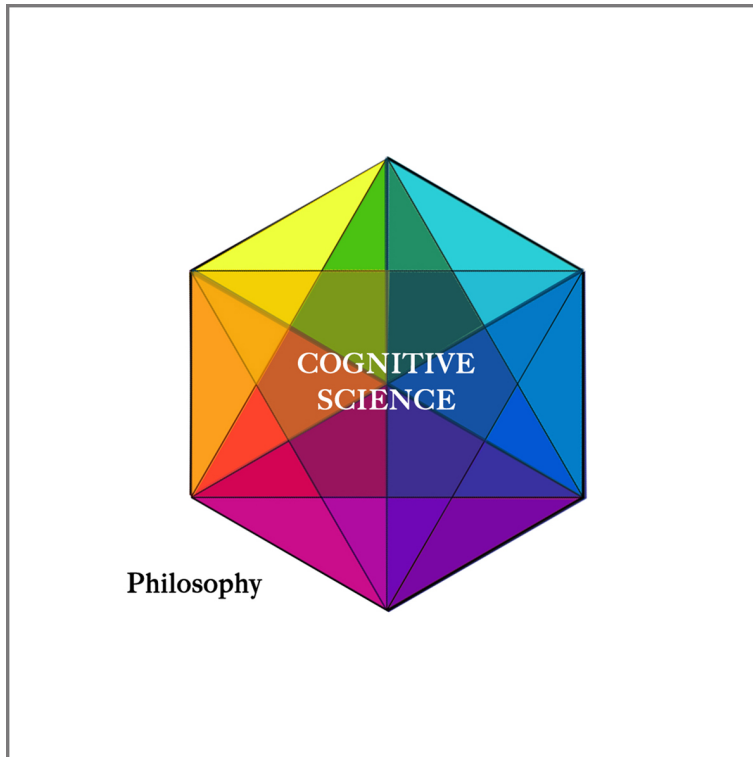
Overview of Cognitive Science



Contributing disciplines that are familiar to SLP:

Neuroscience
Psychology
Education/Learning
Linguistics

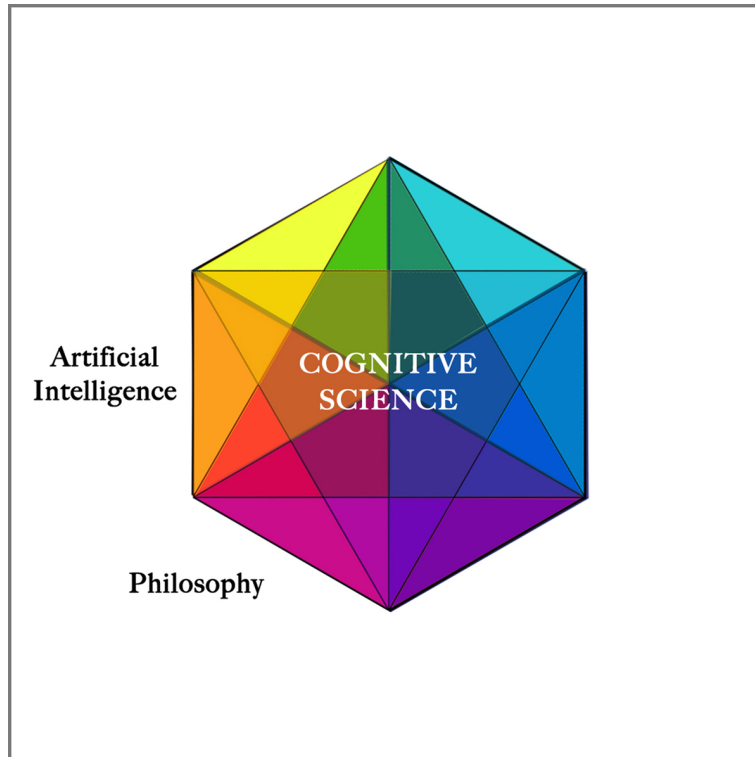
Overview of Cognitive Science



Contributing disciplines that are unfamiliar to SLP:

Philosophy
(subjective investigations of what happens when we think, feel, sense, reason, and come to know things)

Overview of Cognitive Science

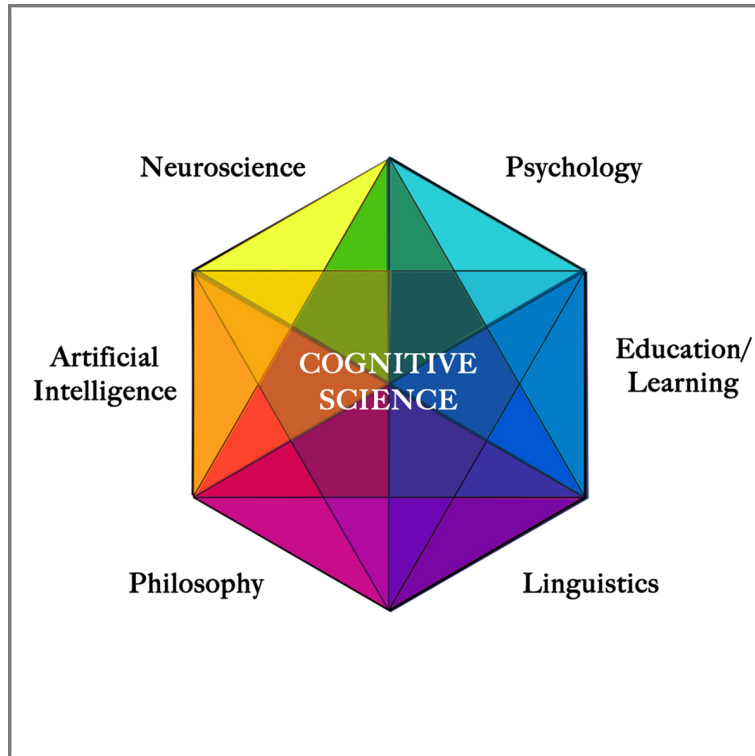


Contributing disciplines unfamiliar to SLP:

Philosophy

Artificial intelligence (AI)
(computer simulations and extrapolations of thinking, perception, and information processing)

Overview of Cognitive Science



Together, these fields view the same cognitive phenomena from different perspectives and with different tools:

- direct witness
- behavioral observations
- brain imaging (Damasio, 2010)

Their emerging, integrated evidence challenges traditional clinical assumptions:

- Inter-relationship of body (brain) & mind
- Reconciliation of subjective & objective points of view.

