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# The Polyvagal Theory in our understanding of safety and danger: How our body holds on to our experiences.

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# Abstract

The Polyvagal Theory provides a broader and holistic understanding of the biology and evolution of safety and danger, by suggesting how social interaction shapes the way humans think, feel, and act, as well as how they shift from one emotional state to another. Together with the acknowledgment of three adaptive Autonomic Nervous System mechanisms, an evolutionary shift from ancient reptiles to mammals, unravels a new phylogenetic mammalian system with emergent properties to facilitate social interaction, called the social engagement system. Through the spectacle of the Polyvagal Theory, an evolutionary point of view is adopted to further understand the relationship between early life experiences with caregivers, and the impact of overwhelming experiences, or trauma, on the human mind, and behavior, but most strikingly, how they are able to alter the body's homeostasis and manifest into illness.



*Keywords:* Polyvagal Theory, Vagus Nerve, Autonomic Nervous System, Trauma

# CHAPTER 1

## AN EVOLUTIONARY PERSPECTIVE OF EXPERIENCE

### Our Autonomic Nervous System in action

". . . When the mind is strongly excited, we might expect that it would instantly affect in a direct manner the heart…. and this deserves especial notice, that when the heart is affected it reacts on the brain; and the state of the brain again reacts through the pneumogastric [vagus] nerve on the heart; so that under any excitement there will be much mutual action and reaction between these, the two most important organs of the body" (Darwin, 1989, p. 52).

Through his book, "The Body Keeps the Score" *Mind, brain and body in the transformation of trauma*, Dr. Bessel Van Der Kolk, a psychiatrist and trauma research author, remarkably outlined the relationship of overwhelming human experiences and their impact on the development of brain, mind and body awareness. He comments on Charles Darwin's quote above – "Of course we experience our most devastating emotions as gut-wrenching feelings and heartbreak. As long as we register emotions primarily in our heads, we can remain pretty much in control, but feeling as if our chest is caving in or we've been punched in the gut is unbearable. We'll do anything to make these awful visceral sensations go away, whether it is clinging desperately to another human being, rendering ourselves insensible with drugs or alcohol, or taking a knife to the skin to replace overwhelming emotions with definable sensations" (Van Der Kolk, 2014, p. 76). Charles Darwin explored the connection of mind and body, a relationship still investigated today. This relationship has been researched extensively, modified and refined, in an attempt to provide a thorough understanding of the internal bodily mechanisms that can protect us against threat and lead us to safety, but at the same time, how their misattunement can be responsible for the development of many mental

and physical health problems – a phenomenon commonly seen in individuals with a history of trauma.

Traditionally, Arousal theory had prevailed in the scientific community for providing a means for psychophysiological measurement tools to accurately indicate the level of arousal in the body at a specific point in time. This was based on the rudimentary understanding that measurements such as heart-rate and sweat responses could serve as precise indicators of sympathetic activity for detecting the level of arousal (Porges, 2021, p. xvi). According to the author, psychiatrist and neuroscientist Dr. Stephen Porges, there is a widespread misunderstanding of the mechanisms by which the Autonomic Nervous System functions. The widely shared view states that our ANS is set into balanced models of sympathetic mobilization responses, responsible for fight or flight, juxtaposed to an antagonistic parasympathetic model responsible for controlling our body's health, growth and restoration. This resulted in the notion that there is a certain level of arousal, which when experienced, allows you to either engage or disengage from the world. Dr. Porges explained that most people separate the brain with the state of their viscera. When dealing with the body's physiology people consult doctors of different disciplines while when dealing with mental struggles people consult psychologists or psychiatrists. "The problem with this conceptualization is that it is missing the linkage between the underlying neuroregulation of our viscera, with how our higher nervous system functions" (Dharmacafe, 2012). Therefore, if there is another point of view that asks for our attention, what can this mean for our understanding of overwhelming experiences, trauma and recovery?

Dr. Porges argues that this misconception, or myth as he calls it, does not account for an ancient parasympathetic defense system of a reptilian origin which renders organisms immobile in the face of danger (Dharmacafe, 2012). This means that our ANS is capable of activating mobilization, fight or flight responses, and immobilization, freeze responses to cope with

dangerous situations. This finding was especially fascinating to trauma therapists, because it provided an explanation for what happens when victims of trauma enter an immobilized defensive response where they would completely freeze and shut down. Since there was no explanation for this phenomenon within the traditional model of arousal, trauma victims were simply given a diagnosis of Post-Traumatic Stress Disorder (PTSD) and expected to show increased sympathetic activation with high levels of stress hormones after the traumatic incident. To the surprise of trauma therapists, these criteria did not fit with the behavioral patterns and symptoms of many trauma victims who instead exhibited markedly low activation and responsiveness. Thus, there was no acknowledgment of the immobilized defense system (Dharmacafe, 2012).

