

„Trauma and Somatic Experiencing“

Method: Somatic Experiencing® founder Peter Levine, PhD
Foundation for Human Enrichment – SEI – Somatic Experiencing
International Co. USA

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By Sonia Gomes, PhD

WHAT IS TRAUMA?

Traumatic events are highly prevalent in the United States and are a major cause of medical and psychiatric morbidity. Each year between 1.5-2.5 million American civilians, require hospitalization for the treatment of traumatic injury. Traumatic injury accounts for approximately 12% of medical expenditures in the United States. From a global perspective, approximately 16% of the world's burden of disease is attributable to traumatic injuries (KRUG G., SHARMA K., LOZANO R., 2000).

Seriously injured patients are at high risk for developing Post-traumatic Stress Disorder (PTSD¹) and related co-morbid² conditions, such as depression and substance

¹ Post-traumatic Stress Disorders (PTSD) is characterized by a constellation of distressing and/or impairing symptoms that occur after experiencing, witnessing, or being confronted with a traumatic event that includes an actual or perceived threat to the self or others. PTSD involves repeated and intrusive memories related to the trauma (thoughts, dreams/ nightmares), avoidance of situations that are reminders of the trauma, and hyperarousal as irritability, reduced concentration, exaggerated startle response (JITENDER S., BRIAN J., MURRAY B., TRACIE O., CLAIRE F., GORDON A., 2007).

² Co-morbidity refers to the occurrence of two syndromes in the same patient. Defined literally, every pair of syndromes where the diagnosis of one does not categorically exclude the diagnosis of the other is potentially co-morbid. Determining whether both disorders occur in the same patient at different times or concurrently may help suggest the mechanism of co-morbidity (KRISHNAN, K., 2005)

abuse/dependence (BRYANT A., O'DONNELL L., CREAMER M., McFARLANE C., CLARK R., SILOVE D., 2010). Between 10-40% of physically injured American civilians may go on to develop symptoms consistent with a diagnosis of PTSD (SHIH A., SCHELL L., HAMBARSOOMIAN K., BELZBERG H., MARSHALL N., 2010). PTSD makes an independent contribution to post-traumatic functional limitations and diminished quality of life beyond the impact of injury severity and medical conditions (ROBERTS P., KITCHINER J., BISSON J., 2009). PTSD is associated with increased costs to society; these costs appear to be, in part, secondary to increased health care costs (WALKER A., KATON W., RUSSO J., CIECHANOWSKI P., NEWMAN E. and WAGNER W., 2003). Since September of 2001, PTSD has been of major interest because it is arguably one of the most prevalent and debilitating consequences of terrorism-related incidents.

According to Levine (1999), trauma³ lies upon the instinctive physiology. Levine does not see the event as a determining factor, therefore trauma is not perceived as deriving from the nature of the event itself, but the determining factors are found in the relationship of trauma with the body and its capacity for neuroplasticity⁴, as well as the level of resilience⁵ in the nervous system. In the very time a stressful situation takes place, it is the availability of resources or the lack thereof to deal with and to cope with stressful situations is what shall determine the traumatic potential of the stressing event (LEVINE, 1997).

³ The notion of trauma suffered transformations, but it was never completely abandoned in Freud's work. Its culmination can be found in the fundamental formulations as in *Beyond the Pleasure Principle* (1920) and *Inhibitions, Symptoms and Anxiety* (1926). Freud posits that terror, anguish without mediation and / or a disproportionate psychic pain, are the leading causes of traumatic neurosis. The passive experience of the traumatic event is due to the nature of the episode, which prevents the motor or verbal response necessary for the discharge of affect, reinforced by the surprising nature of the event. Freud points out, "one to remember not accompanied by affection is almost always totally ineffective" (1893, p 32.). And further emphasizes: "the trauma refers to an excess of excitement not downloaded" (Sabourin, 1988).

⁴ Neuroplasticity is the brain's property to modify the connections amongst neurons.

⁵ Mancini Bonanno proposed that resilience to potential trauma be defined as "the ability of adults in otherwise normal circumstances who are exposed to an isolated and potential highly disruptive event, such as the death of a close relation or a violent or life-threatening situation to maintain relatively stable, healthy levels of psychological and physical functioning, as well as the capacity for generative experience and positive emotions" (BONANNO, Mancini, 2009:20-21).

