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The Polyvagal Theory as a model of neural regulation of the Autonomic Nervous System.

1. Introduction

The Autonomic Nervous System is a pair of antagonistic systems: the sympathetic supports mobilization, and the parasympathetic supports immobilization, usually associated with relaxation, growth, and restoration. In the past, stress responses and defending against danger were vested within sympathetic nervous system's capacity to support fight-or-flight behaviors. However, there is another defense system, dependent on the parasympathetic nervous system. The mechanisms and adaptive function of this defense system are impossible to understand from the paired antagonism model. The parasympathetic defense response produces a behavioral shutdown such as fainting, numbness or dissociation. This defense system doesn't fit within the fight-or-flight model. Nor does it fit within the view that the vagus, the major nerve in the parasympathetic nervous system, mediates calmness and induces resilience and health.

Doctor Stephen Porges developed Polyvagal Theory which suggests that the autonomic systems are better thought of as hierarchical, rather than competing. Functionally , the autonomic nervous system is composed of three phylogenetically organized subsystems. People utilize the newest systems first, and when they don't work, they recruit older ones. The newest autonomic circuit is a uniquely mammalian vagal circuit, which inhibits sympathetic activity. The root of the Polyvagal Theory is the recognition that in the absence of the ability to fight or flee, the body's only effective defense is to immobilize and shut down. However, unlike the mammalian vagal pathway, these vagal pathways are unmyelinated, and are only effective as a defense system, when the newer circuits, including the sympathetic nervous system, are no longer available for interaction or defense. This immobilization can lead to states of dissociation.

The Polyvagal Theory provides a way of seeing how the organization of the nervous system can shape one's understanding of clinical disorders and issues, enabling them to see symptoms like dissociation not as bad behaviors, but as adaptive reactions to clues in the environment that trigger the physiological responses to perceived dangers.

Therefore, this research paper describes, explains and evaluates the following research questions: What is the relationship between human physiology and social engagement? How effective is Polyvagal Theory at activating the part of the nervous system that promotes stronger social engagement that supports health, growth and restoration? What effect does vagal tone have on regulation of emotions? How does the nervous system know when the environment is safe, dangerous, or life threatening and what neural mechanisms evaluate the risk? How can neuroception help fuel a client's irrational thoughts and behavior? What are the most practical implications of the Polyvagal Theory for coaches or therapists?

2. Social Engagement System

According to S. Porges social engagement system is the preamble to attachment. And what moderates the ability to develop secure attachment is safety. This system of safety and connection is guided by the evolutionary newest part of the Autonomic Nervous System which is active in the ventral vagal pathway of the parasympathetic branch. This is also called „smart vagus", mammalian and myelinated, it is above the diaphragm, that is primarily the myelinated vagus which inhibits the heart rate by placing a tonic inhibition on the heart's pacemaker. The brainstorm areas controlling this neural pathway coordinate the nerves controlling the muscles in the face and head. So people are literally showing their heart on their face. That is because humans are social beings who have to convey to one another that they are safe to come close to, to hug. While the face is crucial vehicle for this, the voice also plays an important role in conveying a physiological state of calm. That is why a person feels calmer when people use a soothing, prosodic voice, when the vagal circuit is working, the middle ear muscles, similar to the muscles of the face, are regulated by the brainstem area that controls the mammalian vagal circuit.

When a person wants to calm someone down, they smile and talk to them in a soothing way. People also use ingestive behaviors to calm them down and to develop social engagement, as these behaviors use the same neural mechanisms that are used for social behavior. They go out for lunch, for a drink, as a way of socializing. The nervous system detects the cues of safety and down-regulates or inhibits the sympathetic nervous system. But when the sympathetic nervous system is activated as a defensive system, it turns off all those social-engagement behaviors.

