

## "Am I Safe?"

### A Neurobiological Theory of Social Engagement

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There is a little bit of Batman in all of us. We may not share his approach to scaling skyscrapers, but the detection of threat in social situations feels familiar. By processing information from the environment through the senses, the nervous system continually evaluates risk. While we may not be cognitively aware of danger, our body has already invoked a sequence of neural mechanisms that generate or inhibit defense behaviors such as fight, flight, or freeze.

#### **Seeing the invisible**

Shadowed by perils as we all are, you'd think that we would tire from exhaustion. Conducting risk assessments each time we want to start a conversation with the person next to us sounds effortful. But we would be wrong. Most of our keen risk detection mechanisms, according to professor Dr. Stephen Porges who is Director of the Brain-Body Center at the University of Illinois at Chicago, are mediated by the central nervous system and occur subconsciously.

For more than three decades, Dr. Porges has studied the neurobiological mechanisms of social engagement. He theorizes that the knowledge of human biology helps us to understand the generation of prosocial and defensive behaviors. Instead of wondering why we froze in a meeting or related social situation, Porges contends that we should recognize that our social behaviors reflect an evolutionary need for safety.

According to Porges' Polyvagal Theory, social engagement and defense behaviors are responses triggered by the perceived level of risk in the environment. To switch effectively from defensive to social engagement strategies, the nervous system must do two things: (1) assess risk, and (2) if the environment looks safe, inhibit the primitive defensive reactions to fight, flee, or freeze. After all, "a leisurely conversation," is not a particularly adaptive behavior in a precarious or life-threatening situation.

By processing information from the environment through the senses, the nervous system constantly evaluates risk. In detecting the person/environment as safe or dangerous, particular areas of the brain are triggered to support forms of social engagement. The cortex detects the face, prosody, movement, and intonation of a stranger or a new environment. Researchers have also identified that a particular area in the cortex becomes activated when we view familiar faces or hear familiar sounds.

Through this process of neuroception, the nervous system distinguishes whether or not to inhibit defensive behaviors. "Only in a safe environment is it adaptive and appropriate to inhibit defensive systems and exhibit prosocial behaviors," says Porges. The bottom line is that even though we may not be consciously aware of how we perceive our environment, our body is responding as if we do. Our nervous system acts more rapidly than any listening, thinking, or rationalizing process.

## **An old system in a new world**

Part of the problem with understanding the mechanisms of social behavior is that we are moving through the modern world with a prehistoric understanding of the autonomic nervous system. We've grown accustomed to the organizational model, developed in the late 1800's, that links the sympathetic nervous system to arousal and the parasympathetic nervous system to relaxation. This popular premise does not take into account how the human body and mind have evolved since the Paleolithic era.

According to the Polyvagal Theory, the autonomic nervous system has evolved new systems and orders of functioning. The first part of this theory emphasizes that a new system, called the social engagement system, links the nerves of the face with the myelinated vagus that regulates the heart and lungs. This system is intended to promote calm states and engender prosocial behaviors. The linkage between the nerves that regulate the heart and lungs means that we can use facial muscles to calm down. This might help us understand why "putting on a smile," can actually help us feel better. Dramatic facial expression exercises both the sensory and motor nerves regulating the facial muscles. This means that by exercising our facial muscles, we are also controlling our breath and inhibiting defense systems in heart and abdominal viscera.

Ultimately, it makes Darwinian sense for the regulation of the heart and lungs to be controlled by the same part of the brain that regulates the muscles of the face. As the vertebrate of the nervous system became more complex during the course of evolution, its affective and behavioral repertoires expanded. Emotional expression, ingestion of food, listening, and social interaction all became ways to regulate our bodies. The complex linking of systems offers a very real chance to turn off defensive strategies. Resulting prosocial behaviors that get genes into the next generation-- offer a more valuable prospect in the Darwinian calculus than fight, flight, or freeze.

The second part of the Polyvagal Theory emphasizes that the autonomic nervous system is no longer composed of just a sympathetic and parasympathetic system in balance. It is actually a hierarchical response system.

Influencing how we react to the world, three neural circuits compose this hierarchy. The exact order in this hierarchy is determined by its newness.

We usually react with our newest system, the myelinated vagus to calm or sooth. If that doesn't work, our sympathetic-adrenal system engages fight or flight behaviors. If our nervous system still detects risk, the most ancestral system is activated. The unmyelinated vagus triggers our most primitive form of defense known as immobilization. In the state of immobilization, our body reduces cardiac output to save metabolic resources. Behaviorally, immobilization with fear manifests as death feigning or passive-avoidance.

## **When we misinterpret risk**

There is clearly an evolutionary benefit to detecting risk. What happens though if our ability to perceive risk is impaired?

