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## Using Polyvagal Theory to Understand Autistic Meltdown

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**Abstract:** This paper takes the perspective through the lens of Stephen Porges’s Polyvagal Theory in terms of three stages - social engagement, mobilization, and immobilization - to understand autistic meltdown. In 2004, Porges coined the term *neuroception* to denote an automatic neural process by evaluating safety and risk of the environment without conscious awareness. The behavioral response of the nervous system (either calm or rigid) of individuals with autism having meltdowns are also discussed based on the vagus nerve activity (involving ventral vagal and dorsal vagal systems). Previous studies linking autistic meltdowns to the Polyvagal Theory is also briefly discussed here. Finally, the theory has raised a better awareness among the educational therapists and other allied professionals managing autistic meltdown to understand that disassociation occurs due to disintegration of the neural connection between the brain and the nervous system, rendering behavioral challenges in both teaching and learning.

**Keywords:** Autism, Meltdown, Neuroception, Polyvagal Theory

### 1. What is Polyvagal Theory?

According to Porges (2007), the Polyvagal Theory, which he eventually proposed in 2004, is based on the phylogenic (evolutionary) development of the human autonomic nervous system (Porges, 2001, 2003, 2004). The theory focuses on two systems: (I) the parasympathetic nervous system which is ultimately connected to the vagal nerve, and (II) the sympathetic nervous system. Each system has its own function, and causes the body to react differently before, during, and after a traumatic or stressful episode. If these two systems were to become damaged from excessive and recurrent trauma/stress, a breakdown could occur and several psychiatric disorders such as autism, schizophrenia, depression, and anxiety disorders might result (Porges, 2004).

Porges’s Polyvagal Theory posited that human brain structures can regulate both social and defensive behaviors and that our nervous system provide us the ability to express emotions, communicate, and control physiologic and behavioral states. The theory also describes three different stages of response that are built into the human autonomic system as shown in Table 1 below.

**Table 1.** The 3 Stages of Response in the Polyvagal Theory

Stage	Description of each stage	Symptoms
1. Social Engagement	Also known as social communication, this stage allows a person to negotiate danger in an environment through facial expression, vocalization, or listening (activated by the ventral vagal pathway of the parasympathetic nervous system). Post-trauma symptoms caused by traumatic experiences can cause deficits in social interaction and communication as evident in individuals with autism due to compromised cardiac vagal regulation (Porges, 2003).	Feel safe, love, and connected with others, have a sense of regulation. The implications on health are healthy immune system, quality sleep, and good digestion.
2. Mobilization	Fight-flight behaviors when the body goes into the sympathetic nervous system to escape from danger with	Anxiety, anger, panic attacks, loss of focus,



	increased heart rate and blood pressure. This stage sees an impediment in social engagement behaviors.	
3. Immobilization	The most primitive response (activated by the dorsal vagal pathway of the parasympathetic system) and the nervous system may result in shut down or feigning death (if the danger is still present).	Dissociation, social isolation, depression, despair, and hopelessness can be evident.

The above three stages also describe three different neural circuits that underlie different ways of negotiating with our environment. For example, according to Porges (2001), we rely upon a neural circuit that promotes social engagement behaviors when we feel safe and he called this the *social nervous system* where he described this part of the parasympathetic nervous system engages neural structures that inhibit our defensive systems. This relies upon the myelinated ventral vagus nerve which allows us to engage socially by establishing eye contact, softening our voice tone, and expressing care with our face. The importance of the social nervous system helps to facilitate immobilization within a context safety to promote greater closeness or intimacy, thereby developing social interactions.

The tenth cranial nerve of the human autonomic nervous system, is known as the vagus nerve. This nerve is the longest that controls a human's inner nerve centre in the parasympathetic nervous system. It oversees a vast range of vital functions communicating sensory input from outside triggers to the rest of the body (e.g., heart rate, digestions, etc.). The vagus nerve has the power to calm all of these systems in our children's bodies. If other parts of their bodies are calm you'll see a calmer more regulated child.