**An introduction to the Polyvagal Theory**

Fortunately, a theory was established that was able to incorporate all these pieces together and provide an adequate understanding of the relationship between our internal sensations and our mind and brain. It is called the "Polyvagal Theory," established by Dr. Stephen Porges in 1994 and continues to develop to this day. The term polyvagal refers to the different branches of the tenth cranial nerve, the vagus. This nerve is connected to our brainstem and our visceral organs such as the heart, lungs, stomach and intestines (Van der Kolk, 2014, p. 78). The theory provides a complex and non-linear model of autonomic activation, unlike the theory of arousal, which emphasizes the existence of a bidirectional communication (top-down and bottom-up) between the brain and the viscera (Porges, 2021, pg. xvii). In other words, through bidirectional feedback loops, the body's internal physical responses (e.g. heart-rate) influence the brain and the way an individual reacts, and likewise, the brain can influence the visceral sensations of the body (e.g. gut-wrenching feelings). An example of this is perfectly described by Van Der Kolk (2014, p. 81) "The vagus nerve (which Darwin called the pneumogastric nerve) registers heartbreak and gut-

wrenching feelings. When a person becomes upset, the throat gets dry, the voice becomes tense, the heart speeds up, and respiration becomes rapid and shallow."

The Polyvagal theory investigated the existence of an ancient unmyelinated phylogenetic vagal pathway from our reptilian ancestors, emerging from the brainstem and connecting to our viscera, responsible for a defensive response of immobilization (Porges, 2021, p.9). In the past, this primitive defense system allowed reptiles to survive by reducing metabolic activity long enough for the threat to pass. In the face of danger from a predator, they remained immobile, and appeared dead. Through evolution, mammalian organisms carried this ancient phylogenetic circuit in a cortical structure we now refer to as the reptilian brain (in the brainstem), which can be activated in human beings as the last resort, when a situation becomes so overwhelming and all efforts to escape or fight off the enemy fail. As a result, people shut down, freeze or collapse (Van Der Kolk, 2014, pp. 83, 80).

**The three levels of safety**

With the consideration of this ancient defense system, we are now aware of two autonomic defense system activations to be recruited in response to threat – *fight, flight (mobilization)*, and *freeze or collaps*e (immobilization). In combination with these two, our ANS regulates three hierarchical phylogenetic stages, with the remaining one being the youngest and most efficient subsystem that is activated first (Kolacz et al., 2019). The detected level of safety determines which one of the three stages will be recruited as a response. When faced with danger, our instincts lead us to the first and youngest level of response *1. Social engagement*. Here we attempt to seek help and support by turning to and interacting with the people around us. If this is not possible (help from our social environment cannot be provided to us), we activate the first level of defense *2. Fight or flight* – where we attempt to fight and escape by all means necessary. However, if

this response is also unsuccessful in eliminating danger, we revert to the second and most primitive way of defense, *3. we freeze, shut down, and collapse*. This is when our bodies detect the danger to be inescapable and our last hope for survival depends on preserving the energy we have left (Van Der Kolk, 2014, p. 80).

## The multibranched vagus nerve

The anatomy of the vagus nerve from an evolutionary point of view is crucial for our understanding of how people deal with overwhelming or traumatic situations. As well as which factors contribute to the recruitment of these three different stages, a topic which will be revisited gradually within the next sections.

With the phylogenetic shift from reptiles to mammals, specific vagal pathways were developed to support the complexity of a social mammalian life. A face-heart connection was formed with properties of a social engagement system that allows humans to efficiently regulate their visceral states through social interaction. This is how we can shift from one emotional state to another. This connection is located in a vagal pathway called the Ventral Vagal Complex (VVC) that coordinates the heart with the muscles of the face and head, responsible for sucking, swallowing, breathing, facial expressions, and vocalization. It is through this social engagement system by the VVC, that individuals communicate and signal their emotional and physiological states to other people around them, through the use of their voice and face (Porges, 2009; Van Der Kolk, 2014, p. 83; Porges, 2021, p. xx). Prior to the development of the VVC, there was an evolutionary older and primitive complex that activated in response to stress. Arising from the dorsal vagal nucleus, the Dorsal Vagal Complex (DVC) connects to organs below the diaphragm and during defense, it dampens metabolic activity to reserve metabolic and oxygen resources necessary for survival in the face of terror or danger. As a result, this is

experienced behaviorally as a shut-down, freeze, collapse, or feigned death, referred to as immobilization (Porges, 2021, pp. 91-92).

## Our instincts are our Neuroception

While detection of threat promotes defense responses, detection of safety facilitates social interaction, due to our social engagement system. Our body responds to safety by promoting affiliative co-regulation, and maintaining a calm emotional baseline (Kolacz et al., 2019). This capacity for detecting whether our environment is threatening or safe occurs through the process of Neuroception, which is a mechanism functioning precisely beyond conscious awareness and thus distinct from our perception (Porges, 2021, p. 12). While all humans possess this capacity, neuroception is usually very accurate during a young age. Specifically, children's awareness of people and surroundings match well with their instincts. This detection is not a cognitive one, but rather a neurophysiological one that automatically prepares the body to adopt the appropriate response (Porges, 2004). It functions through neural circuits shared by our vertebrate ancestors capable of detecting and picking up on relative environmental ques of safety or danger and can therefore either promote or disrupt engaging social interaction and visceral homeostasis (Porges, 2021, p. 12). As long as our neuroception functions properly, these neural processes work optimally. Although, how can we explain why some individuals respond disproportionately with respect to their actual environmental cues and have a hard time detecting what is safe and what is dangerous? How is it that, in response to the same or similar life events, some people become socially engaged and take effective action, while others become depersonalized, frozen or collapsed?