As defined by Freud, trauma occurs when there is a breach in the organism's protective barrier against stimulation in the nervous system⁶ coupled with a lack of available resources to modulate such experiences in which then brings about an overwhelming state of impotence. Trauma is thus not defined by the causing event but rather by the results of an overcharging of stimuli provoked in the organism; when any organism perceives overwhelming mortal danger (with little or no chance for escape) the *biological* response is a global one of paralysis and shutdown⁷ (VAN der KOLK, B., 2015).

ETHOLOGISTS CALL THIS INNATE RESPONSE TONIC IMMOBILITY (TI):

Humans experience this frozen state as helpless terror and panic; such a state of shutdown and paralysis is meant to be temporary. A wild animal exhibiting this acute physiological shock reaction will either be eaten or, if spared, presumably resume life as before its brush with death. Humans, in contrast to animals, remain stuck in a kind of limbo, not fully re-engaging in life after experiencing threat as overwhelming terror or horror (SCHMIDT, NORMAN B. and al. 2008, 39: 292 – 304).

A paralysis state⁸ becomes a “default” response to a wide variety of situations in which one's feelings are highly aroused (LEVINE, 2010:23-24); for Levine, “*Trauma arises when one's human immobility responses do not resolve; that is, when one cannot make the transition back to normal life, and the immobility reaction becomes chronically coupled with fear and other intense negative emotions such as dread, revulsion and helplessness.*” And for him, after this coupling has been established, “*The physical sensations of immobility by themselves evoke fear*” a traumatized individual, Levine

⁶ “*Overstimulation*” was added by Levine.

⁷ According to the polyvagal theory (see chapter III), being in shutdown (immobility/freezing/or collapse) or in sympathetic/hyperactivation (fight or flight) greatly diminishes a person's capacity to receive and incorporate empathy and support. Traumatized people dominated by shutdown are physiologically unavailable to calming and sharing feelings and attachment (LEVINE, 2010:111).

⁸ It is a state where traumatized people are stuck in the primitive root of immobility with its greatly reduced capacity for reading face, bodies and emotions; they become cut off from the human race (LEVINE, 2010:111).

affirms, has become conditioned to be fearful of his or her internal (physical) sensations that now generate the fear that extends and deepens (potentiates) the paralysis. Fear begets paralysis, and fear of the sensations of paralysis begets more fear, promoting yet a deeper paralysis. In this way, a normally time-limited physiological adaptive reaction becomes chronic and maladaptive. The feedback loop closes in on itself; in this downward spiral, the counter vortex of trauma is born (LEVINE, 2010:68). Trauma disrupts the organization of the internal experience of internal homeostatic balance, and trauma can be turned into many symptoms as a result of that dysregulation also defined as dissociation.⁹ The events that threaten life can leave a person in a very restricted state by inhibiting the sympathetic and parasympathetic high load, which results in a "locking" of the natural flow of body function; the two systems, the sympathetic and parasympathetic are co-activated at the same time: analogous to accelerating and braking simultaneously in a car. I mean, the individual overload; you're nervous to the point that can trigger the alarm system and paralyze their activity system. Bodily reactions are innate, power-endowed to survive in a state of readiness to act, and if these muscular tensions that are organized by the brain are not used, in part lie in a stream of neural impulses from the spinal cord to the *thalamus* (headquarters of sensory transmission) and in another part of the brain, the cerebellar tonsils are still signaling the persistent presence of danger and threat, even though the danger and the threat no longer exist anymore.

If the muscles and viscera are ready to react to danger, the mind will say that there is still reason to fear (LEVINE, 2010:169). This hyperactivation causes an irresistible impulse to identify the source of the threat or danger because of the guidance system sensorimotor; and if you cannot find the source of the threat, danger signs, the mind will continue firing warning sensations, emotions, thoughts or repetitive images obsessively seeking the causes in the past and / or future, since the body continues to warn the brain (LEVINE, 2010:170). When it is perceived (consciously or unconsciously) that it is in danger, the defensive postures necessary for protection are mobilized in the body; instinctively the body deviates, shrinks, bends down and hardens to fight or flee, and when you cannot use one of these two strategies, the body freezes or collapses, and the

⁹ Dissociation may be characterized by loss of memory for an event, and memory is particularly impaired in dissociative disorders. See chapter II.

energized voltage remains stagnant in the muscles. Trauma can be conceptualized as stemming from a failure of the natural physiological activation and hormonal secretions to organize an effective response to threat, rather than producing a successful fight or flight response the organism becomes immobilized (VAN der KOLK, B., 2006:282).

