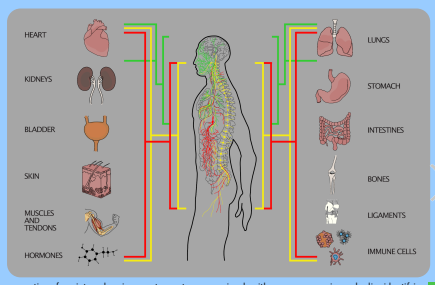
POLYVAGAL THEORY

Our autonomic nervous system scans our inner and outer environment for signs of safety, danger or life threat through neuroception. Neuroception facilitates the autonomic nervous system's evaluation of risk and initiation of autonomic survival responses without conscious awareness. The autonomic nervous system broadcasts feelings of safety, danger or life threat to other people/animals. These signals are exchanged primarily by vocal prosody, facial expressions, posture, and body gestures. The autonomic responses shape our physiological state, which in turn shapes our experience of reality. Autonomic responses affect how we perceive ourselves, what we feel and think, how we interpret the world, and our behavior. Our physiological states (behavior neuro platforms) filter and shape our reality by influencing and/or distorting our experiences, perceptions, and behaviors. When we experience safety, we see, hear, and feel differently than when we experience danger or life threat.

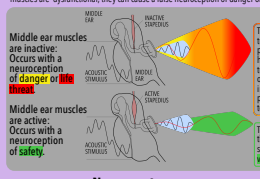
NEUROCEPTION - Inner Environment



The neuroception of our internal environment operates unconsciously with sensory nerves in our bodies identifying safety (function), danger/life threat (dysfunction) in the vital body systems, such as digestion, respiratory, circulatory, infections/viruses, and damage to our body such as bones, skin, and muscles. These signals travel along the vagus nerve and adjust our vital functions like body temperature and heart rate to adapt to the current perceived opportunity or threat. This shift in physiology triggers autonomic survival strategies that drive our thoughts, feelings, and actions. (see the grey Autonomic Response panels in the bottom half of the chart). Approximately 80% of vagal fibers are sensory (afferent), transmitting sensory input from the viscera to our brain stem. 20% of vagal fibers are motor (efferent), sending action information from the brain stem to our body. Therefore, our gut has a much more significant influence on our autonomic physiological/psychological state than our conscious mind.

MIDDLE EAR MUSCLES:

Our auditory system is the primary way our autonomic nervous system evaluates safety, danger, or life threat in our outer environment. Our middle ear muscles control the tension on the eardrums and change our sound perception. When these muscles are dysfunctional, they can cause a false neuroception of danger or life threat.



Sound Neuroception

The middle ear is less able to hear human voices and instead is tuned to hear low-frequency sounds associated with danger and predators. A chronically shut off stapedius will cause auditory hypersensitivities and a faulty neuroception of danger or life threat, turning off the vagal brake and activating the sympathetic gas pedal or the vagal emergency brake. An inactive stapedius is often present in conditions like autism, mental disorders, chronic disease, chronic pain, and PTSD. Dr. Porges pioneered the Safe and Sound Protocol to correct a chronically inactive stapedius.

The middle ear is tuned to hear high-frequency sounds and activates the higher brain structures associated with safety and human speech. Consequently, when the stapedius turns on, it activates the vagal brake and allows for feelings of safety and pro-social behaviors.

Neuroanatomy

Phylogenetically Newer Circuits Inhibit Phylogenetically Older Circuits
The ANS Faces Challenges Using The Newest Circuits First

Ventral Vagal Complex

Social Engagement System, States of Safety

Parasympathetic Nervous System

Neuroprotection

Myelinated Vagus to Internal Organs Above the Diaphragm - Heart and Lungs

Smart Vagus, Mammalian Vagus

Phylogenetically Newest Circuit

Cortex, Brainstem, Paraventricular Nucleus, Nucleus Ambiguus

Cranial Nerves V, VII, IX, X, XI

The Muscles of - Mastication, Middle Ear, Facial, Larynx, Pharynx, Head-Turning, Hearing, and Bronchi

The Vagal Brake - is a metaphor that reflects the inhibitory influence of ventral vagal pathways on the heart in response to a neuroception of safety. It slows the heart's pacemaker's rate below its intrinsic level. Furthermore, the vagal brake inhibits the influences of the phylogenetically older circuits of fight/flight, freeze, and shutdown. When the vagal brake is engaged, it has a calming effect on the autonomic nervous system supporting homeostasis by optimizing sympathetic and dorsal vagal circuits to support social bonding, health, growth, and restoration.

