Polyvagal Theory: Foundation for a Neurobiological Model of Trauma Treatment

Jared D. Kass
Sidney M. Trantham

Division of Counseling and Psychology
Graduate School of Arts and Social Sciences
Lesley University

Trauma and Contemplative Practice: Exploring the Territory

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Trauma produces severe disruptions of healthy functioning among individuals, families, groups, and nations.

“Complex” trauma magnifies these disruptions through multiple and repetitive traumatic events, including physical and sexual violence, emotional abuse and neglect, social injustice, racial trauma, forced migration, and war.

Intergenerational transmission of complex trauma magnifies disruptions exponentially.

Humanity’s “Chain of Pain” disrupts multiple dimensions of self (Kass, 2007, 2014):

**Behavioral:** Dysregulation of threat appraisal systems; hyper-reactivity, dissociative behaviors, and numbing.

**Cognitive:** Distorted Schema - Self, Others, Life.

**Social-Emotional:** Insecure & Disorganized Attachment.

**Socio-Cultural:** Rejection/fragmentation of identity; Loss of voice; Internalized oppression.

**Existential-Spiritual:** Loss of Coherence, Despair.

Result: Severe Disruptions of Healthy Functioning.
Polyvagal Theory

Neurobiological foundation for understanding how/why trauma disrupts healthy functioning so severely

role of contemplative practice and mind-body therapies in trauma treatment

Stephen Porges (2011)
The Polyvagal Theory – Neurophysiological Foundations of Emotions, Attachment, Communication, Self-Regulation

Book spans his distinguished research career:
- Measurement of Heart Rate Variability: 1985-1990
- Clinical Significance
  - Vagal Brake
  - Heart Rate Variability: 1990-2000
- Polyvagal Model of Stress Coping: 2000-2010

Explanation of Polyvagal Theory for Early-Career Clinicians & Counseling Students:


in L. Rappaport (Ed.) Mindfulness and the Arts Therapies: Theory and Practice

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Vagal Brake

Heart Rate
Heart tissue contracts naturally
Pacemaker of heart: Sinoatrial node (SA) (100-120 bpm)
Faster than “healthy normal rate”

Vagus Nerve (PNS) plays a key regulatory function:
Slows heart to healthy rate (60-80bpm): “Vagal brake”

Autonomic Nervous System: Regulates essential organs
Traditional emphasis (Cannon, adrenaline)
Sympathetic Nervous System (SNS): Activation
Parasympathetic Nervous System (PNS): Relaxation
Benson: Intentional interruption of SNS (1975)
Polyvagal Theory: PNS - Foundation for resilient stress coping

Vagal Brake Release: Heart Rate increases (w/o SNS activation)
Renews: Heart Rate decreases

Capacity for rapid changes in metabolic activation w/o Fight-Flight
Potential for flexible, resilient coping

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Heart Rate Variability: Resource for Resilient Coping

Diaphragm: Dome-shaped skeletal muscle, separates thoracic and abdominal cavities

Heart: Between Lungs (Frontal view, partially hidden)

Inhalation
Diaphragm contracts centrally & downward
Lungs expand vertically
(Abdominal cavity expands, allowing expansion of lungs)

Exhalation
Diaphragm relaxes, returning to dome shape
Lungs deflate vertically
(Abdominal cavity shrinks, supporting exhalation)

Relationship Between Breathing & Heart Rate:
Inhalation: Heart Rate Increases
Exhalation: Heart Rate Decreases

Respiratory Sinus Arrhythmia (RSA)
Heart Rate Variability (HRV)

Deep Breathing = High Vagal Tone = High HRV
High HRV = Healthy Heart & Increased Resilience
Positive Coping Skills

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Polyvagal Theory:
Hierarchical Model of Stress Coping: Three Modes

1-Resilient Coping

High Vagal Tone = Activation & Relaxation w/o SNS
"Internal Composure" vs Fight-Flight (Kass & Trantham, 2014)
Reflective & Accurate Stress Appraisal
Social Engagement (Social Support = Not Alone)
Primary Brain Area: Pre-frontal cortex (humans)

2-Fight-Flight

Vagal Brake releases, enabling SNS activation
High activation necessary during danger/physical challenge
Stress appraisal is reactive, not always accurate
Reduced capacity for social engagement when tense
Primary Brain Area: Limbic system/Amygdala (mammals)