HOW TRAUMA AFFECTS THE BODY

When the physiology is overwhelmed by the magnitude and speed of an event, multiple body systems may be affected, and the urgency to fight or flight is thwarted: from one moment to another, balance, memory, muscle-skeletal system and other systems alter. It is common that important lapses of memory or mental representation of the event appear, as well as sensory-motor amnesia. The trauma can evoke unconscious and preverbal content translating into many unusual behaviors due to experiencing abrupt changes of one's physiological condition: discontinued sensations, altered heart rate, fear of impending death, emotional instability, continues uncontrolled respiration, fear of a possible physical injury and seizure with respect to physical and emotional condition.

The trauma affects the body as a whole: affects cognition, learning and creates severe emotional dysregulation; disrupts the protective barrier that contains the dynamic equilibrium of the internal environment, blocking the relationship between the body systems, reducing the ability of perception, physical and gravitational orientation, spatial awareness, as well as the ability to achieve embodiment.

The trauma, according to Levine, is an interrupted process, which is frozen in time and space, which has a natural inclination to be completed whenever this is possible; if the opportunity is created, anyone can complete this process and avoid the debilitating effects of trauma. This is the approach of SE - Somatic Experiencing.

WHAT IS SOMATIC EXPERIENCING®, BY PETER LEVINE?

BY Sonia Gomes PHD

Peter A. Levine created the SE™ method, the fruit of many years of multidisciplinary study. The method offers a clinical map for accessing the physiological states in which the person is “trapped” in the responses of fight, flight, freezing, or in the collapse state. This method facilitates the completion of the self-protective motor response and relieves the survival energy accumulated in the body, intervening in the root that causes the symptoms of the trauma. It is a method that removes the traumatic shock in order to transform and prevent the symptoms of PTSD, adult emotional wounds or those of early psychological development. Levine states that his clinical work with thousands of patients confirms the fact that immobility may exist *with or without fear*, and that one powerful tool in transforming the trauma is to help the patient access the state of immobility without fear. He believes that “...only when the immobility becomes inextricably and simultaneously coupled to an intense fear and other strong negative emotions, do we have the trauma feedback loop rooted in the form of persistent PTSD”.

Levine, with his clinical observations over decades of work, states: “The ‘physiological’ capacity of entering and later leaving the innate (inherent) response of immobility is the key both to avoiding the debilitating and prolonged effects of the trauma and to curing even the most deeply-rooted symptoms. For a person who is traumatized, having the capacity to touch their feelings of immobility, even for a brief moment, restores the completion at their own pace and allows the ‘unraveling’ of the fear and freezing to begin”. This therapeutic method, observing the nervous system of traumatized people within a state of relative relational security, has the primary objective of resolving the trauma, “...having the capacity to unlink and separate the fear from the immobility”. Peter Levine, one of the few psychologists who work with tonic immobility as a model for trauma, agrees that when an intense fear (and other strong negative emotions) is associated with the immobility response, it becomes imprisoning and consequently traumatic. *“This difference indicates a clear logical foundation for a therapy model that separates the fear and other strong negative emotions from the biological response of immobility (normally*

of limited duration). The separation of the two components breaks the feedback loop that feeds the trauma response”.

Levine’s main idea, in his wonderful, creative genius, is to enable the person to touch the sensations of immobilization, or freezing, in small doses – *titrated*, as he calls it. This challenges the physiology, through the biological pendulum of movement, to move the noxious stress or irritation that stress causes in the organism. Thus, with the help of the therapist maintaining his or her own presence and the patient’s felt-sense, a new adaptation, a new organization can emerge, so that homeostasis may be reestablished.

The manner proposed by Levine to increase awareness of integral health is to identify and use the trauma indicators that are available through the felt-sense. The felt-sense process, as you track sensation from bottom to head will only work if you have a relationship to the feeling tones held within the body space. “This is the embodied realm of the felt-sense”.

Helping the patient develop the felt-sense of the internal sensations, the tensions, the relaxation, the respiratory cycle, and other responses of the autonomic nervous system, etc., is a powerful resource for the recovery of resilience. If we remain in this state of consciousness for some time, we begin to develop the felt-sense of the movement of energy flow that is vital and alive. This is pleasurable: it’s a good feeling, a resource that can help us obtain a non-verbal knowledge of who we are. Healing the psychological effects of trauma require us to cultivate the awareness of these sensations, because through this process of gaining awareness, we can allow the physiological impulses to be fulfilled. Levine, with his tracking model from bottom to head, inspired by Yakovlev and by Paul McLean’s map of the triune brain, classified a dynamic order for the felt-sense. This dynamic of self-observation favors a constant flow in the relationships among the three hierarchical functions of the brain. What happens in the brain is represented on the sub-cortical level, involving all the tissues of the bodily systems. This classification, based on the sensory and perceptive information that is part of the functions of the parietal lobes, which process this information of internal experience, that is, what the human experiences.