Sympathetic Nervous System

Mobility -Torso and Limbs

Activation - Fight/Flight

Sympatho-Adrenal (HPA axis)

Cortex, Brainstem, Spinal Cord

Phylogenetically Second Oldest Circuit

The SNS Gas Pedal - is a metaphor that reflects a withdrawal of the VVC and the activation of the SNS fight and flight behaviors in response to a neuroception of danger.

Dorsal Vagal Complex

Immobility/Freeze, Shutdown

Parasympathetic Nervous System

Unmyelinated Vagus to Organs Below the Diaphragm

Vegetative Vagus

Phylogenetically Oldest Circuit

Brainstem

The Vagal Emergency Brake - is a metaphor that reflects the inhibitory influence of the DVC on the heart in response to a neuroception of life threat. It suppresses the sympathetic gas pedal and when it is engaged, our heart rate and blood pressure drop, activating reptilian survival strategies like death feigning.

Autonomic Response

Behavior	Feeling/Thoughts
Open, Friendly, Concerned Face **Conciliatory Prosodic Voice with an Appealing Inflection/Rhythm** Pupils - Smaller Eye Lids Alternate Tense/Relaxed Eyes Moist Friendly/Concerned Prosodic Voice Relaxed, Alert Body while Social Skin - Rose Hue, Slightly Sweaty Good Understanding of Human Speech Rational, Empathetic, Nervous Voluntary Behavior - Available Top-Down Self-Regulation **Seeks Out Reciprocal Responses From Others** Fawning to Gain Favor Spontaneously Seeks Alliances Soothes Distress in Others Seeks Common Ground	**Safety Mixed With The Anticipation Of Threat** Desire for Affiliation, Bonding Desire for Soothing Physical Contact Desire to Sooth Others Desire to Form Alliances Desire to Repair Alliance Blends in with Group, Environment Cautiously Friendly Seeks Social Support **Story/Personal Narrative** I Can Resort Peace/Harmony I Can Understand/Be Understood I Want To Belong

Vital Signs

Frontal Cortex - On Heart Rate – Slightly Elevated Slight SNS Activation Relaxed, Measured Breath Blood Pressure – Slightly Elevated Immune Function - High Visceral Homeostasis	Digestion - On Feet/Hands - Warm Mouth – Less Moist Oxytocin, Norepinephrine 5-Hydroxytryptamine Parvocellular Vasopressin

Please/Appease/Negotiate

YES ⟵ Can I Please/Appease/Negotiate To Create Safety? ⟶ NO

Yes ⟵ Am I Safe? ⟶ I'm Not Sure

Vagal Brake Turns Off → The SNS Gas Pedal Turns On

The Vagal Brake Turns On → The SNS Gas Pedal Turns Off

Safety

Social Engagement

Play

Intimacy

Personal Neuro Profile Filter

Our neuro profile filter modifies our adaptive autonomic responses by comparing sensory cues against past experiences, both supportive and traumatizing. If we have trauma triggers, they can cause maladaptive neuroception. Maladaptive neuroception can detect risk when there is no risk or identify safety cues when a risk exists, causing maladaptive responses to our environment.
(see the Adaptive and Maladaptive box to the right)

Very Safe — Vagal Brake ON

YES ⟵ Am I Safe? ⟶ I'm Not Sure

Vagal Brake On - Secure Safety

Activates pro-social behavior like play and intimacy by inhibiting the HPA axis and the older evolutionary circuits of fight/flight, freeze, and shutdown. It allows the heart to speed up without activating the SNS gas pedal and the heart to slow down without activating the DVC vagal emergency brake.

Safety mixed with mobility and immobility (All Left Panels)

Very Safe ⟵ Safe ⟵ Less Safe

Vagal Brake ON

YES ⟵ Can I Appease/Persuade/Negotiate to Create Safety? ⟶ NO

Vagal Brake Tentatively On - Concerned About Safety

Activates social survival behaviors designed to restore safety.

Safety mixed with anticipation of threat (Top Panel)

Safe ⟵ Less Safe ⟵ I'm Not Sure

Vagal Brake OFF — Not Safe

SNS Gas Pedal OFF — Danger Turns OFF

SNS Gas Pedal ON — Danger Turns ON

YES ⟵ Can I Fight Off Or Avoid Danger? ⟶ NO

Vagal Brake Off, SNS Gas Pedal On - Danger

Activates sympathetic survival behaviors to confront or escape danger.

The SNS gas pedal turns on the HPA axis - adrenaline and cortisol.