According to Porges's Polyvagal Theory, the vagus nervous system consists of two subsystems, namely the *ventral vagal system* and the *dorsal vagal system*. For instance, when face with danger or being threatened (experience a trauma or traumas), this system is triggered to take us out of the ventral vagal system into the sympathetic nervous system, where the body is mobilized to deal with danger. Should the danger persist, and an individual cannot cope with the situation, then the dorsal vagal system is triggered causing him/her to "power down", faint, dissociate and/or become numb. These two subsystems are briefly described in Table 2 below.

**Table 2.** Contrast between the Ventral and Dorsal Vagal Systems

Ventral Vagal System	Dorsal Vagal System
<ul style="list-style-type: none"> <li>*When activated, the body will go into a calm and resting state (a.k.a. parasympathetic state).</li> <li>* Myelinated nerve that helps to regulates the face muscles, establish eye contact, and feel connected to others. Enables social engagement to take place.</li> <li>*Give rise to feelings of safety, connectedness, and joy.</li> <li>*Learning takes place as the body feels safe, calm and joyful with positive connection to others.</li> </ul>	<ul style="list-style-type: none"> <li>*When activated, the body will go into a fight or flight response when faced with threats such as dangers or traumas.</li> <li>* Unmyelinated nerve that originates from the dorsal motor nucleus.</li> <li>*Give rise to feelings of insecurity, fear, and disconnection.</li> <li>* Learning is hard to take place as the body will become immobilized (collapsed) and come to a complete shutdown with the onset of emotions such as hopelessness and apathy.</li> </ul>

## 2. Polyvagal Theory and Autistic Meltdown

According to the National Autistic Society (2021), a meltdown is a severe reaction to an extraordinary circumstance in which a child with autism either loses control their own behaviours or no control over their actions at all. This is so as they find it hard to communicate their emotions to others, especially when they become highly anxious or overwhelmed by the environment (e.g., nervous system overload).



Meltdown is different from temper tantrum (or simply known as tantrum), which is emotional outburst of anger and frustration. Children who throw tantrums usually have an intention or purpose (e.g., wanting a toy or seeking attention from adults) and will stop after they have achieved their desired outcome (when the toy is given). However, children with autism suffer meltdowns that have no underlying intention or purpose and their response is usually involuntary. When meltdowns happen, these children are unable to regulate themselves and thus resorting to behaviors such as shouting, screaming, kicking, biting or hitting themselves, and even destroying properties, especially having difficulties with sensory processing. According to Miller (2023), one of the causes of meltdowns is emotional overload. When the emotions are too much to handle and children with autism cannot manage, meltdowns will happen (Spencer, 2022). Other causes could be due to sudden transitions (Smith, Donlan, & Smith, 2012), changes in routines (Lipsky, 2011), and struggling in problem-solving (Tice, Bratslavsky, & Baumeister, 2001) as these could also be the contributing factors to meltdowns.

### 3. The Three Stages of Meltdown Trajectory

According to Myles and Southwick (2005), there is a meltdown trajectory in three stages (Triple-R): (1) the Rumbling stage; (2) the Rage stage; and (3) the Recovery stage. These three stages are briefly described below:

#### *Stage 1: The Rumbling Stage (Trigger or Agitation Stage)*

This is the first stage during a meltdown, which is also known as the triggering or the antecedent stage. In this rumbling stage, children with autism might manifest behaviors like making noises, fidgeting, or increased in hands flapping, rocking, stamping foot, etc. Not all children will display the same behaviors. Some may even refuse not to talk to anyone and socially withdraw themselves (Beck, 1987).

In order to avoid these behaviors from escalating to the second stage (Rage stage), it is best not to involve in any power struggle with the child with autism. One of the approaches is redirecting the child away from the task/activity that he/she is attending to, especially things of interest to him/her. If the triggers of this stage cannot be identified, then the child will go into the next stage, i.e., the Rage Stage.