TYPES OF TRAUMAS: *By Sonia Gomes, PhD*

An event will most likely lead to any type of trauma; situations that include violent personal assault, sexual abuse, motor vehicle accidents, natural or made disaster by man, a difficult birth or high level of stress during pregnancy, medical procedures, learning about the sudden, unexpected death of a family member or a close friend, learning that one's child has a life-threatening disease, or being diagnosed with a life-threatening disease. Experience of a humiliation or deep disappointment can break up a significant relationship. The trauma is a pervasive fact of modern life (LEVINE, 1997); most people were traumatized or otherwise since the sources as to the consequences of trauma have a wide range and are often unconscious.

There are several examples for different trauma experiences, but it needs more time to study about it. I am including some more specific for this workshop.

TRANS-GENERATIONAL TRAUMA:

It concerns the legacy and heritage of psychic components that are propagated from generation to generation among the families or among all members of human kind.

Genes – functional units that make up our DNA – provide the information that directs the basic cellular activities of our bodies. Research on the human genome has shown that the DNA sequences of any two individuals are 99.9% identical. However, that 0.1% variation is profoundly important, contributing to visible differences, like height and hair color, and to invisible differences, such as increased risks for, or protection from, heart attack, stroke, diabetes, and addiction. Genes influence the numbers and types of receptors in the brains, how quickly our bodies metabolize drugs, and how well we respond to different medications. Recent advances in DNA analysis are enabling researchers to untangle complex genetic interactions by examining a person's entire genome at once. These genome-wide association studies (GWAS) identify subtle

variations in DNA sequence called single-nucleotide polymorphisms (SNPs) – places where individuals differ in just a single letter of the genetic code. If a SNP appears more often in individuals with a disease than those without, it is presumed to be located in or near a gene that influences susceptibility to that disease.

Building on GWAS results, scientists gather additional evidence from affected families, animal models, and biochemical experiments to verify and understand the link between a gene and risk for a disease.

Some diseases, like sickle cell anemia or cystic fibrosis, are caused by an error in a single gene. Medical research has been strikingly successful at unraveling the mechanisms of these single-gene disorders. However, most diseases, including addiction, are more complicated: variations in many different genes contribute to an individual's overall level of risk or resistance. Addiction is regarded for some studies as a trans-generation trauma, but there several examples of effects of trauma that have passed between generations among families and societies. For now, let's have a look on trauma involving addiction.

EXISTENTIAL TRAUMA:

An existential injury that explores the psychosocial basis of traumatic experience: the combination of both psychological and sociological dimensions, which has profound existential resonances. It can be applied to trauma at any stage in the life course; child abuse is used as an example of how trauma can have a significant and detrimental effect on identity development, invoking a need for a commitment to trauma recovery.

LOSS TRAUMA:

Loss leads to trauma: loss or fear of loss of a loved one is central in this category. Loss situations involve 'problems' (i.e. loss of something or someone) that cannot be solved by or with design. In the first stage, a practitioner has to be embodied with a deepening of understanding about the phenomenon of human loss, and to study the

current role of design in loss situations. Loss situations are divided in two phases: pre-loss phase and post-loss phase. The pre-loss phase concentrates on fostering human resilience ability to loss yet to happen; and the post-loss phase explores the coping strategies and emotions regulating process after loss has happened.

BONDING TRAUMA:

Bonding occurs as the result of ongoing cycles of abuse in which the intermittent reinforcement of reward and punishment creates powerful emotional bonds that are resistant to change; it means "a strong emotional attachment" between an abused person and his or her abuser, formed as a result of the cycle of violence.

BIRTH TRAUMA:

Birth is a great initiation and rite of passage; during birth, internalized strengths are developed that become a resource for the personality and for life development. However, difficult births imprint shock responses¹⁰; under stress one can over-identify with this birth template and appear pushy, passive, withdrawn, in control, or resistant. Such behavior wreaks havoc on intimate relationships, is mostly unconscious, and linked to survival activation; activation produces emotional reactivity and prevents one from releasing birth imprints. Activation hijacks the nervous system and limits behavior options that are more nourishing for self and others (BROOK: 2012:91).