3-Freeze

Danger is overwhelming; perceived helplessness
"Ancient" PNS protective system takes over
Dramatic shift in metabolic & psychological processes
Body freezes
Physical & psychological numbing
Social engagement: minimal, isolated, chaotic
Memory: dissociative & implicit (right brain/somatized)
Dissociative mental and physical processes
SNS activation often persists (high adrenaline/ high anxiety)
Disorganized, ineffective activity
Primary Brain Area: Brain Stem (reptiles)

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Core Concept in “Polyvagal” Theory

Vagus Nerve
Primary circuit of Parasympathetic Nervous System (PNS)
Originates in Brain Stem (Cranial Nerve # 10)
Connected to Reticular Activating System
  Consciousness, Attention, Sleep
  Somatic & Visceral Motor Functions (Heart, lungs)

Two Sub-Circuits

Dorsal Vagal Complex (DVC):
Ancient “Reptilian” Vagal Circuit
  Activates freeze / immobilization behaviors
    Reptiles (cold-blooded): Need to conserve energy
  Dorsal Motor Nucleus, Brain Stem (Medulla)
    Relatively slow signal transmission (Fiber C)
    On / Off
      Not capable of subtle gradations
      Not responsive to “nuances” of environment

Ventral Vagal Complex (VVC):
More recent “Mammalian” Vagal Circuit
  Regulates HRV: Integrated responsivity of heart & lungs
    Mammals (warm-blooded): High energy management
  Nucleus Ambiguus, Brain Stem (Medulla)
    Fast signal transmission (Fiber B: myelinated sheathing)
    Subtle gradations & rapid response to environment
    Approach and Withdrawal
  Connections to heart & lungs (regulates HRV)
  Connections to cranial nerves for facial expression & voice
  Cardio-vascular system ↔ Social engagement system
Brainstem - Ventral View

Vagus Nerve (CN X)
(Left Side)

Sensory Fibers (Afferent)
Motor Fibers (Efferent)

Cross Section of Medulla
Area of Vagus Nerve
(Middle of Inferior Olivary Complex)

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**Sympathetic Nervous System (SNS)**

**Segmented Chain of SNS Ganglia**

- **Spinal Cord**
- **Brain**
- **Social Engagement**
- **Heart rate**
- **Lungs / Bronchi**
- **Liver**
- **Stomach - Intestines**

**SNS: Second Tier of Stress Coping**
Triggers fight - flight arousal when danger is perceived
After release of vagal brake

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Parasympathetic Nervous System (PNS)

Vagus Nerve (2 branches)

Cranial Nerves:
- Regulate Heart, Lungs, Visceral Systems
- Detect/Regulate Facial Expression, Sound, Speech, Behavioral Cues – for Threat Appraisal Social Engagement

Social Engagement

Heart rate
- Decreases

Lungs / Bronchi
- Constricts (less oxygen)

Liver
- Restores Glycogen Storage

Stomach - Intestines
- Activates Digestion

Brain

Cranial Nerves:

Vagal tone raises capacity for attuned engagement

Vagal Brake creates capacity for gradations of response

VVC

DVC

Polyvagal Theory (Porges, 2011)

Ventral Vagal Complex (VVC):
- Mammalian, myelinated vagus
- Regulates vagal tone / HRV
- Tier 1: Resilient Coping

Dorsal Vagal Complex (DVC):
- Reptilian vagus
- Tier 3: When fight-flight fails
- Activates freeze / immobilization

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Central Principles:
Sensorimotor, Bio-Energetic & Gestalt Therapies
(With Mindfulness Practice and Hatha Yoga)

**Traumatic Stress = Hyper-Arousal = Fight – Flight – Freeze**
Psychophysiological Hyper-Reactivity and/or Numbing
Chronic Tension in Musculature

**Protective Suppression of Core Emotions:**
Neuromuscular Defense Mechanisms
Chronic Contraction of “Transverse” Muscle Systems (Reich)

**Protective Repression of Traumatic Memories:**
Implicit Memory (Lack of “Narrative” memory)
Somatic, Intrusive, Fragmentary, Dissociative
Suspended in Limbic System, Right Brain, & Body
Transverse Neuromuscular Defense Mechanisms (Reich)

**Primary Therapeutic Methods:**
**Create Safety**
Empathic Attunement; Therapeutic Alliance
Increase HRV; Stress-Coping Skills (CBT; EMDR)

**Awareness and Release of Neuromuscular Tension**
Range: Gentle Breath Work
       Subtle Movement Work
       Vigorous Muscular Work
       Sculpt/Enact Emotions - Integrate “Parts”

**Releases suppressed emotions**
**Restores repressed memories**
**Facilitates free flow of emotional energy**
**Increased capacity for healthy contact and withdrawal**

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