Overview of Cognitive Science

One working group's definition of mind:

*"Mind is an **embodied** and **relational** process that regulates the flow of energy and information."*

(Siegel, 2010, emphasis added)



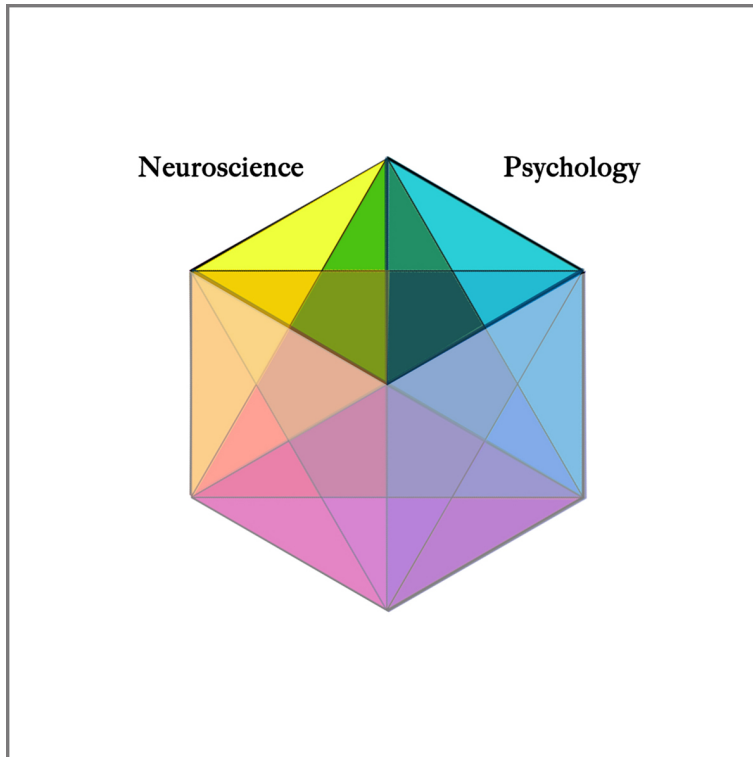
Overview of Cognitive Science

Selected areas from cognitive science that appear relevant to voice therapy:

- Re-valuing the parasympathetic NS
- Embodied cognition
- Interpersonal neurobiology
 - Clinical empathy
- Voice as a Neurophysiological Signal



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Re-valuing the
Parasympathetic NS

Re-valuing the parasympathetic NS

- Partner to sympathetic "fight/flight/freeze" system
- "Rest/digest" system involved in nutrient absorption, cellular repair, sleep; internal "housekeeper."
 - Subjective association: safety, receptivity, satiety, pleasure.
- Not the opposite of sympathetic NS, but a separate, complementary axis of regulation.
 - *Increased parasympathetic activity* is distinct from *decreased sympathetic activity*, such as simple muscle relaxation.
- Hot topic in psychotherapy: anxiety management; trauma recovery; stage fright (Brennan, 2014).



Re-valuing the parasympathetic NS

Possible application: vocal cool-down as a whole-body activity, to activate PNS for rest/recuperation.

Example: USC theater professor Lauren Yeoman, at local PAMA conference: vocal cool-down routine developed by experience, that seemed to decrease reported fatigue and injury when her students went through their most-demanding multiple-shows-at-once final project.

- Vocal components: familiar humming, trills, gentle phonation
- Other components:
 - Whole-body activities: gentle shaking, rocking, tapping self-massage of limbs, trunk, face
 - Affective cues: pleasure, enjoyment of vibration, appreciation of recent performance, self-reassurance. (Yeoman, described in Cazden, 2017)



Although chosen subjectively/experientially, each of these components aligns with known ways to activate PNS.

Did enhanced PNS activity improve student's cell repair, improve sleep, or otherwise enhance whole-body restorative processes?