EMOTIONAL OR PSYCHOLOGICAL TRAUMA:

Emotional or psychological trauma is the result of extraordinarily stressful experience that shatters the sense of security, making one feel helpless and vulnerable in a dangerous world. People are also more likely to be traumatized by a new situation if

¹⁰ By definition *shock* is a jolt, a scare, a start, terror, jostle, or surprise. It can be wild, astonish, daze, paralyze, stun or stupefy ones (Webster Dictionary). Shock occurs in response to an overwhelming event or a chronic low-grade stressor; the body goes into high alert and responds with a fight/flight/freeze and/or withdrawal. Shock creates template responses that organize future experiences; in shock, the body freezes and the psyche dissociate.

they've been traumatized before – especially if the earlier trauma occurred in childhood. The developmental themes related to such issues as neglect or abuse become so severe that they are experienced as potentially life-threatening. When the child is unable to integrate developmental disturbances or challenges, the body ego begins to lose important functional areas, which impedes future growth. The sensorial field becomes reduced or divided, and this key system of integration will be inhibited (LEVINE, 2007). Experiencing trauma in childhood can have a severe and long-lasting effect; children who have been traumatized see the world as a frightening and dangerous place. When childhood trauma is not resolved, this fundamental sense of fear and helplessness carries over into adulthood, setting the stage for further trauma. Childhood trauma results from anything that disrupts a child's sense of safety and security, including: an unstable or unsafe environment, separation from a parent, serious illness, intrusive medical procedures, sexual, physical or verbal abuse, domestic violence, bullying, etc.

Research¹¹ has consistently shown strong associations between affective disorders and substance use disorders. Specifically, people with mood disorders are at increased risk of substance use disorders. Affect and addiction can be related in a variety of ways as they play a crucial role in influencing motivated behaviors. For instance, affect facilitates action, directs attention, prepares the individual for a physical response, and guides behavior to meet particular needs. Moreover, affect is implicated in a range of concepts relevant to addiction: negative reinforcement and positive reinforcement, behavior motivation, regulation of cognition and mood, and reasoning and decision making. Emotion-motivated reasoning has been shown to influence addictive behaviors via selecting outcomes that minimize negative affective states (while maximizing positive affective states).

¹¹www.drugabuse.gov

THREAT TRAUMA:

Threat related trauma or stress can be caused by a variety of circumstances such as a personal experiencing of a traumatic event, living in a neighborhood with frequent drive-by shootings, proximity to repeated acts of violence such as suicide bombings or in combat zones like Iraq, reoccurring natural disasters, etc.

Threat trauma includes attack by a perceived predator, especially when the escape is inhibited by physical restraint, generated conflict, and/or perceived lack of response. It also includes any sources where escape is inhibited, such as medical procedures when restrained, witnessing violence to another, being trapped in a vehicle after an accident, animal attacks, rape. These types of traumas include accidents in which a client is traumatized by falling, being thrown from a moving vehicle or colliding with something. Sexual abuse, medical procedure, surgical, poisoning, burns, horror like war, torture, ritual abuse traumas, can be potentiated in the freeze/dissociative states in which one begins to mobilize from these states; high levels of rage, anger, or other strong emotions may also mobilize – even when they have not been present to date (LEVINE, 2007).

When one is flooded by rage, the frontal¹² parts of the brain “*shutdown*”. Because of this extreme imbalance, the capacity to stand back and observe one’s sensations and emotions is lost; rather, one *becomes* those emotions and sensations. Hence, the rage can become utterly overwhelming, causing panic and the stifling of such primitive impulses, turning them inward and preventing a natural exit from the immobility reaction. Maintaining this suppression requires a tremendous expenditure of energy. One is, essentially, doing to oneself what experimenters have done to animals to reinforce and protract their immobilization. Traumatized individuals repeatedly frighten themselves as they begin to come out of immobility. The “fear-potentiated immobility” is *maintained from within*. The vicious cycle of intense sensation/rage/fear locks a person in the biological trauma response (LEVINE, 2010:66).

¹²See chapter Three

POLYVAGAL THEORY, BY STEPHEN PORGES *By Sonia Gomes, PhD*

How to disengage the Dorsal Vagus System to the Sympathetic Nervous System or to the Ventral Vagus System in order to desensitize negative emotions which trigger disorganization in neural regulation?