Danger mixed with mobility (Top Right Flight/Flight Panels)

Vagal Emergency Brake OFF — Life Threat Off

Vagal Emergency Brake ON — Life Threat Turns On

YES ⟵ Can I Hide Or Disappear From Life Threat ⟶ NO

SNS Gas Pedal Off, Vagal Emergency Brake On - Life Threat

Activates dorsal vagal behaviors to escape life threat.

Life Threat mixed with immobility (Right, Bottom Freeze ,or Shutdown Panels)

Trauma Or Death

Ventral Vagal Parasympathetic Safe While Socially Connected

Sympathetic

Safe Mobile

Unsafe Mobile

Dorsal Vagal / Parasympathetic

Safe Immobile

Unsafe Immobile

Danger Life Threat

Fight

YES ⟵ Can I Fight Off Danger? ⟶ NO

Flight

SNS Gas Pedal Turns ON

YES ⟵ Can I Avoid Danger? ⟶ NO

SNS Gas Pedal Turns OFF — Vagal Emergency Brake Turns ON

Freeze

YES ⟵ Can I Hide From Life Threat? ⟶ NO

Shutdown

YES ⟵ Can I Disappear From Life Threat? ⟶ NO

Trauma Or Death

Adaptive and Maladaptive Neuroception

There is no such thing as wrong or inadequate autonomic responses, just the adaptive responses that enable survival. As long as we survive, our body/neuroception chose wisely. However, in the absence of skills and resources for recovery, threat states often have residual adverse effects on our health. Ideally, our neuroception is agile enough to turn on the most appropriate autonomic survival strategies in response to internal and external environmental challenges. For example, healthy neuroception allows us to go into fight/flight, freeze, or shut down, then, as soon as the danger is gone, we will switch back to states of safety. Therefore, behavioral state flexibility is what determines resilience.

Consequently, people who have a maladaptive social engagement system will be unable to activate defensive strategies in an unsafe environment and fail to activate pro-social behaviors in a safe environment. The resulting autonomic maladaptive responses may include moving towards relationships with abusive people and avoiding kind loving people. The consequences of being stuck in states of danger/life threat and spending little or no time in states of safety are chronic diseases, psychiatric disorders, and chronic pain.

Autonomic Response

Behavior	Feeling/Thoughts
Open, Friendly Facial Expression **Friendly Prosodic Voice with an Appealing Inflection/Rhythm** Face to Face Interaction/Eye Contact Pupils Smaller Eye Lids Relaxed, Eyes Moist Relaxed Body while Social Head-Turning - Smooth and Relaxed Skin - Rose Hue, Dry Good Understanding of Human Speech Rational and Empathetic Voluntary Behavior - Available Top-Down Self-Regulation **Reciprocal, Synchronous Behaviors** Spontaneously Seeks Connection Social Cooperation	**Safe While Social** Friendly Open Trusting Desire for Connection Cooperative **Story/Personal Narrative** I Want Connection With Others

Vital Signs

Frontal Cortex - On Heart Rate - Resting Relaxed Breath, Often into Belly Blood Pressure - Normal Immune Function - High Visceral Homeostasis	Digestion - On Feet/Hands - Warm Mouth - Moist Oxytocin, Norepinephrine 5-Hydroxytryptamine Parvocellular Vasopressin

Behavior	Feeling/Thoughts
Excited, Friendly Face **Energized Prosodic Voice with an Appealing Inflection/Rhythm** Face to Face Interaction/Eye Contact Pupils Widening,Eyelids Toned Eyes Moist Relaxed Body In Motion Head -turning - Smooth and Fast Skin - Rose Hue, Flushed, Sweaty Good Understanding of Human Speech Rational and Empathetic Focused, Problem Solving Skills Voluntary Behavior - Available Top Down Self-Regulation **Reciprocal, Synchronous Behaviors** Cooperation, Sports Deep Learning, Work Art, Dance Foreplay and Sex	**Safe While Mobile** Excited Motivated Curious Creative Bold Courageous **Story/Personal Narrative** I Can Do It! We Can Do It Together!