#### *Stage 2: The Rage Stage (Acceleration and Peak Stage)*

If the child with autism is not regulated in the rumbling stage, then he/she will move in the rage stage and begin to act out. In this stage, the child is emotionally dysregulated (the emotional part of the brain is taking over). Two forms of behaviors will occur in this stage: externalizing behaviors (screaming, biting, kicking, head banging, etc.) or internalizing behaviors (social isolation). When a child with autism is in this stage, any form of learning and/or intervention will not help the child. Trying to reason with the child and stopping their inappropriate behaviors will not help either. Instead, adults working with such children having a meltdown need to stay calm, not to take the behaviour personally, avoid scolding the child, and ensure safety (of the child and others) by removing any dangerous items (sharp objects) around him/her (Myles & Southwick, 2005).

#### *Stage 3: The Recovery Stage (De-escalation Stage)*

After a meltdown, children with autism will then feel safe and calm. Some may feel tired/sleepy or clingy. Some may even unable to recall what had happened previously. Staying by their side and provide assurance that they are fine is crucial to calm their overloaded nervous system (Myles & Southwick, 2005).

### 4. Studies on Autistic Meltdowns using the Polyvagal Theory

Numerous studies had been done on individuals with autism using the Polyvagal Theory and most results were reported to be positive. Stimulating the vagus nerve can be really useful for a number of medical conditions including seizures, and a treatment known as the Vagal Nerve Stimulation (VNS) just provides that. Approved by FDA, the VNS therapy is safe enough to be administered to individuals with epilepsy and depression (see Engineer,



Hays, Kilgard, 2017, for detail). This therapeutic treatment is done with an implanted pulse generator via an electrode cuff placed in the left cervical branch of the vagus nerve that delivers intermittent electrical stimulation.

A study conducted by Murphy, Wheless, and Schmoll (2000) with six participants which four of them exhibiting severe autistic behaviors and meltdowns (e.g., ritualistic behaviors, compulsions, and self-injurious behaviors). Findings from the study suggested that all the four had manifested behavioral improvement during the treatment procedure. According to Porges (2003), about 80% of the vagal fibers are afferent and this provides crucial information regarding the visceral state of the human body. Previous studies using VNS therapy to stimulate the vagal afferents that regulate brain structures in people with epilepsy (Boon, Vonck, De Reuck, & Caemaert, 2001), depression (Rush et al., 2000), and autistic behaviours related to repetitive and self-injury (Murphy, Wheless, & Schmoll, 2000).

Other studies (e.g., Cheshire, 2012; Cohen et al., 2015; Hall et al., 2009) had found that the parasympathetic system is dysregulated and frequent reduction in vagal tone is observed in people with autism. Moreover, there are also studies (e.g., Klusek, Martin, & Losh, 2013; Roberts, Tonnsen, Robinson, & Shinkareva, 2012) on the application of the VNS therapy in association with both autistic behaviors and language impairment indicated a diminished vagal activity. In addition, several studies (e.g., Hull, Madhavan, & Zaroff, 2015; Levy et al., 2010) that employed VNS therapy in treating children with epilepsy and autism also reported positive results in that it reduces the frequency in epilepsy and improved that quality of life in individuals with autism.

There is no doubt that the Polyvagal Theory has contributed much to better our understanding of how difficulties in spontaneity of social behaviors observed in individuals with autism is associated with both facial expression and regulation of the visceral state, particularly deficits related to both somatomotor (i.e., poor eye contact, poor facial expression, and lack of prosody) and visceromotor (i.e., indigestion and heart problems) (Porges, 2003).

## 5. The Role of Neuroception in the Polyvagal Theory

What is the underlying mechanism that triggers the brain's neural circuits that regulates the autonomic system to instruct an individual to fight or flight? Porges (2004) coined a term known as *neuroception*, which he defined it as "by processing information from the environment through the senses, the nervous system continually evaluates risk. I have coined the term "neuroception" to describe how neural circuits distinguish whether situations or people are safe, dangerous, or life threatening" (p. 19).

Five years later, Porges (2009) redefined neuroception as cognition or detection without awareness and explained that it is very distinct from perception. In other words, neuroception does not need a conscious awareness of things that are happening around an individual. Porges (2017) also posited that neuroception, as a subconscious ability, is the human internal surveillance system that makes autonomic adjustments to move people either toward connection or into protection.