The Polyvagal Theory, at the base of SE™ theory and its practice, is about turning off the survival defense mechanisms when faced with a threatening environment and learning to understand how these systems reconnect to guarantee the safety of life. By incorporating the knowledge from more than thirty-five years of research and studies, the more open-minded therapist has the opportunity to apply this knowledge of the function of the Autonomic Nervous System, brought by Stephen Porges, as an instrument of clinical intervention. He/she can help the patient facilitate his/her physiological adaptation and the neuronal – and consequently emotional – regulation.

Porges' theory understands that the physical body must be engaged. Biologically, if a mammal is isolated, its neurophysiology and psychological experiences change. The perception of the world also changes and generally becomes distorted. We understand with this theory that being engaged, being kind, sociable, using the face and heart connection demonstrated by studies and research, that behaviors and feelings have an adaptive function. And if animals and/or humans do not use this system of engagement, they may be eaten by a tiger, by culture or by society. This theory of social engagement refers to a newer neural system of certain cranial pairs, especially the Ventral Vagus which is an environmental system that manipulates our sensation of safety. SE™, within modern therapies, is a pioneer in using the system of social engagement in its therapeutic intervention in order to resolve trauma.

In trauma therapy, we must remember that for mammals, immobilization is lethal. Although reptiles use this as a defense system, mammals use immobilization when they are safe (without fear), and if they use immobilization as a defense system – that is, when they *are* afraid – they generally extend a high percentage of their vital energy. The use of the social engagement system, as used in therapy, helps mammals to access immobilization without fear, which for Porges is the objective of civilization, and creates the opportunity to discard hyper-vigilance and be safe in the arms of someone significant.

The therapist, through their work of face-to-face and face-heart approximation, aims to turn off the system of hyper-vigilance or surrounding reactions, allowing the patient to awaken visceral sensations of “not fear”. It teaches the patient to negotiate his/her safety, in the hopes that he/she begins to show behaviors of social engagement. And from that sense of safety, also obtained through touch, the patient even further incorporates the sense of guidance and feels safer to leave the symptomatic, restricted space and expand in movement towards life.

In theory and studies, the vagal regulation of human hearts has elevated levels of oxytocin when people are interacting in safety, and if separated or scared, they lose the vagal heart regulation, become more hyper-vigilant and have cardiac arrhythmia. Polyvagal Theory associates immobilizing without fear with confidence, safety and love. Porges calls this the *loving code* and gives one some insights for therapy, because it teaches us the natural ways in which mammals turn off their defenses.

Feeling secure is the gateway to developing a healthy relationship.

The neural code is a neuro-biological system of behavior that allows turning off the defenses. The way one feels and how they feel when they meet someone will determine if individuals will become friends, lovers, or enemies. Feelings and emotions depend on the physiological state, and the physiological state functions as a neural platform for the psychological experiences that one has with other people. This neural platform is generally labeled by words that speak of emotions, but this platform influences how the words are perceived. Love and intimacy require the defense systems to be deactivated in order to feel safe and get close to make physical contact.

The theory defines three neural circuits that form a phylogenetically-ordered hierarchy of response. It means that one uses the new and evolved circuits first (Social Engagement) with the intention of disengaging from the state of immobility with fear – and when those do not work, as in they do not help one to navigate to a safe state, they use their older, less-evolved neural circuits, such as the systems of defense. The theory makes a very important distinction: it says that one has two defense systems, that are known by all, associated with behaviors of fight or flight (the sympathetic system) and freezing, playing physiology, that is, to their physio-neurology.

When a person hurriedly utters words with no pauses in between, one might perceive that there is something wrong – and thus one knows their visceral, physical state. The observation of the face and voice tells them about the homeostatic processes, if it is occurring naturally or if the other person is making an effort. If neuroception detects danger, it can mobilize for fight or flight (sympathetic), but if the neural system detects a threat to life as something inescapable, such as feeling like a prisoner, hostage, or suffering severe abuse, this state may trigger *playing dead*, which is the state of immobilization with fear, the state of *freezing up*. This is the Dorsal Vagus system. But it can be confused. The sympathetic and parasympathetic systems are used not only for defense; the sympathetic and the dorsal are also involved in the function of homeostatic equilibrium, in autonomic functionality.

Perception involves consciousness, and neuroception does not have consciousness – it simply occurs. The model of neuroception is like a traffic light: each light representing a different physiological system, and each physiological system serves as a neural platform for different behaviors. If ones are in the safe state (green), individuals can interpret the environment in a certain way. In the immobilized form, ones will interpret this stimulus in a different way. For example, when looking at a person whose facial expression is neutral if they are in the green state, then ones perceive the person as having little emotion, little affect. But if they are in the dangerous immobilized state (yellow), ones will adaptively interpret an expressionless face as dangerous, and they will ask, “Why doesn't this person like me?”. In the closed psychological state (red), due to a life-threatening situation, ones can dissociate completely and be incapable of reading any expression. These are tips for the SEP to identify the signs and their physiological states of engagement or disengagement. In this way, the SEP can choose an intervention strategy using one of the SE™ tools proposed by Levine.