## Can you trust your instincts? Can you trust your body?

In order to effectively switch from using defensive strategies for protection into engaging socially, humans must perform two adaptive tasks; *1. Risk*

*assessment* and *2. Only if the environment is assessed as safe,* can the defensive responses be inhibited. Any cue that can potentially signal safety, has the potential to recruit the phylogenetically newest mammalian social engagement system (Porges, 2009). The Neuroception's function is the capacity to detect the intention behind movement and sounds, thus, the neuroception of familiar individuals, with warm soothing voices, and friendly intentions, have the capacity to calm us down, make us feel safe, and shift us out of a negative state. Likewise, when we are ignored or dismissed, when we don't feel seen or heard by our significant others, this can lead to rage reactions, and even mental collapse. (Porges, 2021, pp. 81-82; Van Der Kolk, 2014, p.78). As Porges (2021, p. xx) mentions, our social experiences and our interactions with people around us trigger physiological states that can either cultivate trust, promote prosocial behavior, and strong social relationships. However, negative experiences can also be the result of mistrust and poor social relationships – a phenomenon often observed in people with a history of trauma who, as a consequence, develop a faulty neuroception; an adaptive survival mechanism that biases some people into detecting risk when none is present, or identifying safety in the midst of danger.

# CHAPTER 2

## THE IMPACT OF ATTACHMENT AND CONNECTION

### The Importance of Social Engagement

During infancy and childhood, there is an essential requirement of appropriate social engagement between the child and the primary caregiver for the establishment of secure attachments and positive bonds. Van Der Kolk (2014, p. 110) stated that the nature of this attachment style, whether secure or insecure, makes a large difference for the child's life later on. The reason why early developmental stages are so important for an optimal development is because the brain's neurodevelopment matures from the bottom up, i.e. in a hierarchical manner. This means that different areas of the Central Nervous System (CNS) organize and develop at different points in time, and are sensitive to developmental critical periods and sensory experiences throughout the course of life (Perry et al., 1995).

At birth, the brainstem is the first functional area of the brain responsible for cardiovascular and respiratory functions that control heart-rate, sucking, swallowing, breathing and vocalizing. During this time more complex higher brain structures such as the limbic and cortical areas have years to come until they can develop and be used properly, even though babies are very sensitive to detecting facial expressions, tone of voice, posture, and emerging actions (Perry et al., 1995; Porges, 2021, p. 27; Van Der Kolk, 2014, p. 110). As Van Der Kolk (2014, p. 84) accurately portrays, "Newborn babies are not very social; they sleep most of the time and wake up when they're hungry or wet. After having been fed they may spend a little time looking around, fussing, or staring, but they will soon be asleep again, following their own internal rhythms. Early in life they are pretty much at the mercy of the alternating tides of their sympathetic and parasympathetic nervous systems, and their reptilian brain runs most of the show."

Social engagement is important not just within the context of a home, with the children's caregivers, but also with peers in school as well – where children spend many hours of their day at. Our cultural educational system believes that maximizing time for classroom instruction is much more important than leisure time, and time spent socially interacting with others. It conceptualizes play as a distraction from learning opportunities and it can often be judged as a diversion from "real work" (Porges, 2021, p. 61; Porges & Buczynski, 2011). The term play, in this case, refers to social interaction, and it requires the ability to activate mobilization and inhibit any parasympathetic arousal that facilitates defensive states. Our social engagement system requires play as a neural exercise that facilitates the development and control of better state regulation, and enables effective and controlled transition from calm to active states. Creating environments to encourage play from a young age, at home and in school, can train the brain's neural circuits and strengthen the ability to inhibit defense systems and enable the fostering of calming down, attending and learning (Porges, 2021, p. 61). As a result, this can build resilience and allow the brain to better cope with negative and traumatic experiences later on. Unfortunately, many educational systems to this day, tend to overlook emotional engagement and instead turn their focus on training the brain's cognitive capacities (Van Der Kolk, 2014, p. 85). Hence, shifting the focus away from allowing children to adequately have the chance and absorb a variety of sensory experiences.

**Emotional and Physical Attunement**

Babies are entirely dependent on their caregivers for meeting their needs in order to cultivate a secure emotional attachment. This is possible only when the child and caregiver are physically and emotionally attuned with each other – when the mother responds to the baby's impulses and needs. If the mother and child are in synchrony, the baby's emotional state of satisfaction and connection is reflected through a steady heart-rate,

breathing pace, and low level stress hormones (Van Der Kolk, 2014, p. 112). Within the framework of the Polyvagal theory, social relationships are essential to our understanding of experiences and behavior, especially the experiences built in the first weeks and years of life. While infants cannot fully engage socially, they mirror the faces and voices around them, and primarily those of their caregiver. As Bowlby (1988, p. 10) mentions, whenever mother and infant meet each other, they begin an affectionate social interaction with greetings, followed by an interchange of facial expressions and vocalizations from which the baby begins to gravitate closer to the mother and reciprocates with excitement, breaking into happy giggles and body movements. Naturally, and as expected, their time together can be interrupted by periods of disengagement where either the baby or the mother turns away. If the baby turns away and disengages, following its own rhythms, the mother needs to tune in and regulate her behavior to suit the baby; by softening her tone of voice, slowing down her movements, and adjusting the timing and form of her next actions in accordance to her baby's rhythm. This attunement or synchrony, builds a natural communication system which strengthens when the primary caregiver (usually the mother) is responsive and a reliable source for providing comfort, strength, and the reassurance that the child will be protected from threats later in life, whilst interacting well with others (Van Der Kolk, 2014, p. 111).