The social engagement system helps people navigate better relationships. Helping the clients shift into the use of their social engagement system allows them to become more flexible in their copying strategies. In this „rest and digest" system of safety and homeostasis people tend to feel grounded, mindful, joyful, curious, empathetic, and compassionate. One might describe himself/herself as happy, active, interested and the world as safe, fun, and peaceful. A person can see the „big picture" and connect to the world, people and his/her experiences . Some of the daily living experiences of this state include being organized, following through with plans, taking care of yourself, taking time to play, doing things with others, feeling productive at work, and having a general feeling of regulation and a sense of management. This is the place that brings people into connection, communication, regulation and social engagement.

That's the system that a person and a coach or a therapist can bring alive during the session, or it can be also a conversation with a friend. And it is someone's ventral experience that really helps people do this. And so if a person slips out of ventral and has a moment of feeling sort of a rise of that survival energy, the fight or flight or the disappear, hopefully the therapist's or friend's ventral will be strong enough to hold the two of you and that is the beauty of nervous system, that people go back and forth. People support each other through this ventral energy and the biology is helping someone show up and support another human being. Physiologically, digestion, resistance to infection, circulation, immune responses, and ability to connect is improved. Health benefits also include a healthy heart, regulated blood pressure, a healthy immune system decreasing your vulnerability to illness, good digestion, quality sleep, and an overall sense of well-being.

3. Neuroception

Neuroception is proposed by S. Porges as a reflexive mechanism capable of instantaneously shifting physiological state in order to effectively switch from defensive to social engagement strategies. It is the autonomic process through which the nervous system evaluates risk, through the processing of sensory information, without requiring awareness. It functions through neural circuits that are shared with the phylogenetic vertebrate ancestors and may involve subcortical limbic structures. Neuroception is a plausable mechanism mediating both the expression and the disruption of positive social behaviour, emotion regulation, and visceral homeostasis. Neuroception might be triggered by feature detectors involving areas of temporal cortex that communicate with the central nucleus of the amygdala and the PAG, since limbic reactivity is modulated by temporal cortex responses to biological movements including voices, faces, and hand movements. Embedded in the construct of neuroception is the capacity of the nervous system to react to the intention of these movements. Neuroception functionally decodes and interprets the assumed goal of movements and sounds of inanimate and living objects. This process occurs without awareness. Although people are not aware of the cues that trigger different neuroceptive responses, they tend to be aware of the physiological shift. Sometimes they experience this as feelings in their gut or heart or as an intuition that the context is dangerous. Thus, the neuroception of familiar individuals and individuals with appropriately prosodic voices and warm, expressive faces translates into a positive social interaction, promoting a sense of safety. This system triggers physiological states that support trust, social engagement behaviours, and the building of strong relationships.

The term neuroception emphasizes a neural process, distinct from perception, capable of distinguishing environmental features that are safe, dangerous, or life threatening. In safe environments, autonomic state is adaptively regulated to dampen sympathetic activation and to protect the oxygen dependent central nervous system, especially the cortex, from the metabolically conservative reactions of the dorsal vagal complex. Neuroception is not always accurate. Faulty neuroception might be an adaptive survival reaction that biases neuroception toward detecting risk when there is no risk, or identifying cues of safety when there is risk. Individuals with a trauma history frequently experience such a biased neuroception.

Part of what has been neglected in modern society and in terms of dealing with the management of being a human being is a rejection of bodily feelings and a respect for the feedback your body is telling you. But what if your body is trying to cue you- to tell you something, to help you, or to inform you of the situation? That is why neuroception is a very interesting concept- that is the nervous system's evaluation of risk in the environment from a variety of clues. With neuroception there is no cognition. It is just occurring and then people try to make a narrative to explain why it happens.