Neuroception will evaluate the situation as safe or dangerous; if it is safe, one will spontaneously engage with others. They will make eye contact, physical contact, facial expressions mainly with the upper part of the face, and speak with a melodic and *non-monotonous* voice. Their words will call to people, engaging them. The theory and its observations say that verbalization is linked to visceral connections with the heart. So, there is no distinction, the face (and voice) is a window to the persons neural.

SOCIAL ENGAGEMENT SYSTEM, *By Sonia Gomes, PhD*

Special, visceral, efferent nerves innervate striated muscles, which regulate the structures derived during embryology from the ancient gill arches. The social engagement system has a control component in the cortex (i.e., upper motor neurons) that regulates brainstem nuclei (i.e., lower neurons) to control eyelid opening (e.g., looking), facial muscles (e.g., emotional expression), middle ear muscles (e.g., extracting human voice from background noise), muscles of mastication (e.g., ingestion), laryngeal and pharyngeal muscles (e.g., prosody of vocalization), and head-turning muscles (e.g., social gesture and orientation). Collectively, these muscles function as neural gatekeepers, detecting and expressing features of safety (e.g., prosody, facial expression, head gestures, eye gaze) that cue others of intention and control social engagement with the environment. The phylogenic origin of the behaviors associated with the social engagement system is intertwined with the phylogeny of the ANS. As the muscles of the face and head emerged as social engagement structures, a new component of the ANS (i.e., a myelinated vagus) evolved that was regulated by nucleus ambiguus, a medullary nucleus ventral to the dorsal motor nucleus of the vagus.

This convergence of neural mechanisms produced an integrated social engagement system, with synergistic behavioral and visceral voice, facial expression, head gesture, and prosody is a common feature of individuals with autism and other psychiatric disorders in which the social engagement system is compromised. Thus, it indicates from the functioning of the face and the prosody of the voice, difficulties in both social engagement behaviors and physiological state regulation. There are inter-neuronal connections between the source nuclei (i.e., lower motor neurons) of special visceral efferent pathways and the source nucleus of the myelinated vagus. These neurophysiological circuits provide an inhibitory pathway to slow heart rate and lower blood pressure, which, by actively reducing autonomic arousal, promote the calm states necessary to express social engagement behaviors and to support health, growth and restoration. The brainstem source nuclei of this system are influenced by higher brain structures and by visceral afferents. Direct corticobulbar pathways reflect the influence of

frontal areas of the cortex (i.e., upper motor neurons) on the medullary source nuclei of this system.

Porges says that feedback through the afferent vagus (e.g., tractus solitarius) to medullary areas (e.g., nucleus of the solitary tract) influences both the source nuclei of this system and the forebrain areas that are assumed to be involved in several psychiatric disorders. Also, the anatomical structures involved in the social engagement system have neurophysiological interactions with the HPA axis, the social neuropeptides (e.g., oxytocin and vasopressin) and the immune system. Afferents from the target organs of the social engagement system, including the muscles of the face and head, provide potent afferent input to the source nuclei regulating both the visceral and somatic components of the social engagement system. Thus, activation of the behavioral component (e.g., listening, ingesting, looking) could trigger visceral changes that would support social engagement, while modulation of visceral state, depending on whether there is an increase or decrease in the influence of the efferents on the sinoatrial node (i.e., increasing or decreasing the influence of the vagal brake) would either promote or impede social engagement behaviors. For example, stimulation of visceral states that would promote mobilization (i.e., fight-or-flight behaviors) would impede the ability to express social engagement behaviors.

Deficits in the social engagement system would compromise spontaneous social behavior, social awareness, affect expressivity, prosody and language development. Interventions that improve the neural regulation of the social engagement system, hypothetically, would enhance spontaneous social behavior, state and affect regulation, reduce stereotypical behaviors, and improve vocal communication – including enhancing both prosody in expressive speech and the ability to extract human voice from background sounds.