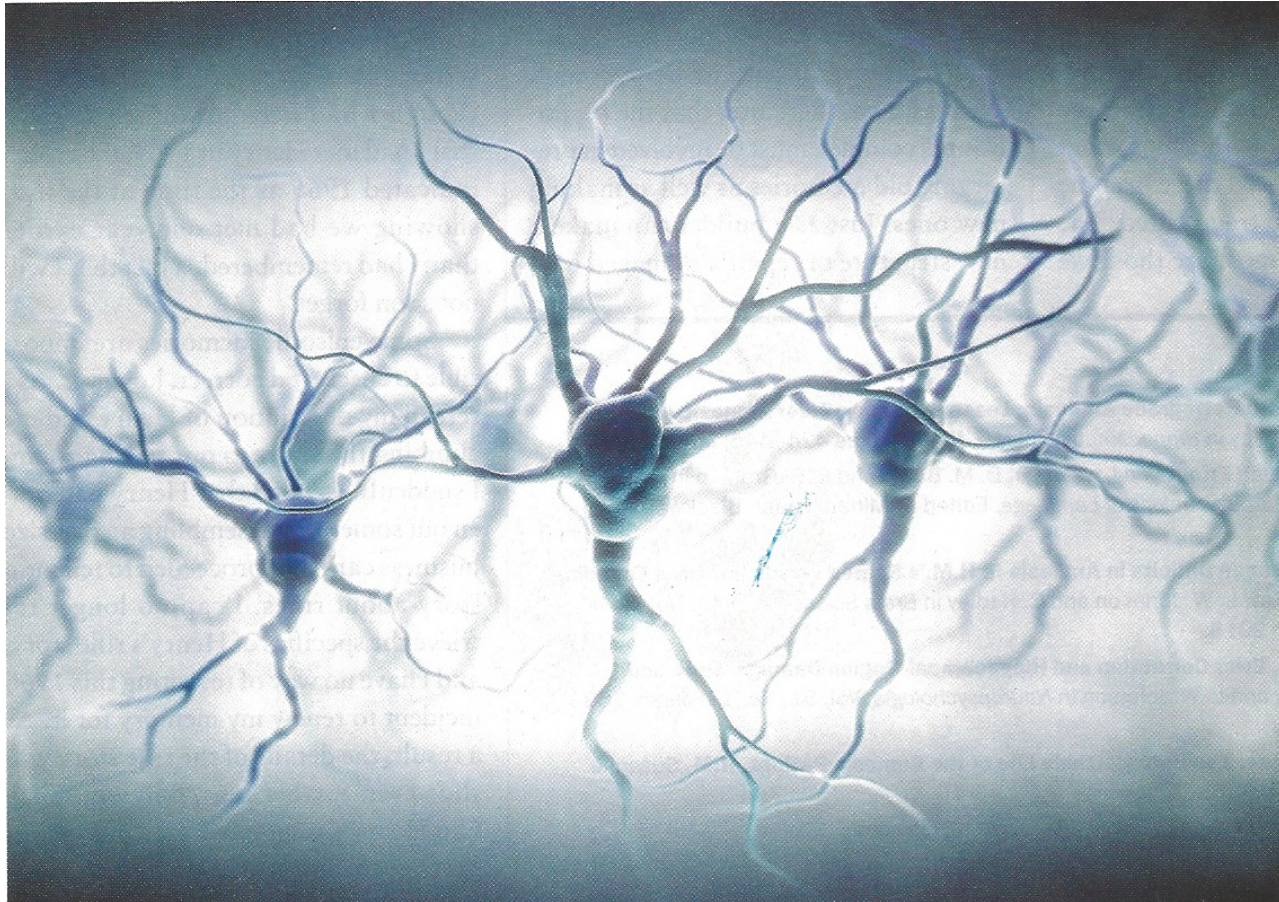
Re-valuing the parasympathetic NS

More regarding PNS, of possible relevance for voice work:

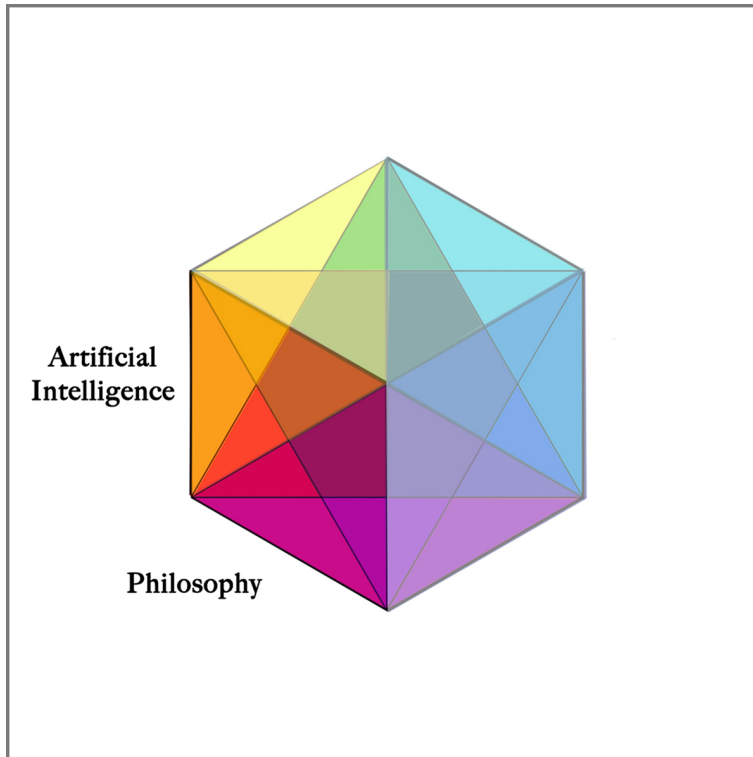
- Primary mediator of PNS is the vagus nerve, CNX. Laryngeal and pharyngeal branches are CNX's only somatic bundles, otherwise it is autonomic.
 - Implication: laryngeal/pharyngeal function may receive close cross-talk from parasympathetic system, and ANS in general. (Porges, 2011)
- Parasympathetic NS function has been linked to interpersonal communication:
 - Physiological measure of PNS activity and flexibility across situations, aka vagal tone, is associated with better communication skills including voice/speech (ibid).
- Subjective descriptions of “stage presence” appear to correspond to enhanced co-regulation of sympathetic and parasympathetic systems, both at heightened levels; relevant to vocal performance and to public speaking skills. (Cazden, 2017)



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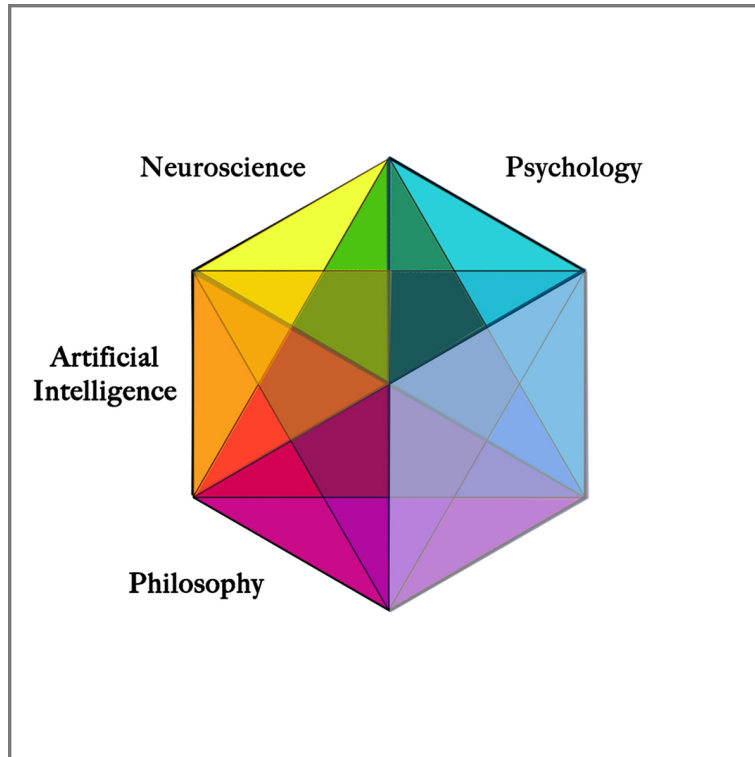
Embodied Cognition *(mind as embodied)*



- Origin in 19th C. philosophical school of phenomenology
- Used in 20th C. to distinguish human intelligence from AI.