Vital Signs

Frontal Cortex - On Heart Rate - Quick and Forceful No SNS Activation Fast Deep Breath Blood Pressure - Increases Immune Function - High High Energy Visceral Homeostasis	Digestion - Slows Feet/Hands - Warm Mouth - Moist Oxytocin, Norepinephrine 5-hydroxytryptamine Parvocellular Vasopressin

Behavior	Feeling/Thoughts
Soft, Open Face **Soothing Prosodic Voice With An Appealing Inflection/Rhythm** Face to Face Interaction/Eye Contact Pupils Smaller, Eyelids Heavy Eyes moist Relaxed, Immobile Body Head-turning - Smooth and Slow Skin - Rose Hue, Flushed,Dry Good Understanding of Human Speech Rational and Empathetic Restorative Rest, Deep Healing Deep Sleep Voluntary Behavior - Available Top Down Self-Regulation **Reciprocal, Synchronous Behaviors** Deep Connection, Deep Spiritual States Post-Orgasmic Afterglow	**Safe While Immobile** Love Empathy Compassion Calm in Connection Stillness Soft Connected to a Higher Power **Story/Personal Narrative** I Belong We Are Connected

Vital Signs

Frontal Cortex - On Heart Rate - Slow and Steady No DVC Activation Slow Deep Breath Blood Pressure - Decreases Immune Function - Very High Visceral Homeostasis	Digestion - On Feet & Hands - Warm Mouth - Moist Oxytocin, Norepinephrine 5-hydroxytryptamine Parvocellular Vasopressin

Autonomic Response

Feelings/Thoughts	Behavior
Unsafe While Mobile Frustration Irritation Anger, Rage, Hostility Polarized Emotional Flooding Cynical Controlling of Others/Environment **Story/Personal Narrative** I Can Confront Danger! Who Is With Me Or Against Me?	**Aggressive Face, Less Eye Contact** Pupils Dilated Eyelids Tense, Raised, Eyes Dry Growling Voice Tense Body in Motion Head-Turning - Jerky, and Fast Skin - Pale, Sweaty Trouble Understanding Human Speech Less Rational Confrontational, Meltdowns Learning Problems, Tantrums Sound - Exaggerated Startled Response, Addictions Voluntary Behavior - Unavailable

Vital Signs

Frontal Cortex - Reduced or Off Heart Rate - Fast/Racing, Tachycardia Fast Shallow Breath - Upper Chest Blood Pressure - Elevated Visual Field -Tunnel Vision High Energy, Hyperarousal	Immune Function - Very Low/Off Digestion - Slows Down Hands/Feet - Cold Mouth - Dry HPA Axis - Adrenaline, Cortisol Arginine Vasopressin

Feelings/Thoughts	Behavior
Unsafe While Mobile Panic, Fear Anxiety, Worry Terror Polarized Emotional Flooding Cynical Controlling of Others/Environment **Story/Personal Narrative** I Can Escape From Danger! Who Is With Me Or Against Me?	**Fearful Face, Less Eye Contact** Pupils Dilated Eyelids Tense, Raised, Eyes Dry High Pitched Shrill Voice Tense Body In Motion Head-turning - Jerky, and Fast Skin - Pale, Sweaty Trouble Understanding Human Speech Less Rational Avoidance Behaviors, Meltdowns Learning Problems, Tantrums Sound - Exaggerated Startled Response, Addictions Voluntary Behavior - Unavailable

Vital Signs

Frontal Cortex - Reduced or Off Heart Rate - Fast/Racing, Tachycardia Fast Shallow Breath - Upper Chest Blood Pressure - Elevated Visual Field -Tunnel Vision High Energy, Hyperarousal	Immune Function - Very Low/Off Digestion - Slows Down Hands/Feet - Cold Mouth - Dry HPA Axis - Adrenaline, Cortisol Arginine Vasopressin

Feelings/Thoughts	Behavior
Unsafe While Rigid/Immobile Can't Make Eye Contact Overwhelm, Terror Pain, Disorientation Emotional Flooding Nausea **Story/Personal Narrative** I Can't Escape! I'm Cornered! I Can't Protect Myself!	**Deer In The Headlights Face, No Eye Contact** Pupils Very Small or Dilated Eye Lids Very Tense, Eyes Dry Flat or No Voice Body Stiff, Immobilized No Head-Turning - Rigid and Fixed Skin - Cold Sweat Cant Understanding Human Speech Irrational, Learning Problems Sound - Exaggerated Startled Response, Addictions Voluntary Behavior - Unavailable

Vital Signs

Frontal Cortex - Off Heart Rate - Very Low, Bradycardia Slow Shallow Breath - Low Oxygen Blood Pressure - Very Low Visual Field - Unfocused, Blurry Energy Conservation, Hypoarousal Vasovagal Syncope	Immune Function - Very Low/Off Bowels/Bladder - Emptying Hands/Feet - Very Cold/Hot Mouth - Dry Opioids, Low Cortisol 5-hydroxytryptamine