In cases of no synchronicity, when mother and child are not attuned with each other as it often happens when the mother disappears from sight, or does not engage fully with her child, this can cause nervousness. To illustrate this, Van Der Kolk (2014, p. 112) observed a mother playing with her two-month-old son during an ongoing observational research study. The mother leaned over to nuzzle her baby, and from his excitement he pulled at a piece of her hair. Caught off guard, the mother pulls the baby's hand away contorting her face with pain and anger. The baby releases his hand immediately and pulls away as well. Frightened, he holds his arms up

to cover his face and block out the sight of his mother's unpleasant reaction. Both went from a joyful time into a distressed state in the course of a few seconds. As the mother begins to notice that her baby is upset, she attempts to reestablish harmony and calm him down by leaning closer and tickling his belly. As a response, her baby lowers his arms and begins to smile and giggle once again. Attunement is emotional as well as physical and it can be disrupted as long as it can eventually be restored. Babies tune in to their caregivers' energy and in turn begin to sync up according to the current emotional state, while their body's physiology does the same. We can tell attunement has been restored when the child's physiology returns back to normal levels.

**Emotional and Physical Misattunement**

Children with a secure attachment learn what makes them feel good or bad, what actions to take to achieve their desired state, as well as how others will respond to them. They begin to understand in which situations they can or cannot have any control over (Van Der Kolk, 2014, p. 112). Unfortunately, this is not the case with children that have not developed a secure attachment. These are infants or young children who have not been exposed to appropriate sensory experiences (either a deficiency, or an extreme amount) during critical time periods of their brain's neurodevelopment (Perry et al., 1995).

A newly sensitive brain of an infant or child is much more malleable and plastic than that of a mature brain. Children's brains are sensitive to environmental input, and a lot more vulnerable to their experiences during this time, which unlike for adult brains, provide an organizing framework by which a young child will process information throughout its life. Early experiences become the prototypes that the child will hold on to and use for all connections as he/she steps out into this world (Perry et al., 1995; Van Der Kolk, 2014, p. 109).

## Experience shapes neurodevelopmental processes

As mentioned earlier, the brain develops in an organized hierarchical, bottom up process, and each subsystem varies in function. Systems mediating heart rate, blood flow, and arousal are regulated in the brainstem, the first functioning area starting from birth. Systems regulating affect, emotions, and attachments are located higher, in the limbic cortex, an area that develops throughout the first years of life. While higher functioning regulatory systems responsible for reasoning, abstract thought, and language present in the neocortex, such as the frontal lobes, are the last to develop. All subsystems are regulated following and obeying the same developmental rules, and change in response to chemical signals upon incoming information in the neurons. The brain's neural structure is designed to take form with response to experience. In essence, all types of sensory experiences influence the brain's neurochemistry, and through time, depending on frequency, and level of intensity, neuronal circuits develop to accommodate different types of sensory experiences for each time they are perceived.

That being the case, experience starts to generate a processing algorithm through which all new input will be filtered by. The more frequent a certain experience occurs, the more prevalent the neuronal circuit activations will become for that specific experience – allowing these circuits to take a more permanent form in the brain. Therefore, the brain develops in a use-dependent manner, hence the term neuroplasticity. Later attempts to modify neuronal networks become harder as time passes. Evidently, efforts to change someone's reaction, attribution, or perception about something is far easier during childhood, or adolescence than it is during adulthood.

This is immensely important to remember while speaking about trauma. If during early life, young children sustain neglect, violence, separation, and/or any other form of abuse, they become susceptible to developing emotional, behavioral, psychological, psychiatric, cognitive, and social problems (Perry et al., 1995). Sustained traumatic experiences trigger use-

dependent neural processes associated with responding and dealing with threatening and overwhelming situations. In effect, the brain builds cognitive memory and internalizes learned responses utilized to cope with a given situation. A consequence of these repeated activations is sensitization – in which brain circuits become over-sensitive to not just the event itself, but to any minor environmental cue associated with the relative traumatic experience. Such that any stimulus, at any given time, can elicit the same "full blown response pattern" associated with their traumatic past (Perry et al., 1995, p. 5). Dr. Van Der Kolk (2014, p. 76) coined the phrase "stuck in survival mode" to illustrate how victims of trauma find themselves trying to defend themselves against unseen enemies. Their brains are unable to move on from the past, especially while various environmental cues are perceived as triggers that elicit defensive mechanisms.