Embodied Cognition (*mind as embodied*)



- Now incorporating psychology and neuroscience: all agree

The mind knows it has a body.

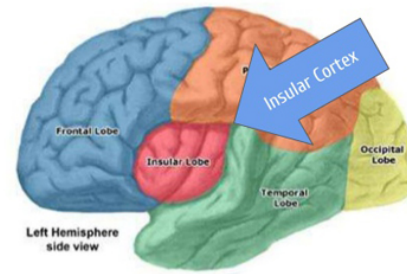
- Challenge to traditional divide between body & mind that still dominates clinical assumptions and practice.
- Evidence from many fields indicates that the “territory between” mind and body is full of communication and inter-relationship.

Embodied Cognition

Embodied nature of the mind is evidence-based.

- The embodied self (bodily aspect of identity) is localized in the brain: the insula.

The Insular Cortex



- Individual sense of embodiment is malleable:
 - May be disregulated/ disconnected from conscious awareness by trauma (“dissociation”)
 - May be enhanced, and made more available to consciousness, by mind-body practices.

(Fogel, 2009; Johnson, 1995)

Embodied Cognition in Voice Assessment

Gallagher, 2005: Individual experience of embodiment includes:	Note that initial voice interview commonly includes:
Perceptual (sensory) experience of body	What sounds bad or feels bad?
Conceptual understanding or beliefs about body, influenced by culture or subculture	What does patient think is happening? (what do they think caused it; who/what do they trust to fix it)
Personal, emotional attitude toward one's body	How does patient feel about disorder? (affect/ distress/ handicap)



Embodied Cognition

Alternative formulation: "The subjective body"

"The term 'body' can mean the biological organism as a whole ... referred to as IT ...[this] is the commonly accepted scientific view. ...But 'body' can also mean, and for the average person does mean, the subjective feelings, emotions, and sensations of the felt body ...[which] includes vital feelings and sensorimotor awareness, and is experienced as *I*." (Wilber, 2000)

Conjecture: The "software" or target of voice therapy—the locus of change—involves this *subjective body*, where client's cognition, belief, sensation, affect, and social identity meet.



Embodied Cognition in Voice Therapy

Corollary: voice therapy may commonly include internal cognitive goals—such as directed focus of attention, and up/down sensory regulation—alongside external, behavioral goals.

- Cognitive change may occur before, during, or after change in behavior
- Cognitive component of therapy is not suggested here as a pre-requisite, but as a co-requirement or co-phenomenon.
- These cognitive goals or processes may or may not be communicated overtly to the client.



Embodied Cognition in Voice Therapy: examples

<p>De-sensitization, dialing down and/or re-framing of familiar sensation (Irritable larynx syndromes)</p>	<p>Heightened awareness (dialing up) of unfamiliar sensation (Overuse dysphonias, MTD, LSVT)</p>
<ul style="list-style-type: none">•Distraction from discomfort•cognitive re-interpretation of discomfort (“feels like phlegm but isn’t”)•Cognitive-behavioral over-ride of reflexive responses to discomfort	<ul style="list-style-type: none">•Recalibrating effort-level (confidential, flow, SOVT, LOUD)•Directed attention to vibrotactile self-feedback plus optimal effort-level (LMRVT)•Others: sense and retrain<ul style="list-style-type: none">•Body position/posture•Breath management