The neuroception could be the situation when you enter a crowded party and see strangers huddled together, laughing, a person may unconsciously pick up cues of rejection. In a micro-moment, his/her sympathetic nervous system leaps into action, signaling to turn around and leave the party , or perhaps sit alone somewhere in the corner. Just then, one of the guests is breaking away from the crowd and walking towards this person. She extends her hand and introduces herself, her face is friendly and welcoming. Almost instantly, that person's breathing slows, the heart rate goes down, and the body relaxes into the experience of feeling safe. Friendly ANS has just guided this person from a sympathetic state to a ventral vagal one, permitting what Porges calls the social engagement system to come fully online. Person is now calm, ready to connect, and maybe initiate a new conversation. Another example of neuroception could be the situation when you meet a person, the

person appears to be bright, attractive, but you don't really like the person because of the way the person is articulating- the lack of prosody and the lack of facial expressivity. You don't understand why, but neuroceptively your body has just responded „this person is not safe", so you develop a personal narrative to make it fit. Neuroception also explains why a baby smiles at a familiar caregiver but cries at the approach of a stranger, or why a toddler enjoys a parents gentle embrace but interprets the same gesture from a stranger as an assault.

A neuroception of safety is necessary before social engagement behaviours can occur. Neuroception thus provides a basis for Maslow's old hierarchy of needs. As long as the organism feels safe, the new vagus including the social engagement network is active. But if the organism detects a threat, it can be real or imagined, it transitions to the sympathetic nervous system. If that fails, and the organism faces a life threat, then it reverts to the immobilization system of the old vagus: losing muscle tone, reduced heart rate, and reduced pain sensitivity. These three streams are working all the time, moving people towards, away, up, down that hierarchy without knowing it. Neuroception is the furthest upstream place that things began and people can work with neuroception, because it's simply the nervous system in acting responses, someone works with what happens from neuroception. So people bring perception to neuroception and they bring the implicit experience of neuroception alive, make it explicit so they can work with it. Then people can think what state has it brought, and as they keep going down that stream of awareness they find feelings, beliefs, behaviours, and at the end point they find the story that takes them through their days. So neuroception is really important principle of Polyvagal Theory. It is important embodied experience for people to be able to attend to so that they can begin to shape their stories in new ways.

4. Coregulation

The Polyvagal Theory links mental and physical health and well-being through the coregulation of autonomic state through social behavior. In the biological quest for safety, people have an implicit biological imperative to connect and coregulate one's physiological state with another. Even how people look at each other is critical in this capacity to connect. It appears that the major issue is about coregulation, which occurs naturally with most infants who are born full term. When a mother calms her baby with cooing and smiles and loving gestures, the baby relaxes, and that in turn calms the mother, that is a coregulation. According to S. Porges, neurophysiologically, coregulation is primarily about reciprocal facial expressions, gestures, and vocalizations between mother and infant via the striated muscles of the head and face. The preterm baby doesn't have the neural resources for behaviors that would enable coregulation. However, these systems can be recruited and returned. A major landmark of health in preterm infants is the proper coordination in sucking, swallowing, and breathing, which involves the use of the cranial nerves controlling the striated muscles of the face and head. In the brainstem, structure regulating the cranial nerves that control these muscles communicate with the brainstem structure regulating the activity of the myelinated vagus. This proves the mechanisms for social behaviors such as facial expressions and vocalizations, as well as ingesting food, to regulate physiological state.

People's longing is not only to feel safe but to feel safe in the arms of others. It is actually a biological imperative. This means that without coregulation people don't survive. People's world is often focused on self-regulation, but in fact coregulation is the first to arise. People come to the world needing to be met by another human being. And this biological imperative lasts through the lifetime. But without the sense of connection to another person, the ANS cannot work properly. People's Nervous system is longing for safe, reliable ongoing connection with another nervous system. People are looking to regulate and be in a reciprocal relationship with someone else. People don't need relationships that are always in balance though. In fact it is in the relationship that people feel connected and find their way back that people build resilience. The cycle of reciprocity, rapture and repair is a nature of healthy relationships. It is when the rapture happens without a repair the people's longing for connection brings suffering. People are wired for connection, they are wishing for connection and waiting for connection and so often it has been due to people's connections that people are feeling not seen, not understood and welcomed, not safe. People are meant to be in connection with people who are regulated and welcoming, not all the time, but enough of the time for the ANS to be nourished in these systems of connection. And when that doesn't happen people are bewildered, they are stunned by the absence. The ANS revisits the messages of unsafety, but in the moment a person can take the necessary action to regulate himself/herself.