**Experience-based defense mechanisms**

We carry our early experiences with us throughout our lives, and our brain holds on to the mechanisms that succeeded in eliminating threat or at least minimized our distress. Our connections with our caregivers shape the way we perceive reality and a map of the world is formed, remaining relatively unchanged across time. People who sustained abrupt or prolonged traumatic experiences early in their life, often internalize the use-dependent fear-responses they have utilized when the traumatic event occurred. As a result, the response became a "state" memory in their brain that can regularly be reactivated later, resulting in a character trait (Perry et al., 1995). This phenomenon accounts for the difference in defense responses varying between people undergoing similar negative experiences throughout life.

According to Perry et al. (1995), a deficiency of sensory experiences during critical time periods of development are commonly seen in neglected children, who exhibit an under activation of neurochemical cues. While

children who sustained an overstimulation of sensory stimuli during sensitive time periods, as a response to traumatic events such as emotional or physical abuse, exhibit an over activation of neurochemical cues. Furthermore, Van Der Kolk (2014, p. 113) explained that abused children become very sensitive to faces, voices, and body movements. They are fast at interpreting any alterations in someone's voice or face as threatening. They have difficulty in staying in sync with their surroundings, and are constantly alert – a "sensitized" hyperarousal state (Perry et al., 1995). On the other hand, (Van Der Kolk, 2014, p. 114) when a mother is absent and neglectful of her child and unable to attune to her baby's reality, the baby begins to adopt the mother's idea of what the baby seems to be for her, and in turn, learns to discard its own needs, suppresses its impulses, just like the mother does, and eventually adjusts to her needs instead. Children who have not experienced physical and emotional attunement are susceptible to neglecting feedback cues from their bodies, shutting down pleasure, and purpose, which according to Perry et al., (1995), these phenomena can lead to dissociative states.

**Stuck in survival mode**

The Polyvagal theory illuminated the fact that the human nervous system is capable of eliciting three defensive responses, each originating from a deeply ingrained physical and mental response pattern against threat; fight, flight, and shutdown or collapse. Infants and children however, are much less likely to utilize a fight or flight response strategy, since it wouldn't be very effective or practical. During different stages of development and depending on the experienced stress levels, defensive responses vary. There are two main response patterns that can be categorized as hyperarousal, and dissociation (hypoarousal) (Perry et al., 1995). Identical to fight or flight, and collapse. Perry et al. (1995) referred to prolonged stress response states as the hyperarousal continuum, in order to describe the state of alarm following the perception of threat,

characterized by increased heart-rate, blood pressure, respiration, hypervigilance, and an increase in stress hormones that prepare the body to fight or flee. However, this state of hyperarousal does not subside when the threat ceases to exist, rather, due to sensitization, it continues to re-emerge upon cues or even thoughts that trigger the memory of their traumatic past; leaving children at a long term state of alertness that prevents their neuroception from functioning accurately. Consequently, leading to potential faulty detection of threats in safe situations and/or safety in dangerous ones.

Since children cannot utilize the traditional fight or flight response, they will alternatively vocalize their distress by crying, to attract their caregiver's attention and bring them to their rescue. This choice to engage outward is their way to actively defend themselves against a threat. However, for a maltreated child, this attempt is often unsuccessful, since the parent often is the cause of their trauma and typically unresponsive to the child's outcries. Therefore, when hyperarousal defense responses of mobilization (actively trying to defend) do not eliminate the threat, and attempts to pull their caregivers' attention to them fail, children will have no choice but to surrender and move into a dissociative state waiting for the threat to pass. They activate the last resort. A behavior indicative of multiple desperate and disappointing attempts to get through to their caregiver. A dissociative state begins by remaining immobile, staying compliant, and eventually to dissociate; a state of disconnection from oneself and the world around them (Perkins, 2021, p. 25). States of dissociation are characterized by decreasing cognitive processing, proportional to increasing anxiety.

Similar to the hyperarousal continuum, sensitization can also be developed in this case, resulting in the dissociative continuum. Which is a pattern of behaviors exhibited during anxiety inducing conditions and often unrelated to their traumatic past per se, yet still perceived as triggers (Perry, et al., 1995). States of dissociation occur beyond conscious awareness, when one feels complete lack of control over their mind and physical state.

Traumatized children with a dissociative continuum, can quickly move from threatened to terrorized, often in response to an adult persistently forcing them to comply to a directive. In consequence, these children tend to attend inward to their internal world of fantasy and daydreaming which sometimes moves them into a state of derealization and depersonalization – states often belonging to profound dissociative gradations, commonly observed in victims of trauma.

In a holistic view, our ANS functions by maintaining a cycle of defensive responses against challenges, and preserving homeostasis. Processes during development can shape or "customize" ANS functions throughout the course of our life. For the majority, traumatic stress from negative experiences will cause adaptive responses to be maintained post-trauma and rehearsed over and over (Kolacz et al., 2019). The nervous system absorbs and retains the overwhelming stress from all those negative experiences, and when trauma is left unattended, or untreated, stress can precipitate psychological, cognitive, or psychiatric symptoms which, in time, may manifest into illness. Something that starts "out there," Van Der Kolk (2014, p.69) mentions, can be brought inward and preoccupy our minds by "playing out in the battlefield" of our bodies, "without conscious connection of what happened back then and what is going on right now inside." Therefore, the impact can never be confined in our heads alone. If we acknowledge, at least to a simplified extent, that the nervous system connects both mind and viscera, how can we limit our sensory experiences within our cognitive world, and expect they will have no influence on our physiological well-being?