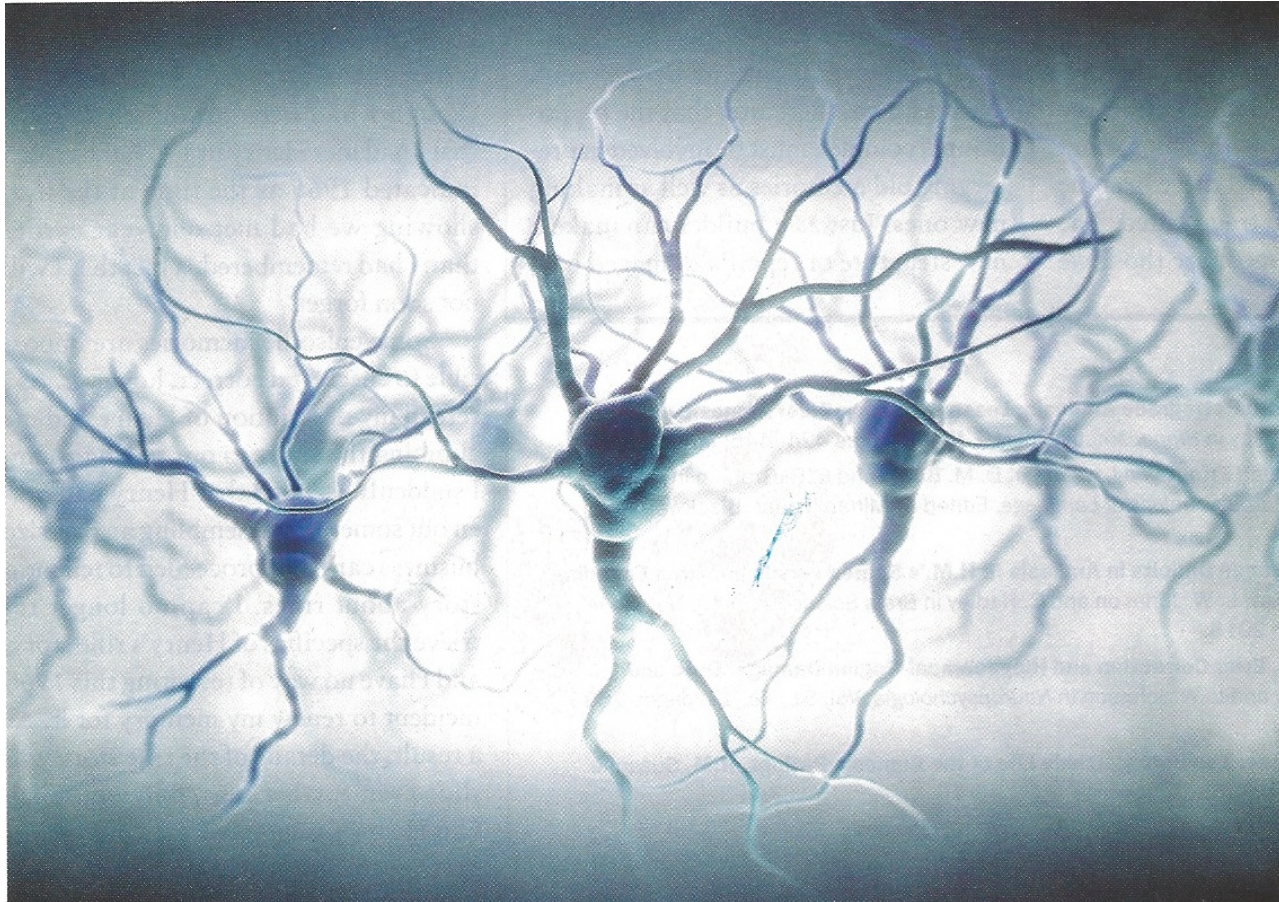
Embodied Cognition in Voice Therapy

Concept of embodied cognition may help us understand the components of voice therapy that involve sensation, focus of attention, and conscious change in internal regulation.

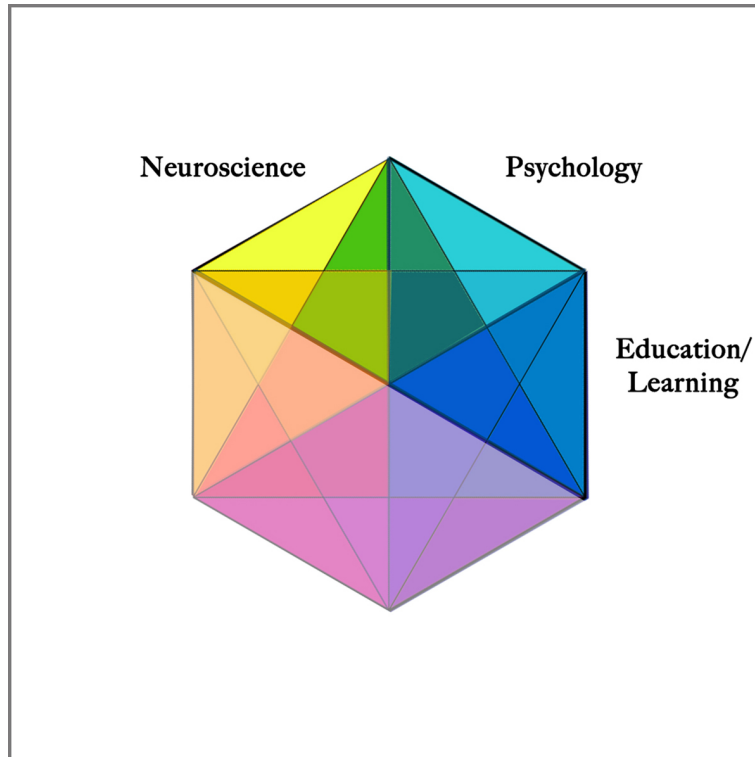
- Additional relevance of embodiment concept:
 - Body senses are processed in present time; psychological terms include “groundedness, presence.”
 - Cues to attend to present sensation can interrupt rumination on past (what caused this, was diagnosis correct) or future (what-ifs; treatment options outside the room).
 - Linguists Lakoff & Johnson (1990) associate embodiment with metaphor, positing sensations of body as the ultimate (most familiar) domain of meaning, and the root of abstract concepts.
 - May illuminate some uses of metaphor/imagery in vocal arts training.



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Interpersonal Neurobiology *(mind as relational)*

"The ways in which [social] relationships and the brain interact to shape our mental lives." (Siegel 2012).

- Cognition is not just mind +body; also self+other.
- People respond to each other at deep physiological levels, some of them measurable.

Interpersonal Neurobiology *(mind as relational)*

- Interpersonal dynamics formerly described in subjective terms are found to have objective correlates.
 - perceived good/bad communication corresponds to neurobiological coherence/discongruity.
- Hot topic across psychotherapy; see Norton book series.
- Major subtopic: EMPATHY.



Interpersonal Neurobiology: Clinical Empathy

- Throughout medical care: patient perception of empathy leads to improved compliance & outcomes. (Verdolini Abbott, 2009)
- Perception of empathy from MD may even impact patient's immune system: URI example (Ackerman, 2010)
- Increasingly included in medical training. (Cleveland Clinic 2017)
- Validated scales/scores are available.



Interpersonal Neurobiology: Clinical Empathy

Empathy is linked to embodiment.

- Some aspects of empathy are processed through insula.
- Clinician's sense of embodiment appears to increase capacity for empathy, and increases perception by others that we are empathic.

"People who are more aware of their bodies have been found to be more empathic. The insula is key: when we can sense our own internal state, the fundamental pathway for resonating with others is open as well."

(Siegel, 2010)



Interpersonal Neurobiology: Clinical Empathy

- Traditional SLP training of "rapport" occurs through (brief) didactic material and individual supervision;
 - Not formalized or given conceptual frame.
- Cognitive science offers new training models;
 - Empathy can be enhanced by both
 - subjective (self- development) practices
 - objective (data-driven) practices.



Empathy Training

Subjective mode:

Capacity for empathy, and perception of empathy, are related to embodiment, which is enhanced by mind-body practices.