5. Applications for coaches or therapists

There are a lot of practical implications of the Polyvagal Theory for coaches and therapists. This theory heightens our appreciation of the role of creating safety in therapy, which carries a physiological state. If people feel safe, they have access to the neural regulation of the facial muscles, they have access to a myelinated vagal circuit that is capable of down-regulating more traditional fight/flight and stress responses, and they have opportunity to play. And what I mean by play, is not playing computer games, but play which requires social interaction. Play requires an ability to mobilize with the sympathetic nervous system and then to down-regulate the sympathetic excitation with face-to-face social interaction by looking at each other, so play is actually a neural exercise of using social engagement system to regulate their fight/flight behaviors. This neural exercise would be

to enable it to dampen sympathetic activity. Play literally becomes a functional therapeutic model, the exercising of the neural regulation of the face through song, through listening, through music, and through reciprocal social interactions. So in a sense talk therapy can be a neural exercise. As a coach get rid of low-frequency sounds, enable music or melody to engage people using prosodic voices, voices with great intonation, don't „bark" on people. This is critical in therapy because the intonation of voice conveys more information about the physiology of the client then the syntax. Social communication has a lot to do with intonation, gestures, and a cluster of behaviors. The face is moving along with the voice and hand gestures. The behavioral features trigger areas of the brain outside the realm of consciousness and change one's physiology, enabling them to feel closer and safer with another.

Clients who were traumatized should be told to„celebrate" their body's responses, since these responses enabled them to survive, it saved their lives. They can be proud of surviving without being angry or disappointed in themselves, or feeling guilty. Increasing self- compassion may also put the brain in a completely different state, a state of safety. And what is happening in most therapies? Therapies often convey to the client that their body is not behaving adequately. The clients are told they need to be different, they need to change. So therapy in itself is evaluative of the individual and when people are evaluated , they are in defensive states, they are not in safe states. So therapists should talk to their clients about all the wonderful things that their body did to enable them to be safe. So if coaches or therapists are able to create safe environments, clients have access to neural circuits that enable them to be social, to learn, and to feel good.

Another practical implication of Polyvagal Theory is a „Listening Project" introduced by S. Porges. It was developed to maximize the social engagement system in individuals.This project is functionally a neural exercise of acoustic stimuli. In the listening project therapists use vocal music, because they want to emphasize the prosodic features of the human voice. If people listen to the voice characterized by a great degree of tonal modulation, their nervous system functionally starts triggering a state associated with safety. The motivation of this project is to keep clients safe and then expose them to modulated acoustic information. Only if the nervous system is not required to be hypervigilant and defensive can the nervous system regulate the middle ear muscles to allow the client to experience the modulated sounds and it functionally starts triggering a state associated with safety.

Another way to apply Polyvagal Theory in practice is regulating behavioral state by vagus nerve, which in turn affects heart-rate variability. People can be taught how to maximize good vagus nerve activity in appropriate situations. The idea is to have a higher heart-rate variability, that is a more flexible nervous system, which can be done in a number of ways. Exercise is one of them. Exercise does an incredible amount for the nervous system. In particular, exercise that will increase heart-rate variability in interval training can help the vagus function in a better way. It is generally known that when heart-rate variability is increased, people have better emotional regulation. Brief meditation exercises- just watching one's breathing for five minutes is another way of stimulating the vagus nerve. Work with the breath can be a very useful technique as well. The simplest way is to inhale through the nose, exhale as if one is breathing through a straw, and to do that for about two minutes. Reducing one's breathing rate to between four and six breaths per minute also increases heart-rate variability.

6. Summing up

Stephen Porges' Polyvagal Therapy gives a useful picture of the Autonomic Nervous System that can guide coaches or therapists. This theory is the science of human relationships, connection and the science of feeling safe enough to fall in love with life. Thanks to the Polyvagal Theory people have the possibility to become active operators of their nervous systems. Good therapy, good parenting and good teaching is all about the same thing- how do you turn of defensiveness? When you turn defensive systems off, you have accessibility to different cortical areas for more profound understanding, learning, and skill development.

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