The detection of risk in a safe environment means that defense systems remain active. This would explain why Porges proposes that maltreated and institutionalized children with Reactive Attachment Disorder (RAD) are often emotionally withdrawn and impassive. The residual parts of the primitive brains did not give these children any choice but to engage in defensive social behaviors.

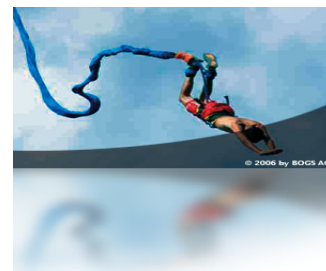
Still there is always a flip side. A person can trust their enemies and environments too much. Porges also noted that some children with RAD display uninhibited behaviors such as being indiscriminate in their attachments. A false sense of safety quelled each of their defensive systems.

Both examples of defective neuroception point to the most ironic of evolutionary psychology's implications: not all of the neural mechanisms generated by natural selection's imperative of genetic self-interest are adaptive. Indeed, faulty neuroception is a potential diagnostic feature of psychiatric disorders, such as autism and schizophrenia, in which individuals have difficulty with social engagement behaviors.

### **The comforts of safety**

The notion that innate sensors exist within us- that detect risk and transform messages of safety or danger into social behaviors- may sound like an unsettling perversion. Or at least it feels new. Yet, technological advancements have documented neural structures involved in the detection of safety.

Functional magnetic resonance imaging (fMRI) techniques document areas of the temporal cortex, fusiform gyrus (FG) and superior temporal sulcus (STS), as important arbiters of safe environments and trustworthy people. The FG and STS detect features such as movement, voice, and facial expression, to determine the level of risk in the environment. The detection of safety subdues the adaptive defenses mediated by the limbic system so that social engagement can occur. If danger is detected, however, an inhibition of adaptive defenses does not occur; the body physiologically prepares to respond to challenge.



### **When you watch these pictures - How safe do you feel right now?**

The comforts of safety, neurologically speaking, afford individuals the ability to engage in two dimensions of intimacy including: 1) courting, and 2) the establishment of enduring pair bonds. According to the Polyvagal Theory, courting depends on a synergism between the social engagement system (including the myelinated vagus) and the sympathetic-adrenal defensive system to promote trust and safety. The establishment of enduring pair bonds, however, depends on the release of oxytocin to regulate the unmyelinated vagus and block aspects of defensive freezing behaviors to enable immobilization without fear. The distinction between flirting and love may have never been as pronounced as in our neural pathways.

Is this knowledge useful? Porges demonstrates so. Armed with an understanding of how social behaviors are mediated by neurological substrates, he is changing treatment options for children with deficits in social engagement.

## Making the world safe for our children



The primal need for safety follows us from birth to adolescence to adulthood and beyond. In that sense, we never grow up. The concept of safety, of course, is relative. There is the psychodynamic view that a child's need for safety can be considered a dependency on the caregiver and a manifestation of fears of abandonment and rejection. Behaviorists posit that children's attitudes about safety reside in their habitual behaviors, habits that have been selectively reinforced. Neither addresses the neural mechanisms that deftly filter cues from the environment to evaluate risk.

Thanks to Porges, who designed the "Listening Project," data is being collected to determine how triggering specific neural pathways improves the behavioral functioning of autistic children. He posits that social behaviors such as looking, listening, communicating, and engaging in facial expressions are triggered by neural mechanisms that detect safety. Porges theorizes that brainstem structures associated with social behavior, known as special visceral efferents, are no longer function appropriately in children with behavioral and conduct related disorders. He explains that the disinhibition of the special visceral efferents promotes mobilization behaviors (e.g. hyperactivity, poor state regulation and lack of attention) and compromises prosocial behaviors (e.g. looking, listening, facial expressions, and vocalizations). Thus, Porges predicts that the stimulation of phylogenetically newer structures associated with the myelinated vagus will trigger coordinated responses in efferent visceral pathways. He predicts that spontaneous prosocial behaviors will result.

As currently implemented, the intervention involves five consecutive trainings, each of a 45-minute duration. During the initial training, the frequency band is narrow. Over the course of the training, the frequency band expands. Preliminary data, collected on approximately 200 autistic children, demonstrated immediate and significant effects on behavior. Results based on behavioral coding of videotapes, parent questionnaire data, and psychophysiological monitoring indicate that most of the children experienced changes. These included reduced auditory hypersensitivities, increases in facial affect, spontaneity, listening, communication and behavioral state regulation. At a three-month follow-up, parents report that children's improvements persist.

The implications of "The Listening Project," extend to the deepest concerns of childhood development. How do we create environments that make our children feel safe? How does the perception of safety change the nature of a child's social interaction with the world? How can our understanding of the heart and face connection change treatment options for youth with listening, communicating, organizing and behavioral difficulties? These questions remain at the heart of Porges' research.