- Clinicians' personal use of embodiment practices outside of the therapy setting:
 - May increase our capacity for empathy, and perception of it
 - May improve patient receptivity and compliance, therefore
 - *May improve clinical outcomes.*

Empathy Training

Objective mode:

Pilot study of empathy training in ENT residents (Reiss et al, 2011)

- Didactic material on neurobiology of communication, plus
- Viewing of videotaped doctor-patient interactions with real-time, streaming data of neurobiological markers in both people
- Recognizably easy/difficult conversations were thus associated with data showing physiological congruence/disconnection.
 - Evidence-basis of training was well-received
 - Empathy scales improved
 - Initial trend toward increased patient satisfaction.



Empathy Training

”An empathy and relational skills protocol focusing on the neurobiology and physiology of emotions ... augmented the concept of “being nice” by demonstrating the specific physiological and ameliorative effects on autonomic nervous system activity produced by empathic skills.”

(Reiss et al, 2011)



Interpersonal Neurobiology: Clinical Empathy

- Psychotherapy literature “common factors:” empathy and self-regulated ‘presence’ may be as important as any particular skill, technique, or school of practice.

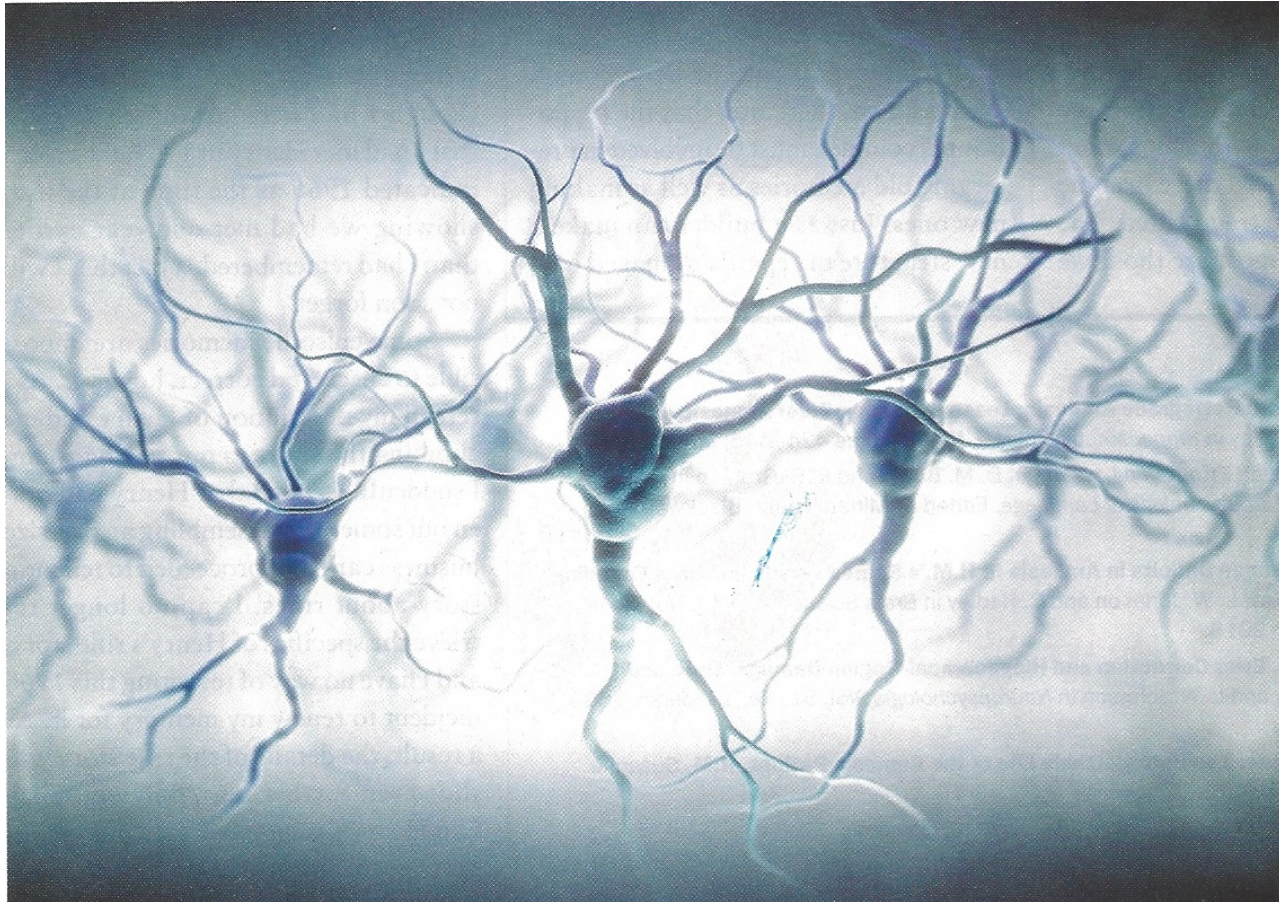
“Alignment of our conceptual self-awareness and our embodied self-awareness....makes us a **psycho-biological co-regulator** [who enhances] a sense of safety in the relationship and in the body ...helping the [client] to maintain homeostasis in the subjective present.”

(Fogel, 2009)