SELF-REGULATION AND HOMEOSTASIS, By Sonia Gomes, PhD

Self-regulation is a characteristic of physiological systems. Weiner (1948) proposed a model of self-regulation of the nervous system to explain homeostasis. According to Weiner, homeostasis is an emergent property of a system that, through bidirectional communication, monitors and regulates the status of a body in order to maintain a level of performance within a specific functional level (PORGES, 2012:101). The system would include a central regulator that would determine performance motor for an organ after interpreting information from a sensor (e.g., afferent feedback) that monitors the status of the organ. To maintain physiological homeostasis, sensory pathways originating in peripheral organs transmit information related to the physiological status, and motor pathways (e.g., vagal pathways and cardiac sympathetic system), change the performance of peripheral organs. The sensory pathways from the visceral organs originate in the periphery and usually end in the brainstem; however, many of the paths engines originate in the brainstem and terminate in the periphery.

Physiological systems could be described as being composed of sensors that receives input information about external and internal environments (outside the body), and (within the body) motor systems that control visceral and behavioral activity and an integrating mechanism which evaluates the input from sensors and determines specific aspects of motor performance. The human nervous system operates as a collection of various interactive, self-regulatory, negative feedback systems, each with its specific role. Sensors or receivers are located on the body surface and to evaluate the environmental changes within the body, as well as internal conditions. The motor systems control the movements of the body and visceral organs. The feed-back from the internal structures is interpreted by the brainstem sensors that contribute to the regulation of the autonomic state. The nervous system promotes infrastructure for all levels of self-regulation. The regulation of these processes depends on motor fibers emerging from a medullary core known as the *nucleus ambiguus*. These myelinated motor fibers originate in the nucleus ambiguus, transiting through the tenth cranial nerve, the vagus.

The vagus contributes additional sensory and motor fibers for self-regulation of physiological systems. The vagus contains fibers that provide sensory feedback and

motor fibers that originate in the motor nucleus of the vagus ASR. Sensory fibers comprise approximately 80% of vagal fibers. Vagal sensory fibers originate in various organs (e.g., heart, lung, stomach, pancreas, liver, intestines) and end at an area of the brainstem known as *solitary tract nucleus*. Vagal motor fibers originating in the motor nucleus of the vagus ASR different from myelinated motor fibers originating in the nucleus ambiguus, generate a primary motor control of the digestive system which protects the bronchi and heart: the afferent and efferent pathways that transmit bidirectional communication between peripheral organs and the brain stem, wandering through the vagus. Neurophysiological studies suggest that the frequency of breathing is determined by the brainstem system that also activates the respiratory rhythm to the heart and bronchi. The agreement between these rhythmic processes can functionally enhance oxygen diffusion and coordinate breathing and heart rate with other processes, dependent on motor fibers of the nucleus ambiguus, such as sucking, swallowing and vocalization. The model assumes that behavior with organized motor activity associated with feeding and emotion regulation during social interaction, depend on a more related primary physiological substrate systematic regulation of the autonomous state.

To maintain homeostasis, interoceptors originating in the body cavity (e.g., gastric systems, hepatic enteral cardiac, vascular and pulmonary) transmit information through the neural tracts to the brain stem structures. The brainstem structures interpret sensory information and regulate visceral state, cranking motor pathways or directly manipulating various organs via neural pathways, i.e., to increase or decrease the heart rate, constrict or dilate blood vessels, inhibit or facilitate the peristaltic activity or trigger the release of hormones such as adrenaline or specific peptides, insulin, oxytocin, vasopressin, gastrin, somatostatin.

When there are no environmental demands, the autonomic nervous system meets the needs of internal viscera (internal organs such as heart, lungs and intestines) to enhance growth and restoration. When there are environmental demands, homeostatic processes are compromised and the autonomic nervous system facilitates increased metabolic production, down regulating the functions of "growth and restoration" to deal with these external challenges. The nervous system receptors of sensory response receive notice that conditions within the body (interoceptors) to facilitate homeostasis,

and receivers outside the body realize conditions (exteroceptors) to deal with environmental challenges. The vagal cardiac performance is associated with both. In general, cardiac vagal tone is increased to facilitate homeostatic functions, and there is a decreased to increased cardiac performance and facilitate specific motor behaviors in response to environmental challenges. The vagal system regulates the metabolic performance to promote psychological and motor processes associated with appropriate engagements and disengagements to the environment. To interact with the environment, the priorities of the visceral response system change visceral state optimization, to promote growth and restoration (i.e, homeostasis) to a metabolic performance optimization to facilitate motor behavior required by external challenges. The central nervous system mediates the distribution of resources to handle internal and external demands and can be monitored via the dynamic regulation of the heart by the vagus.

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