# CHAPTER 3

## THE MANIFESTATIONS OF TRAUMA

### The tragic 402 highway accident

During the morning of September 3rd 1999, Ute and Stan Lawrence set out for a business meeting in Detroit. They drove along the 401 four lane highway, when they suddenly encountered a wall of dense fog scattered along the street ahead of them. Stan instantly slammed on the brakes swerving sideways and coming to a stop just barely missing hitting a large truck. All of a sudden, an eighteen wheeler flies over and smashes into their roof. Vans, trucks, and cars all slamming into each other throughout a two kilometer distance of an eighty-seven vehicle pileup. Hell broke loose (Van Der Kolk, 1995, p. 65; "Reliving the horror of the 401 fog," 2009).

Stan and Ute were trapped in their car while Stan desperately attempted to open the door or windows for them to escape, when they heard a little girl from the crashed car next to them scream for help as she was wrapped up in flames. They felt helpless and unable to assist. Stan finally smashes the windshield and climbs out. Ute, however, remained frozen at her seat for the entirety of this devastating incident, up until the point where she was lifted out of the car by her husband with assistance from another driver. After being brought into the emergency room, both Stan and Ute appeared to have sustained no physical injuries. That night, Stan and Ute didn't want to go to sleep, for their fear that if they did let go, they would die. Instead, they numbed their brains with wine, and drank themselves to sleep for many nights (Van Der Kolk, 2014, p. 65).

Eventually, Mr. and Mrs. Lawrence sought treatment to deal with their traumatic stress. They both needed to undergo an fMRI scan aiming at obtaining the brain activity they exhibited at the time of the accident. This was established by recreating the same scenario with the same sensory

stimuli (images, sounds, smells), within the fMRI, to remind them of that day (Van Der Kolk, 2014, p. 66).

When Stan went into the scanner he immediately re-experienced the highway accident in his head. When he came out he was sweating, and his heart rate and blood pressure were elevated. He exclaimed that this was exactly how he felt during the accident, he was sure he was going to die. His scan showed increased activation throughout the cortex, which is typical of someone experiencing a traumatic event in real time. The brain made no distinction of past, present, or future. All sensory experiences were heightened, stress hormones were released, and Stan was prepared to fight or flight (Van Der Kolk, 2014, p. 66). This is how he was able to prepare his escape from the car, and assist in any way he could. In the scanner, Stan experienced dissociation, which is "the essence of trauma," according to Van Der Kolk (2014, pp. 65-66), where the overwhelming sensory experiences become fragmented and separated from the brain and memories can intrude into the present where they can appear as if they are re-lived. When trauma remains untreated, these intrusions keep bringing the body into the same survival mode every time, by releasing stress hormones and preparing to fight.

Ute's scan, on the other hand, showed markedly decreased activation in nearly every cortical area. She re-experienced the accident in the scanner, and went numb, again. Her heart-rate and blood pressure remained at baseline, and when she was asked how she felt, she exclaimed that she felt exactly the same way she did that day – she felt absolutely nothing (Van Der Kolk, 2014, p. 71). The medical term for what Ute experienced is depersonalization. When the mind becomes so overwhelmed with stress that it eventually decides to detach itself from feeling, because it cannot deal with the reality of the situation (Perkins, 2021, p. 40). Depersonalization is the outward manifestation of the frozen immobilization defense response, characterized by an absent mind, a blank state. Ute had

dissociated from her fear, and protected herself by feeling nothing (Van Der Kolk, 2014, p. 71).

Both Stan and Ute had witnessed the same accident, at the same time, sitting right next to each other, and yet, the difference in responses was dramatic. How is it that two people can react to the same event so differently from one another? The answer possibly lies back in time, during the early years of life.

When Ute was nine years old her father had passed away. Since then she lived only with her mother who was often very cruel and demanding with her. Oftentimes when her mother would yell at her, she learned to blank out her mind and cope by mentally disappearing from that situation. Ute's mind had built a neuronal network specifically for keeping out overwhelming emotions. Thirty-five years later, trapped in a crushed vehicle with her husband, her brain reactivated that same survival strategy. Henceforth, intense trauma can absolutely trigger the neuronal mechanism built from the past (Van Der Kolk, 2014, p. 72; Perkins, 2021, p. 45).

## Cognitive and psychiatric consequences of prolonged defense states

Under normal circumstances, when a threat passes, the body's stress hormones return to baseline. For traumatized individuals, however, stress hormones take much longer to do so. As mentioned earlier, when trauma remains untreated, intrusions of the traumatic event may be prevalent, causing the body to respond by continuously preparing its physiological defense. That is, by signaling the release of stress hormones. When the body re-lives the visceral sensations elicited during a past negative event over and over again, this triggers significant changes in brain circuits that receive neural signals responsible for regulating basic bodily functions. Not only is it hard to regulate stress hormone production after experiencing flashbacks, but a disproportionate hormone release is common in response

to new stressors, and future negative situations, or mild stressful stimuli (triggers). The constant elevation of stress hormones can result in cognitive and psychiatric issues such as problems in memory and attention, irritability, and sleep disorders, among many others (Van Der Kolk, 2014, pp. 95, 46).