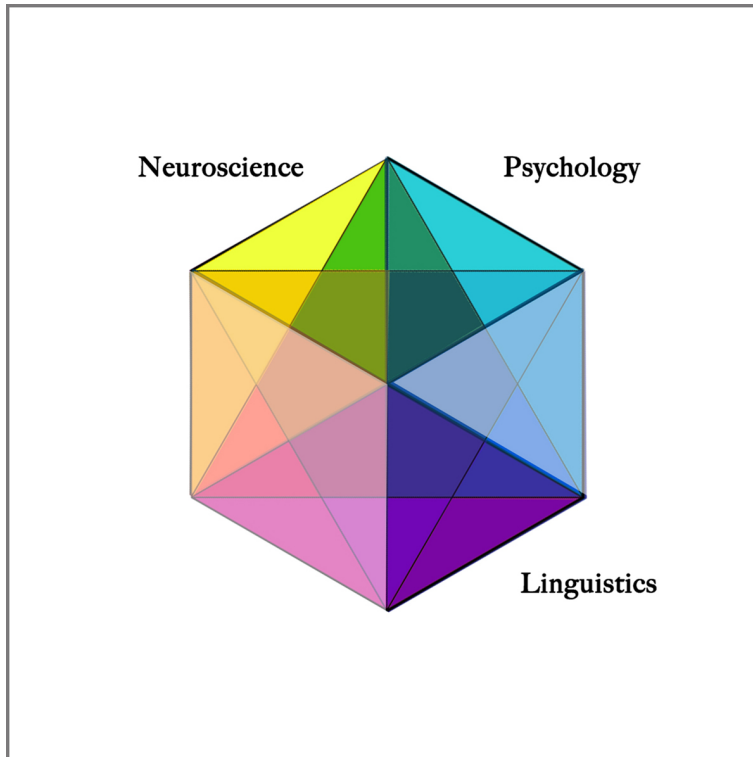
- Voice therapy can seem very personal, sensitive, unfamiliar, weird, scary to patients; therefore clinical empathy and self-regulated ‘presence’ appear highly relevant to outcomes.



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Voice as a
Neurophysiological
Signal

Voice as a Neurophysiological Signal

- Di Cesare, G. et al (2016) found that processing of “tone of voice” involves the insula (among other areas).
- Porges (2011): autonomic fibers of the vagus nerve influence laryngeal branch (close anatomy =>probable crosstalk); this may help to explain the "visceral" impact of voice on listeners.

“The voice is a transparent indicator of our physiological state and an extremely (if not the most) potent trigger of the physiological states of others.”

(Porges, personal communication May 2016)

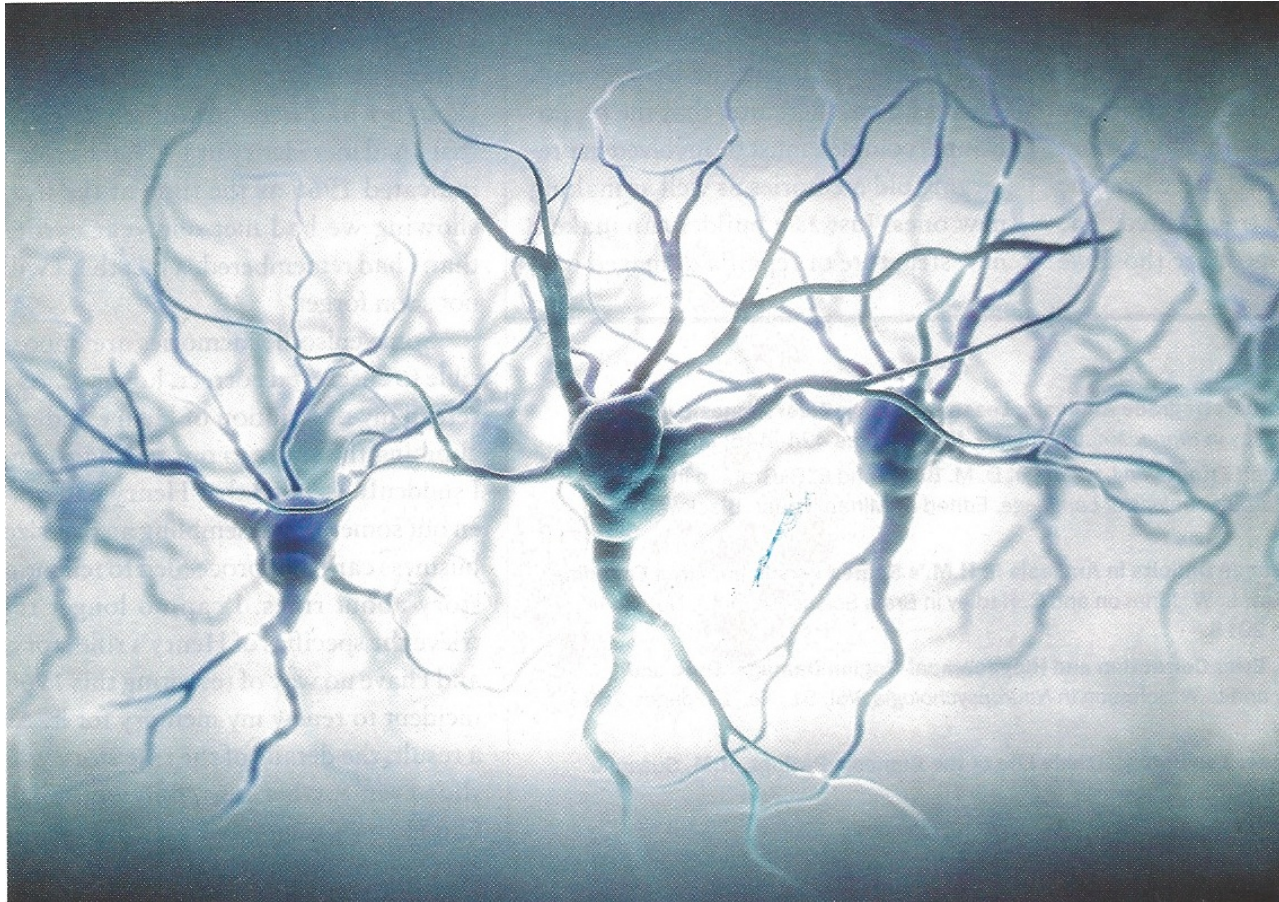
- These show emerging suggestions of structural as well as experiential links among perception of voice, listener's embodied experience, and listeners’ empathic connection to the psycho-physiological state behind that voice.

Voice as a Neurophysiological Signal

If I go to a concert because of “how the singer makes me feel,” are we approaching an explanation of this phenomenon, via interpersonal neurobiology?

- Hypothesis: there may be an identifiable (probably complex) pathway through which listener perceives a vocal signal, processes it at an autonomic level, and empathically re-embodies the speakers’ or singers’ internal state.
- Elsewhere in cogn sci: well-documented “Mirror Neurons” link *visual* processing to *motor* response.
- Hypothetical network linking *auditory* processing to *visceral* response would be conceptually parallel but structurally and functionally different; suggest the term **“Echo Neurons.”** (Cazden, 2017)

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So what happened in my early voice lesson?