Neuroception is crucial as it helps to enable the autonomic nervous system knows whether people are trusted and/or environment is safe or dangerous. After which we can then adjust our behaviors to socially engage and form positive attachment to the people. According to Hirstein, Iversen, and Ramachandran (2001), they hypothesized that children with autism tend to use and seek for overt behaviors (e.g., self-stimulatory behaviors like hands flapping, rocking, or verbal stimming) to stay regulated by calming their sympathetic nervous system. But there was no research data to support their hypothesis. The authors also advised it may be unwise for parents to prevent their children with autism from exhibiting self-stimulatory behaviors as they may need to be engaged in relaxing activities when they are hyper-aroused or in the mobilization stage. Stopping these children may result in fear, panic attack, anxiety, or aggression. If the autonomic nervous system is always on the high alert (or in the hypervigilant state) due to fear, anxiety, stress, or trauma, then the child with autism either go into a stage of meltdown or shutdown as he/she find it helpless or even hopeless to cope with the stressors (Hirstein, Iversen, & Ramachandran, 2001). This may explain why individuals with autism, when stressed out or become over-anxious, often resort to self-stimulating behaviors such as hands flapping, rocking, and jumping. The use of these self-stimulating behavioral mechanisms in response to uncontrollable anxiety, stress, or trauma helps to regulate the sympathetic nervous system (fight or flight) due to low vagal tone (Porges, 1992). The term *vagal tone* is used to denote the neural



activity of the vagus nerve. When the vagal tone is high, it denotes a high vagal activity that puts the ventral vagal system in control so that we can feel regulated and also to recover from stress faster. On the contrary, low vagal tone puts us in higher level of stress, especially when the vagus nerve finds it hard to adapt to demands of stressors, making the nervous system "traumatized." Several studies (e.g., Cheshire, 2012; Cohen *et al.*, 2015; Hall, *et al.*, 2009) discovered that children and adults with autism and attention deficit/hyperactivity disorder often display a low vagal tone which means their nervous system has to put up a struggle in adapting to the everchanging environment.

What happens if the neuroception is not working well? When neuroception becomes faulty (e.g., if an individual cannot cope or lack the coping mechanisms due to persistent danger and/or threat), this means that such vulnerable people lack the ability to accurately detect whether the environment is safe or dangerous, or whether the people around them can be trusted. According to Porges (2004), when such a defence mechanism is impaired, it might cause anxiety, stress, meltdown, or shutdown. It has been found that individuals with autism and schizophrenia display deficits in social behaviors with no brain activity in the areas of the temporal cortex, which is involved in fight, flight, or freeze reactions, and which also causes meltdowns. Children with autism spectrum disorder often spiral into stress and anxiety when they encounter with environmental stressors (e.g., difficulty in predicting outcomes of daily events, high sensory sensitivities, inadequate social awareness or problem-solving skills) (Church, Alisanski, & Amanullah, 2000; Kim *et al.*, 2000). Failure to cope with such stressors may trigger tantrums, emotional outbursts, rage fits, and/or meltdowns (Myles, Trautman, & Schelvan, 2004).

Faulty neuroception can also happen when children with autism mismatch a safe environment as a threat. In other words, they detect danger even when no danger or threat is present. Changes in daily lives (e.g., going to new school, losing a toy, etc.) may pose a perceived danger that, in turn, may trigger a meltdown. This mismatch causes their nervous system to activate flight, flight, or freeze responses. Without an appropriate intervention to calm the autonomic nervous system, negative consequences can happen in the long run, such as these children may run the risk of developing emotional dysregulation in their early years (Hastings, *et al.*, 2008). Hence, the Polyvagal Theory offers to explain and predict the tendency of children with autism to have a hyper-responsive sympathetic system due to the large reduction in their sympathetic activity, or having a low vagal tone as the ventral vagal system is not in control as described earlier.