Anxiety is the most common persistent symptom after a traumatic experience. During childhood, children with a sensitized hyperarousal or hypoarousal continuum, often use a freezing response when they experience anxiety (e.g. during a family visit). Feeling anxious is a response elicited due to a stimulus triggering their already sensitized neural circuits (Perry et al., 1995). From building an autonomic sensitivity to threats, many children and adults experience an over activity of their stress response system (Kolacz et al., 2019). Freezing in response to threat, does not always constitute a problematic behavior. Rather, it can be a very normal protective reflex of the mind to shield itself from the overwhelming impact of the stressor, such as in the case of depersonalization. This mechanism stems from our ancient phylogenetic defense system and can be portrayed as a valve in our brain that opens to release an overflowing surge of anxiety in order to facilitate survival. (Perkins, 2021, pp. 39-40; David, 2020, p. 46). However, it poses a problem when depersonalization continues to be triggered more often, during situations in which this defense might not be realistically necessary. If the prolonged stress experienced in the brain becomes too frequent and too intense, the brain might eventually "decide it's had enough" (Perkins, 2021, p. 42). Essentially, the mind decides that navigating through life would be much easier without having to live with overwhelming stress. The valve eventually blows, and depersonalization can result in a disorder rather than remaining a symptom. Depersonalization disorder (DPD) is a diagnosis given to individuals who often enter states where they separate themselves from their surroundings. For the brain to dissociate the pain, it inevitably numbs out a big part of experience too. As a result, people who suffer from

DPD feel detached, hollow, and find it hard to relate to their environment and situations the way they used to, and the way other people would (Perkins, 2021, p. 43).

Furthermore, findings demonstrate that a history of abuse increases the prevalence of developing symptoms of anxiety and depression, and is attributed to traumatic triggers. Specifically, strong evidence suggests that childhood maltreatment, especially sexual abuse, increases the risk of developing depression and anxiety during childhood or later in adulthood (Kolacz et al., 2019; Li et al., 2015). Adults who came forward about being abused at a young age, were observed to exhibit more post-traumatic stress symptoms, depression and anxiety symptoms, eating disorders, sleeping disorders, and avoidance (Li et al., 2015).

Traumatized individuals experience chronic unsafety within their visceral sensations. As Van Der Kolk (2014, pp. 96-97) represents it, "the past is alive in the form of gnawing interior discomfort." Their physical sensations constantly send warning signs that they themselves attempt to manage by often ignoring them to the point where they become unaware of their existence and are incapable of naming them. The more these visceral experiences are left unattended and placed aside, the more likely they are to take over, and produce serious side effects. People who do not feel comfortable enough to acknowledge and notice what they are feeling inside, run the risk of responding to any trigger by shutting down or having a panic attack. Panic attacks, another side effect of trauma, occur because people develop fears of the physical sensations associated with these attacks. "They develop fear of fear itself" (Van Der Kolk, 2014, p. 97). So long as they cannot let go of their fear and change their perception of their sensations, they will remain hostages in their bodies. According to Van Der Kolk (2014, p. 97), the price to pay for dismissing the body's messages is losing the ability to detect what is safe and what is dangerous. Self-regulation is lost, and reliance on external regulation becomes unavoidable

– such as dependence on medication, substance use, external reassurance or excessive compliance.

**Physiological consequences of unattended trauma**

Suppressing our body's alarm signals for help does not prevent stress hormones from being secreted. Even if one ignores his physical distress, over time, the body will start to develop symptoms that will leave him no choice but to take notice. Of course, one may not always be conscious of the fact that their body is in a defensive state, such as in cases where one is in a state of denial. But even if the conscious mind ignores what is really going on, the stress hormones keep signaling for the body to prepare either a state of mobilization, or immobilization. Some people may even choose to numb their uncomfortable sensations by using substances such as alcohol or drugs (similar to Stan and Ute Lawrence) "but the body continues to keep the score" (Van Der Kolk, 2014, p. 47). The development of somatic symptoms with no clear underlying causal factors are very common among children and adults who have sustained trauma. These may include migraines, chronic back pain or neck pain, gastrointestinal problems, fatigue, and many others (Van Der Kolk, 2014, p. 97).

Some very frequent psychosomatic conditions that many people experience as a result of traumatic stress, are Gastrointestinal (GI) tract dysregulations such as Irritable Bowel Syndrome (IBS). GI tract conditions can encompass a vast range of symptoms, some of which include digestion difficulties, abdomen pain, vomiting, and nausea. Often, people do not receive an answer as to what medical reason is responsible for their condition. In many cases, there isn't one. Interestingly, functional GI disorders are commonly seen alongside other psychiatric diagnoses, such anxiety disorder, depression, and Post Traumatic Stress Disorder (PTSD). There is an increasing amount of patient referrals in gastroenterology and pain clinics with a history of abuse. Among those, are patients with GI dysregulations and fibromyalgia (chronic diffuse pain), of which 67% are

females who have sustained sexual or physical abuse. Nonetheless, the pathophysiological mechanism that links trauma to physiological dysregulations of the gut has yet to be established (Kolacz & Porges, 2018).