- Did teacher present a nonverbal model of diaphragmatic breathing that I simply copied, without consciously knowing how?
- Did teacher's ANS communicate to mine, via empathic neurobiological signals?

Symp: It's urgent that I do what she wants.

Parasymp: It's safe here, OK for me to try something unknown.

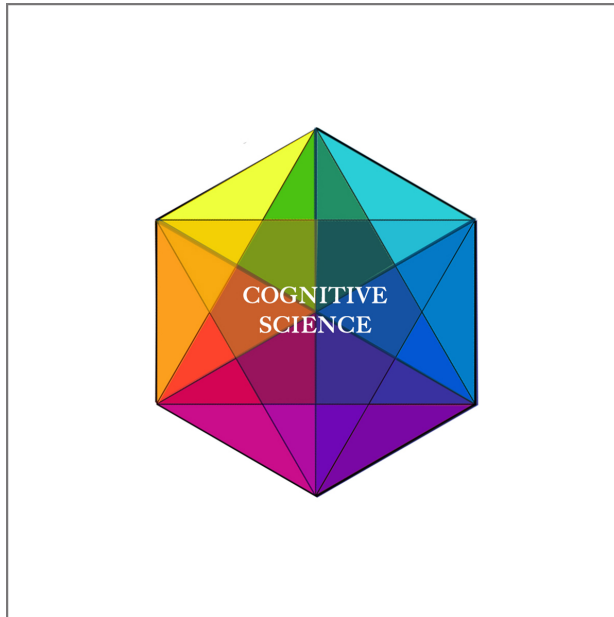
- Or do we just shrug and call this “instinctively good teaching” —the right words and tone of voice for the right client at the right time?

I'm OK not knowing; but we and our clients would benefit from more understanding of these breakthrough training moments, as well as understanding those that are less successful.



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Some Questions for Future Research



Parasympathetic NS:

- Can whole-body cool-downs oriented toward systemic recovery (PNS) help prevent vocal injury?

Embodied cognition:

- Does the concept of the subjective body help us to understand patient's experience and the challenges of voice therapy?

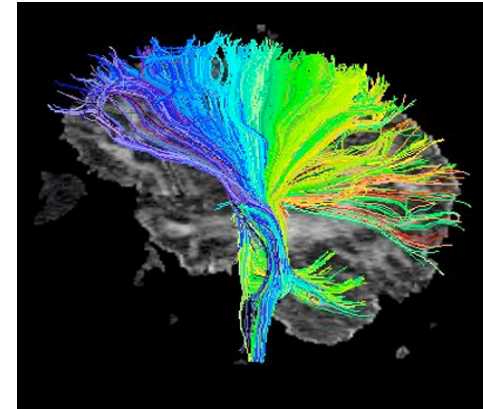
- Can we move beyond strict behaviorist model (internal processing as unknowable black-box), to recognize and investigate cognitive processes (adjustments to internal attention and to sensory regulation) that appear to be involved in vocal change?

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Some Questions for Future Research

Interpersonal Neurobiology:

- Can we improve and formalize empathy training for SLPs, in order to improve outcomes?

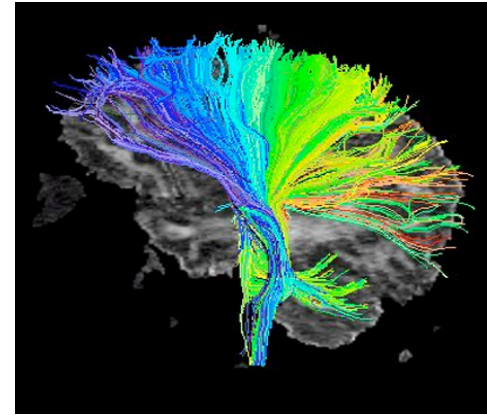


- Do “clinician variables” include our own practice of mind-body activities outside the therapy room, enhancing our embodied empathy, and thereby helping the client to feel grounded and safe enough to enter a process of altering their own subjective body?

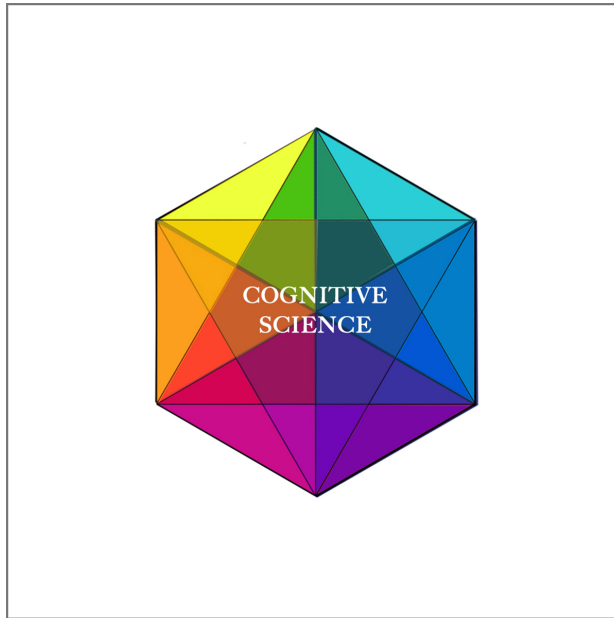
Brain, Mind and Voice Therapy Some Questions for Future Research

Voice as a Neurophysiological Signal:

- How is the insula involved in vocal production as well as perception?
- Is there a functional relationship between the autonomic vagus and its somatic-laryngeal branch?
- Is there an “Echo Neuron” network of auditory-to-visceral connections, that could help to explain the unique power of vocal communication and vocal performance?



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Summary:

- Roy's "territory between mind and body" re-emerges as a territory of co-regulation and complex inter-relationship, which is already beginning to be understood.
- Insights from cognitive science may help to illuminate “soft skills” of therapy that have seemed unexplainable or “off-limits,” and to add useful new questions.

Suggest cognitive science as the next frontier of voice science.

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Thank you

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