Feelings/Thoughts	Behavior
Unsafe While Collapsed/ Immobile Can't Make Eye Contact Completely Overwhelmed Helpless, Despair, Absent Minded Numb, Depressed, Trapped Shame, Depersonalization Life Threatened High Pain Tolerance Nausea, Chronic Fatigue Suicidal Thoughts **Story/Personal Narrative** It's Hopeless, And I'm Going To Die! I Want To Disappear	**Blank Face, No Eye Contact** Eye Lids Drooping Eyes Closed/Open, Fixed, Dry Flat or No Voice Skin - Pale, Cold Sweat Collapsed Posture No Head Turning - Slack/Immobile Cant Understanding Human Speech Irrational Sound - Unresponsive Voluntary Behavior - Unavailable **Trauma/Death Feigning** Disassociated, Self Isolating Addictions, Insomnia, Sleep Apnea, Nightmares, Passed Out/Fainting

Vital Signs

Frontal Cortex - Off Heart Rate - Very Low, Bradycardia Slow Shallow Breath - Low Oxygen Blood Pressure - Very Low Visual Field - Unfocused, Blurry Energy Conservation, Hypoarousal Vasovagal Syncope	Immune Function - Off Bowel/Bladder - Stopped Hands/Feet - Cold Mouth - Dry Opioids, Low Cortisol 5-hydroxytryptamine

Extended Activation Of States Of Safety Support Social Bonding, Health, Growth, And Restoration

Social Engagement System / Neocortex / High Cardiac Vagal Tone = High Respiratory Sinus Arrhythmia, / High Heart Rate Variability

The Vagal Brake Is On, Co-regulation / Self Regulation / Window Of Tolerance

Extended Activation Of States Of Danger Or Life Threat Leads To Chronic Diseases, Psychiatric Disorders, And Chronic Pain

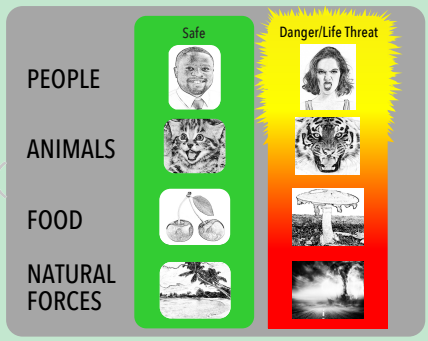
Limbic System, The Sympathetic Gas Pedal Is On, Hyperarousal

Low Cardiac Vagal Tone = Low Respiratory Sinus Arrhythmia, Low Heart Rate Variability

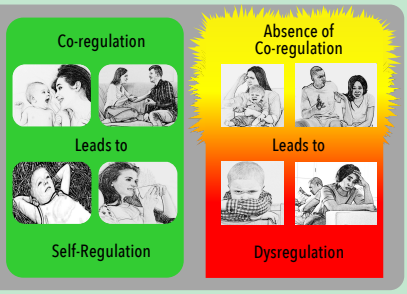
Dysregulation / Window Of Tolerance Exceeded

Reptilian Brain, The Vagal Emergency Brake Is On, Hypoarousal

NEUROCEPTION - Outer Environment



The neuroception of our external environment is unconscious and is used to evaluate the safety, danger, or life threat from the outside world. We unconsciously assess the world around us with our hearing, eyesight, smell, taste, and touch. Signals travel along the vagus nerve and adjust our vital functions like body temperature and heart rate to adapt to the current perceived opportunity or threat. This shift in physiology triggers adaptive, autonomic strategies that drive our thoughts, feelings, and actions. (see the grey Autonomic Response panels in the bottom half of the chart)



We share our nervous system function with other humans regarding stress regulation, meaning that the quality of our social interactions largely determines our sense of wellbeing. Therefore, embedded in our social engagement system is our inherent biological desire for safe connection with other humans. We experience this imperative as an intrinsic quest for safety that can be reached only through successful social bonding. Therefore, we co-regulate our behavior and physiology through mutual, synchronous, and reciprocal behaviors in successful relationships. The purpose of co-regulation is to optimize physiological states that support health growth and restoration. Co-regulation leads to self-regulation, which allows us to feel safe, even in environments that lack cues of safety and/or opportunities for co-regulation. In contrast, the absence of co-regulation/reciprocal behaviors leads to dysregulation.

We communicate with others using cues to invite or discourage connection through vocal prosody, facial expressions, posture, and body gestures. Our verbal and nonverbal cues act as a portal that instantaneously broadcasts our heart and bronchi's physiological state to the outside world, primarily through our face and voice. This instantaneous report is made possible by the shared neuro connections between the nerves that control the heart/lungs and the muscles of the face, neck, and voice.

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