The Polyvagal theory provides an understanding of the brain-body connection which is composed of regulatory systems and interoceptive/exteroceptive detection systems to monitor the body's internal states in accordance with its external environment. Its primary function is to regulate homeostasis to facilitate biological processes and prepare the body for dealing with internal or external threats when needed. Interoceptive signals from within the body provide homeostatic status updates to the brain about the body's condition. The complimentary exteroception, signals status updates of the environmental conditions outside, which allow for a proper preparation of bodily states and resource allocation required to match environmental demands accordingly (Kolacz & Porges, 2018).

The human organism can adaptively switch from homeostasis to a defensive response quickly in the presence of an acute threat. In the long run though, frequent state shifting which maintains threat response states, can pose a major risk for body function dysregulation, and illness. In order to shift to a state of defense the body either increases or inhibits metabolic functions such as digestion and bowel movements. In consequence, feedback-loops integrated in the brain-body connection, and specifically in the brain-gut connection, which work to maintain chronic responses to threat, can set about a compromised functional state that can lead to a manifestation of functional gastrointestinal disorders (FGID) such as IBS (Kolacz & Porges, 2018). In other words, a pathophysiological state is developed due to long-term threat response activations that alter the homeostatic baseline of the brain-gut connection. As a result, these alterations may become self-maintained even after the cessation of threat, which indicate a learned response (Kolacz & Porges, 2018).

## Within the spectacle of the Polyvagal Theory

The conceptualization of such disorders as a systemic dysfunction caused by a maintained chronic autonomic threat response, can transform our understanding of illness and provide opportunities for innovative treatment methods that target the brain-body connection, including the brain-gut axis, rather than focusing solely on fixing localized individual symptoms (Kolacz et al., 2018). By adopting a holistic perspective that acknowledges both psychological and physiological impacts as two sides of the same coin, medical interventions can be coupled with the appropriate forms of cognitive therapy. Correspondingly to what Van Der Kolk (2014, p. 54) writes, "these attempts to maintain control over unbearable physiological reactions can result in a whole range of physical symptoms, including fibromyalgia, chronic fatigue, and other autoimmune diseases. This explains why it is critical for trauma treatment to engage the entire organism, body, mind, and brain."

Within the framework of the Polyvagal theory, there is an outline of a new mind-body science that views the entire ANS as a collaborator in a client's journey to wellness. The framework's core meaning encourages the view that the body's search for safety is submerged within the actions of the nervous system that promote health. Safety and threat are conceived as parallels in the ANS. The theory aims at uncovering the "portals," as stated by Porges (2021, p. xv) through which the social interaction and connection with other people can aid our neurobiological search for safety.

Dr. Stephen Porges (Science and Nonduality, 2022), believes there is a wisdom in our body that is constantly trying to communicate to us what it's pleading. Once heard, and properly attended to, it will provide its service to us. The Polyvagal theory holds the concept that our underlying physiological state can shift how we perceive the world. From a state of mobilization (fight or flight) the world is viewed as the enemy. While if the body supports homeostasis through vagal regulation of the ANS, the world is viewed optimistically. When shutting down through the ancient

phylogenetic vagal pathway, we can dissociate, and immobilize. We begin to withdraw and lose contact with the world. The take home message is that our autonomic state is a powerful mediating variable that stands between the context in which we live in, and the way we respond to it. People who sustained trauma try to communicate that they are up against a world threatening to them, and their autonomic state is threatened. The ANS is not supporting homeostasis when it is dealing with threat. Lack of homeostasis leads to illness, and regrettably, the current vast majority of the medical world attempts to treat many conditions separately and individually, when what is really needed instead, is a "neural retuning of the entire Autonomic Nervous System" (Science and Nonduality, 2022).

Social engagement is in the center of our perception of safety and danger. Our society teaches us the importance of personal uniqueness but places too much emphasis on individualism, when "at a deeper level we barely exist as individual organisms" (Van Der Kolk, 2014, p. 78). The brain is wired to behave as a member of a group. We are social organisms and most of our energy is devoted to connecting, and earning a place as a member in our community from the day we are born. We develop the skills to self-regulate, by heavily depending on how we were taken care of by our caregivers as children and how secure our attachments were. Behind the various symptoms listed in an official psychiatric diagnosis, lies mental suffering involving struggles in creating and maintaining satisfying healthy relationships, and trouble regulating arousal and affect (Van Der Kolk, 2014, pp. 78, 111).

The history of past experiences is embedded in people's faces, body language, voice, and facial expressions. The narrative of the world that is held by anyone, depends in large on how one feels within. Negative feelings inside can lead to interpretations of others' actions as purposely hurtful and undesirable. The powerful impact that our internal states have in the interpretation of our environment, mediated by social interactions, is in line with the notion that the mere removal or absence of threat, is not safety.

The Polyvagal theory emphasizes that negative events, whether traumatic or not, are important variables, but the most important issue of all is how the body reacts. The point in question is not whether an event is, in and of itself, traumatic, but rather, it is whether the organism will respond by shifting into a chronic state of threat and why. “This is operationally what trauma is. The body has been re-tuned.” (Science and Nonduality, 2022).

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