Which part of the brain decides what poses danger or threats upon an incoming stimuli? In neuroception, the nervous system (amygdala, hippocampus, and the prefrontal cortex) detects safety or threat automatically through the external stimuli (Porges, 2011). The neuroceptive system looks for cues of safety or threat through the facial expressions or voices of people (tone and prosody). For example, facial expressions of anger with loud shouting is an example of threat. The neuroceptive system also scans for low frequency sounds as a form of threat. Keeping in a regulated state by the neuroceptive system is achieved by the application of the vagal brake where the vagus nerve slows down the heart rate (Porges, 2017). In addition, the vagal brake also pauses the fight or flight response or gets it ready when required.

## 6. Neural Integration in the Polyvagal Theory

In the Polyvagal Theory, there is a term known as *neural integration*, which is essential when the nervous system and the brain functions have to be integrated. On the one hand, when there is no sign of threat or danger, neural integration is at its strongest level as we feel safe and secure and can reason logically.

Likewise, on the other hand, when threat is encountered, neural integration is weakened and we enter into a fight or flight state in our response to a threatening situation. The consequence in this state can bring us into illogical thinking, escaping or running away, and/or disassociation (Porges, 2017). Disassociation occurs when the mind (*noos*) and the body (*soma*) becomes disconnected during the immobilization stage (freeze or collapse) resulting in what is known as mind-body (*noosomatic*) disequilibrium. All forms of thoughts, memories, and behaviors seem to disconnect from the current environment. Based on Polyvagal Theory, Porges (2011) views the stage of disassociation as a form of adaptation to danger or threats.

Finally, another interesting mind-body state is the *faux regulation*. The word *faux* means 'not real or genuine'. It is a noosomatic phenomenon best explained with the following analogy: when someone appears regulated to others, but, internally, s/he is stressed out, very anxious and dysregulated. This suggests that implicit neural





integration is weakening - brewing silently into a state of immobilization or gradual shutdown (or in the worst state, a complete mental lockdown). One good example is a bizarre medical phenomenon known as Resignation Syndrome, or in Swedish, *Uppgivenhetssyndrom* (Butler, 2020; Von Knorring, A.L., & Hultcrantz, 2020). It hits children of immigrant refugee families in Sweden (and beyond), in which they slowly detach from the world to the point of a slumber from which they cannot awaken (Von Knorring, A. L., & Hultcrantz, 2020).

During the state of faux regulation, an individual's body (soma) is immobilized or shut down because the nervous system goes into what is called a hypoarousal state. In this state, the dorsal vagal system takes over and symptoms such as fear, anxiety, dissociation, foggy minds, or depression start to arise. An individual in this stage may appear calm and composed, but internally they are frozen and numb.

## 7. Suggested Interventions in Alignment to Polyvagal Theory Principles

In therapy, the goal of polyvagal theory is to decrease the freezing response by the activation of the vagal system. In the case of psychotherapy, co-regulation is important as it is an interactive process that taps on the social nervous system of both the psychotherapist and the client, thereby enhancing the development of relationship where neuroception enables the autonomic nervous system knows whether people are trusted and/or environment is safe or dangerous. Some suggested interventions that are aligned to the Polyvagal theory principles to engage the ventral vagal system are: (1) calming sensory activities designed by an experienced Occupational Therapist or Educational Therapist, (2) deep breathing exercises, (3) singing or humming, (4) yoga, or (5) meditation exercises.

## 8. Conclusion

The Polyvagal Theory provides a clear understanding and helps us know how our nervous system reacts to danger or threat. The author hopes that by understanding the Polyvagal Theory, professionals could help individuals having autistic meltdowns to calm both the mind and the body to achieve social engagement. Knowing the three different stages of meltdowns with different behavioral manifestations in each stage serves as a guideline for therapists who are working with individuals with autism. The Polyvagal Theory also enables us to know that disassociation occurs due to disintegration of the neural connection between the brain and the nervous system.

Finally, it should be reminded that while Polyvagal Theory can offer insights, what is more important is to approach each autistic child as unique individual and to work in collaboration with them and their support network to develop strategies that are most effective for their specific needs. Children with autism may have unique profiles in terms of their autonomic responses and triggers for meltdowns. Hence, the Polyvagal Theory helps to tailor one's understanding and interventions to each child's specific needs.

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### Conflict of Interest

The author have no conflicts of interest to declare that they are relevant to the content of this article.

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